Accounting for consumption inequality in Myanmar: 2004/05 and 2009/10

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Declaration of Authorship

I, Lwin Lwin Aung, declare that this thesis, entitled '**Accounting for consumption inequality in Myanmar: 2004/05 and 2009/10'**, is my own work, except where due acknowledgement is made or otherwise indicated. The thesis has not been submitted for the award of any other degree or diploma at any university or equivalent institution. Also, to the best of my knowledge, the thesis contains no material previously published or written by another person, unless otherwise referenced in the text.

The development and writing of all chapters in the thesis are the principal responsibility of myself, the candidate, working within the Arndt-Corden Department of Economics, Crawford School of Public Policy, the ANU College of Asia and the Pacific, the Australian National University (ANU), under the supervision of Professor Peter Warr (Chair of supervisory panel), Dr. Robert Sparrow (Panel member), Professor Raghbendra Jha (Panel member), and Professor Bruce Chapman (Panel member).

(Lwin Lwin Aung)

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Abstract

This thesis investigates consumption inequality in Myanmar, utilising comprehensive household expenditure data sets from 2004/05 and 2009/10 called the Integrated Household Living Conditions Assessment surveys. The distributions of revised comprehensive total household expenditures per adult equivalent indicate a decline in different measures of consumption inequality over time. These data suggest that both 'relative inequality' and 'absolute inequality' have fallen over this five year period. Poorer population groups have gained rapid expenditure growth than richer ones over the whole national consumption distribution. The nationwide Gini coefficient for expenditure per adult equivalent decreased from 0.256 to 0.220 over time. Nationally, the declines in the Gini coefficient, Theil index, Mean Log Deviation, and Atkinson indices were each statistically significant.

Disparities in socio-economic conditions between rural and urban areas, as well as states and regions have persistently been claimed, especially by people in rural areas and minority states who believe that they do not receive equal redistributions of their country's resources. Yangon and Taninthayi had the highest inequality in expenditures and Kayin state was the lowest in the ranking of inequality over time. The static inequality decomposition analyses show that the contribution of within-group inequality of rural and urban areas to total inequality in both levels and changes is higher than that of between-group inequality. Over the study years, both the between-group and within-group inequalities of rural and urban areas have decreased significantly. However, the contribution of between-group inequality of rural and urban areas to total inequality in Myanmar decreased over time, while that of within-group inequality to total inequality correspondingly increased. A similar trend is found for the level of, and changes in, the contributions of states and regions to total inequality. Therefore, the results confirm that a substantial part of expenditure inequality in Myanmar is not spatial. Cyclone Nargis also contributed to the decline in inequality that occurred in the Nargis-affected area, as well as to the observed decline in total national inequality.

The Fields (2003) regression-based inequality decomposition reveals that locational and regional effects, occupation, and levels of education of household members are key to explaining both the level of, and changes in, consumption inequality. Firstly, regional specific variables are the main contributors to the narrowing of expenditure inequality and these explain about 35% and 43% for all households and panel households, respectively. However, these factors have complex origins. Ideally, other variables that are beyond the available data can be correlated with the region-specific variables considered in this study, and thus, while their impact cannot be captured directly, it is reflected in the regional variables. The second largest contributor is the share of household members with different types of occupation, accounting for 22% (all households) and 16% (panel households). The third major influencing factor is the level of education of working-age adults (aged 15-64) constituting about 14% and 18% for all households and panel households, respectively. This research also finds that the results produced using the Yun (2006) approach are inconsistent, and provide a seemingly arbitrary choice for researchers.

Table of Contents

List of Tables

List of Figures

List of Maps

Chapter 1

Introduction

1.1 Inequality: Global, Asia and Southeast Asia

According to the Asia Development Bank (ADB) outlook 2012, inequality in Asia is on the rise (for example, China, India and Indonesia). Between-country inequality rose faster "while the contribution of within-country inequality to Asia-wide inequality declined from 77.4% to 70.4%" between the mid-1990s and the late 2000s (ADB, 2012, p.50). Kanbur (2013) also observes that, over the last thirty years greater global integration is associated with rising inequality in not only developed countries, but also particularly in developing countries. However, Bourguignon (2015) argues that "on the one hand, after two centuries of rising steadily, inequality in standard of living between countries has started to decline. Twenty years ago, the average standard of living in France or Germany was twenty times higher than in China or India. Today this gap has been cut in half. On the other hand, inequality within many countries has increased, often following several decades of stability. In the United States, for example, income inequality has risen to levels that have not been seen in almost a century" (p.2).

High inequality is also found in Southeast Asian countries such as Malaysia, the Philippines, Singapore, and Thailand, all of which had a Gini coefficient of 40 or more based on the data in the 2000s (Zhuang, Kanbur & Maligalig, 2014). In the case of Myanmar, it is even possible that from 2016, with the democratic party—the National League for Democracy (NLD)—in power and if it continues to successfully pursue a policy of supporting a market-oriented economy in Myanmar, then the country may be on the pathway to becoming one of the Asian tigers. However, if inequality is not addressed in the initial stage of the new economy, then there is a high probably of a widening of inequality.

While inequality has increased alarmingly in the US and in some countries in Asia and Southeast Asia, this is not the case elsewhere. A recent study reveals that inequality has declined in Latin American countries. Lustig, Lopez-Calva, and Ortiz-Juarez (2013) find a decline in the Gini coefficient in 13 out of 17 Latin American countries between 2000 and 2010. The authors state that "the decline was statistically significant and robust to changes in the time interval, inequality measures, and data sources" (p.129). They conclude that the analyses of the determinants of the nontrivial decline in inequality in Argentina, Brazil, and Mexico are because of two core factors. They are "a fall in the skill premium and more progressive government transfers. The fall in the skill premium seems to be associated with an increase in the relative supply and a decrease in the relative demand for skilled labour" (p.138). Thus, it is worthwhile to observe their trends of inequality continuously and study the factors contributing to changes in inequality over time, as the policies of governments in most of Latin American countries can apparently influence inequality.

Regional comparisons of Gini coefficients

Zhuang et al. (2014) explain that "inequality can be estimated for per capita income or per capita expenditure. The two measures usually give different results, with income inequality normally higher than expenditure inequality" (p.21).They argue that "for a given country, the income-based Gini could be 5-10 points higher than the expenditure-based Gini" (p.23). Thus, it is essential to understand how expenditure (or income) is defined before making inequality comparisons across countries. With regard to consumption expenditure, the percentages of reported spending devoted to food, non-food, health, durable goods, and rent are noticeably different from one country to the next. Haughton and Khandker (2009) report the magnitudes of inequality, with and without spending on health, durable goods, and rent for selected Eastern European and former Soviet Union countries for the year 2002-2003. Their findings show that the rates of inequality based on the spending on health, durable goods, and rent are higher compared with those estimated without them. It is for this reason that in this research, information on the compositions of consumption expenditure measures at the regional level is compiled to learn how they are constructed.

Table 1.1 shows that of the five countries with information available, the share of food consumption expenditures is the highest in Cambodia, Laos and Myanmar. For

Cambodia, it is unclear whether both actual rent and imputed rent are included in the calculation of consumption aggregates in the 2009 survey, and similarly for Laos for the calculation of consumption aggregates. Imputed rent means that the households were asked to estimate the monthly rental value of their residence if they own their houses, or the rent estimated from regression of rental value using housing characteristics in rural and urban areas. Vietnam does not include rent in its consumption aggregates and while Indonesia includes taxes and insurance for non-food items, and imputed rent is not included. Furthermore, the items of food and non-food considered to calculate consumption aggregates also vary from one country to the next. Consequently, the comparisons of inequality across countries are difficult to interpret.

Table 1.1 Percentage of reported spending on food and non-food expenditures, for Southeast Asia regional countries, 2004-2010

Countries	Survey year	% of consumption expenditure devoted to:					Remarks
		Food	Non-food	Health	Rent	Durable goods	
Cambodia	2004	71.0	29.0	-	-	-	(Non-food includes housing, health, education, and durable goods)
	2005	-	-	-	-	-	
	2009	51.0	41.4	7.6	-	-	(Non-food includes education and still unclear about inclusion of rent and durable goods)
	2010	48.0	44.0	8.0	-	-	
Indonesia	2004	54.6	45.4	-	-	4.15	(Non-food includes housing and household facility, goods and services, clothing, footwear, and headgear, taxes and insurance, health and education, and parties and ceremony, but imputed rent is not included.)
	2005	51.4	48.6	-	-	4.52	
	2009	50.6	49.4	-	-	5.88	
	2010	51.4	48.6	-	-	5.14	
Lao PDR	2002/03	74.6	25.4	-	-	-	(Non-food includes housing, health, education, durable goods; unclear about rent).
	2007/08	72.3	27.7	-	-	-	
Myanmar	2004/05	65.0	17.1	4.7	6.9	6.4	
	2009/10	65.6	17.8	4.7	8.2	3.6	
Vietnam	2004	53.5	46.5	-	-	-	(Non-food includes housing, health, education, and durable goods)
	2010	52.9	47.2	-	-	-	

Sources:

Cambodia: Summary Report on Food Insecurity Assessment in Cambodia: 2003/04 Cambodia Socio-Economic Survey (National Institute of Statistics [NIS], 2007), and Cambodia Socio-Economic Surveys 2009 and 2013 (NIS, 2010, 2014)

Indonesia: Calculated with individual data based on National Socio Economic Surveys (Publication Statistics Indonesia)[1]

Laos: Poverty in Lao PDR 2008 (Department of Statistics, 2010) and Key Indicators for Asia and the Pacific 2011 (ADB, 2011)

Myanmar: Author's estimations for user costs of durable goods and health expenditures, and the calculations for food, non-food and rent by the IHLCA project technical unit—hereafter referred to as IHLCA—based on Integrated Household Living Conditions Assessment Surveys in 2004/05 and 2009/10

Vietnam: Results of the Vietnam Household Living Standards Survey 2010 (General Statistics Office, 2011)

[1] (http://www.bps.go.id/)

Elbers, Lanjouw, Mistiaen, and Özler (2005) argue that "the data are not strictly comparable as inequality is typically measured differently across countries—based sometimes on a consumption measure of welfare and sometimes on an income measure. Even where the welfare indicators are based on the same concept, the precise definition is almost never the same across countries" (p.20). ADB (2007) suggests four key points to consider before making any comparisons of inequality across countries. First, it is important to note that survey designs and questionnaires vary across countries, and over time within countries. Second, it is important to capture the incomes and expenditures of the rich, as a failure to do this can cause underestimation. Third, it is also crucial to track the incomes and expenditures of a common set of households over time. And finally the value of the household survey data is such that it should be made available to researchers and the public as soon as it has been validated. It is critical that analysts have access in order to be able to use it to provide relevant policy guidance.

Table 1.2 Southeast Asia regional comparisons of Gini coefficients

Countries	Income/ Consumption	Unit of Analysis	Equivalent Scale	2004	2005	2009	2010
Cambodia[a]	**Monthly Consumption**	**Person**	**Per Capita**	**35.53**	**-**	**34.67**	**33.55**
Lao PDR[b]	**Monthly Consumption**	**Person**	**Per Capita**	**(2002) 32.60**	**-**	**(2008) 36.70**	**-**
Indonesia[c]	**Monthly Consumption**	**Person**	**Per Capita**	**-**	**36.30**	**37.00**	**38.00**
Malaysia[d]	Monthly Income	Person	Per Capita	46.00	-	44.10	-
Myanmar[e]	**Yearly Consumption**	**Person**	**Per Adult Equivalent**	**-**	**25.60**	**-**	**22.00**
Philippines[f]	Yearly Income	Family	No adjustment	-	(2006) 44.00	44.80	-
Singapore[g]	Monthly Income	Person	Per Capita	46.00	46.50	47.10	47.20
Thailand[h]	Monthly Income	Person	Per Capita		42.50	40.08	39.40
Vietnam[i]	Monthly Income	Person	Per Capita	42.00	(2006) 42.40	-	43.30

Sources: [a] Cambodia Socio-Economic Surveys 2009 and 2013 (NIS, 2010, 2014), and World Development Indicator (http://data.worldbank.org/)

[b] Poverty in Lao PDR 2008 (Department of Statistics, 2010) and Key Indicators for Asia and the Pacific 2011 (ADB, 2011)

[c] BPS-Statistics Indonesia (http://www.bps.go.id/)

[d] Household Income and Basic Amenities Survey report 2009 (Department of Statistics, 2012)

[e] Author's estimations based on Integrated Household Living Conditions Assessment Surveys in 2004/05 and 2009/10

[f] Family Income and Expenditures Survey in 2009 (United National University-World Institute for Development Economics Research [UNU-WIDER], 2014) and Key Indicators for Asia and the Pacific 2011 (ADB, 2011)

[g] Key household income trends, 2013 (Department of Statistics, 2013). Household income from work includes employer Central Provident Fund contributions and before accounting for Government Transfers and Taxes.

[h] ASEAN Statistical Yearbook 2012 (ASEAN, 2013) and Household Socio-economic survey (UNU-WIDER, 2014)

[i] General Results of the Vietnam Household Living Standards Survey 2010 (General Statistics Office, 2011)

Note: Compositions of consumption expenditures generally include food, and non-food including housing, education, health, durables. However, the components vary substantially by country.

Table 1.2 reports Southeast Asia regional comparisons of the Gini coefficients. About half of the Gini index[2] estimates are based on consumption expenditures. ADB (2007) stresses that according to international experience, "Gini coefficients based on data on income distributions would show higher levels of inequality" than those calculated by consumption expenditures (p.4). For example, Vanndy (2013) presents the results of Gini coefficient consumption vs. Gini coefficient disposable income from the Cambodia Socio-Economic Survey. The study shows that the Gini coefficient of disposable income is around 20% higher than the Gini coefficient of consumption. The findings of Kanbur and Zhuang (2012) also reveal that inequality estimated using per capita income is usually higher than expenditure inequality based on the data of World Bank's PovcalNet. For instance, the Gini coefficient measured by income was 47 in the Philippines in 2009 while the Gini coefficient measured by expenditure was 43. Similarly, the Gini coefficient of income of Viet Nam in 2008 was 46 while the expenditure measure was 37. Inequality in Cambodia and Laos appears to be lower than the rest of the countries as shown in Table 1.2. Inequality in Cambodia is decreasing, with a fall from 35.53 % in 2004 to 33.55 % in 2010 according to the World Development Indicators.

To put these results in regional perspective, this research presents the Gini coefficient for Myanmar, along with detailed information how it is constructed. Reported inequality in Myanmar (2004/05 and 2009/10) was lower than that reported for other countries. The low inequality index in Myanmar could be due to survey designs, as both the poor people in urban slums and very rich tycoons in cities are likely to have been excluded, given the fact that 28,899 households are missing from the survey frame in Yangon. Also remote isolated and hardly accessible villages are excluded in Kachin, Kayah, Kayin and Shan (North) for security and accessibility reasons, though the "problem has been addressed in the analysis by adjusting the weights of the remaining households of the strata to which they belong for both rounds".[3]

A low inequality index could also be the result of potential measurement errors such as respondent error and interviewer error; however, IHLCA (2011b) argues that errors are

[2] The Gini index is defined as "the Gini coefficient expressed as a percentage, and is equal to the Gini coefficient multiplied by 100. Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality" (http://data.worldbank.org/).

[3] IHLCA (2011b, p.22) and IDEA and IHLCA (2007b, p.60-61) [IDEA International Institute and IHLCA Project Technical Unit—hereafter referred to as IDEA and IHLCA.]

corrected immediately during the interview and during review by the supervisor in the IHLCA surveys. Also it can be compounded by non-sampling errors, (for example, coverage, outliers, data entry and data processing) though the error rate of verification is at an acceptable level (2%) in the IHLCA surveys.[4] In fact, IHLCA (2011b, p.14) argues that the effects of coverage errors and outliers have been further reduced by adjusting weights when appropriate. Elbers, Lanjouw, Mistiaen, Özler and Simler (2005) also point out that "inequality measures tend to be sensitive to the tails in the distribution of expenditure. Since far-off portions of the tails are typically not observed in the survey (because of its small sample size), the survey estimates of inequality will often be below the true level of inequality. More importantly, non-response may be an issue in household surveys, and to the extent that non-response is more prevalent among rich households, then selection bias will lead to further downward bias of survey-based estimates" (p.39).

1.2 Background to Myanmar's economy

Myanmar is the largest country in Southeast Asia in terms of mainland area, with a total of 676,577 square kilometers (261,228 square miles). It is about twice the size of Vietnam and has 5,858 km of international borders with five nations—China, Laos, Thailand, India, and Bangladesh and over 2,800 km of coastline (Thein, 2004). In March 2014, Myanmar's population was over 51 million and its population density was 76 persons per square kilometre. About 70% of the population lives in rural areas, according to the 2014 Myanmar population and housing census, the first in 30 years (Department of Population [DoP], 2015). Myanmar's economy is still based on agriculture, and the majority of the population in rural areas relies on subsistence agriculture for earning income and for food. Of the country's Gross Domestic Product (GDP), agriculture accounted for 46.7 % in 2005 and 36.8% in 2010 at current producers' prices, followed by services which account for 35.8% in 2005 and 36.7% in 2010. Between 2004/05 and 2009/10, the share of agriculture of the GDP declined while the share of industry increased substantially. The industry sector represented 17.5% of the economy in 2005, and 26.5% in 2010. Over time, Myanmar's GDP per capita more than tripled, from US$ 238 in 2005 and US$ 753[5] in 2010 (ADB, 2015b).

[4] IHLCA (2011c, p.43)
[5] US$ at prevailing market exchange rates in 2005 and 2010.

In spite of its favorable climate and rich natural resources, Myanmar still remains one of the poorest nations in Southeast Asia. The Human Development Index (HDI) for Myanmar was ranked 148 out of 188 countries for 2014[6]. However, Thein (2004) argues that "prior to World War II in the late 1930s and early 1940s, Myanmar was a leading regional economy and a leading exporter of paddy/rice in the world. Myanmar's economy was greatly devastated during World War II. Much of the country's infrastructure was destroyed by the scorched-earth policies of the British when the Japanese invaded the country in 1942" (p.2).

Since independence in 1948, the history of economic development in Myanmar can be classified into three chronological segments: a mix of nationalism, socialism, and market system during parliamentary democracy period (1948-1962); nationalization and burmanization policies during socialist period under military government (1962-1988); and the market-oriented economy period under military government (1988-2004) (M. Than & Tan, 1990; Thein, 2004). In fact, the so-called market-oriented economy period under military rule continued until 2010, and the country continued to practice the so-called market-oriented economy period under the purported civilian government from 2011 to 2015. Thein (2004) also notes that after Myanmar gained independence in 1948, the whole country was unstable due to multiple political and ethnic rebellions. However, the parliamentary democracy government allowed some room for private sector participation and the operation of the market mechanism in many spheres of economic activities, including foreign trade. Soe and Fisher (1990), and Thein (2004) observe that in the first part of the socialist period under military rule from 1962 to 1974, a control-oriented command economy along with an inward-looking self-reliance policy of isolation was practiced during the revolutionary council of the military. The council nationalized all banks, all enterprises in forestry, mining and industry, all business firms in foreign trade, domestic wholesale and even retail trade, and also hospitals and schools. In agriculture, the government directed not only what farmers should cultivate, but also the sale prices. Thein (2004) argues that "they not only had to cultivate planned crops in the areas designated by the government, but also had to sell them to the state at prices fixed by the government, which were below market rates. In addition, foreign loans and grants were viewed with great suspicion and mostly rejected" (p.4-5).

[6] (http://hdr.undp.org/)

From 1974 to 1988, the government re-accepted the official development assistance (ODA) loans and conducted partial reform under 'the Burmese way to socialism' because of the worsening economic situation. A 'Green Revolution' using high-yielding variety (HYV) seeds and chemical fertilizers was adopted with the aim to boost agricultural productivity. However, government intervention in the agriculture sector and the failure of state-led import-substituting industrialization resulted in slowed growth. The printing of money to finance the budget deficit also caused inflation to accelerate, which led to the demonetization of the Kyat[7] in 1985 and 1987. Eventually, the socialist government collapsed in 1988 (Thein, 2004). It is also remarked that "the performance of the economy improved for a time, but could not be sustained, as there was no real change in the basic policy stance of favouring state-led industrial development over that of agriculture or in the way the economy was managed or mismanaged" (Thein, 2004, p.5).

In September 1988, "a new military group—the State Law and Order Restoration Council (SLORC)—took over civil power as a self-declared caretaker government" (Thein, 2004, p.6). Under the so-called market-oriented economy period from 1989 to 2010, several economic reform measures were introduced and there was an impressive growth in the agriculture sector until 1996/97. Myanmar also became a member of the Association of Southeast Asian Nations (ASEAN) in 1997[8], and in November the same year the military government changed its name to the State Peace and Development Council (SPDC). The SPDC government's intervention in the market increased and this resulted in the country suffering economic stagnation, the privatization process slowed down or stopped. However, Myanmar Economic Corporation (MEC) and Myanmar Economic Holdings Ltd. (MEHL) were favoured by the government in the application for permits to conduct business, and eventually these monopolized the economy. The socialist style economy and authoritarian regime has dragged down Myanmar behind its neighboring countries in ASEAN, both politically and economically (Thein, 2004). The liberalisation of rice marketing was announced in 2003, however this was not done to improve efficiency of the rice market sector but "rather it was to keep the rice price at a low level, mainly for the sake of political stability" (Okamoto, 2005, p.136).

Moreover, Myanmar's so-called multiple exchange rate system also continues to generate various economic distortions. The official rate is used for transactions related to foreign

[7] The Kyat is the currency of Myanmar.
[8] (http://www.asean.org/)

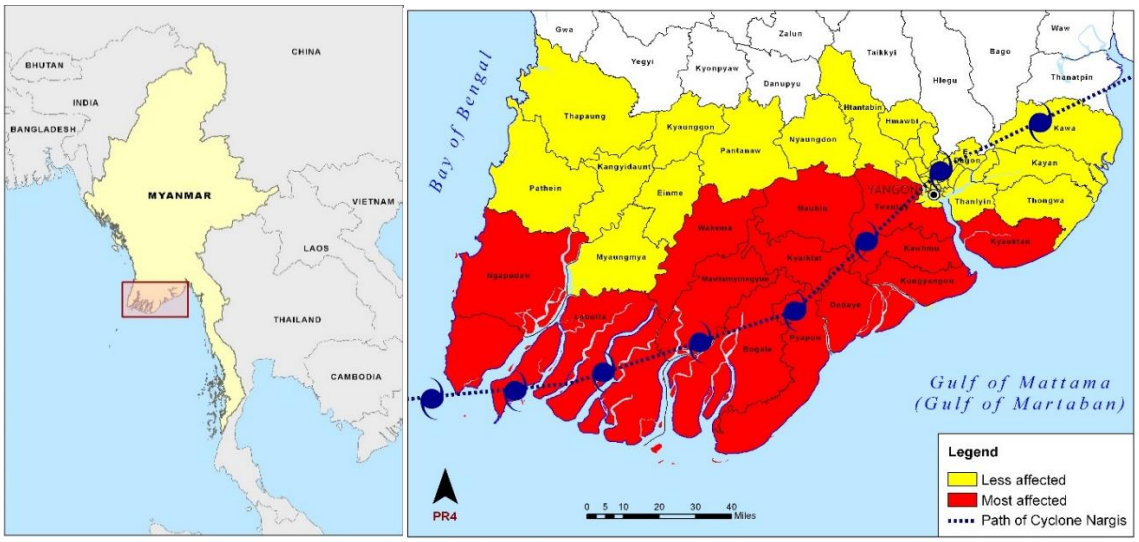
trade and other critical businesses, which are mostly controlled by the government. The unofficial rate is governed by currency market efficiency, which reflects the supply and demand of the Kyat against other currencies. These circumstances create a rise in the currency black market and other disrupted economic situations in Myanmar, such as inflation and economic slowdown. Inflation is also mainly compounded by the printing of money to cover fiscal deficits. After the so-called civilian government took power in Myanmar in 2010, the central bank floated the Kyat against foreign currency when a new exchange rate policy was adopted in April 2012. On the other hand, the government exercises little control over its taxation system. Turnell (2011) points out that "Myanmar's taxation arrangements are disordered, in large part out of the control of central authorities—and singularly inefficient in either collecting sufficient tax revenues or in imposing reasonable and least-distortionary costs on productive enterprise" (p.141).

1.3 External shocks in Myanmar between 2004/05 and 2009/10

Idiosyncratic, external shocks such as Cyclone Nargis in 2008 and the global recession in 2009 occurred between 2004/05 and 2009/10. ADB (2010) argues that policy weaknesses of the Myanmar government compounded by some side effects of the global recession in 2009, and cyclone damage to the agricultural sector in May 2008 reduced economic growth. In fact, ADB (2010) claims "Myanmar was not directly hit by the global recession, given its absence of financial and trade links with industrial countries. However, exports and private consumption were reduced by the combined effect of economic slowdowns in neighbouring economies, a collapse in commodity prices, and the impact of Cyclone Nargis, which inflicted several human loss and considerable damage to agriculture in parts of the Ayeyarwady and Yangon divisions in May 2008" (p.214).

The effects of Cyclone Nargis in May 2008 were catastrophic: it resulted in severe loss of lives, with an estimated 140,000 people killed or missing. About 2.4 million people were seriously impacted by the cyclone and there was considerable damage to the agricultural sector in parts of the Ayeyarwady and Yangon divisions. Furthermore, the business capital city, Yangon, was badly damaged (Tripartite Core Group [TCG], 2008). As shown in Figure 1.1, the rice bowl of Myanmar was critically affected and infrastructure both in Ayeyarwady and Yangon were seriously damaged. Consequently,

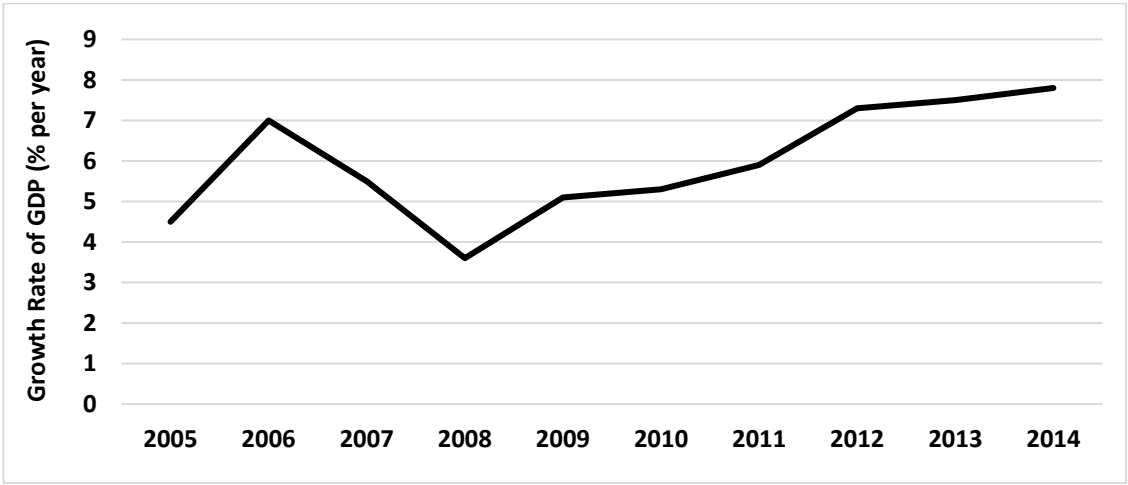
there was a significant reduction in productivity and the amount of land that could be farmed as salt water intruded on large areas of land.



Source: Tripartite Core Group (2008)

Figure 1.1 Cyclone Nargis-affected areas in the Ayeyarwady and Yangon regions (divisions) on 2 in May 2008

In addition, the fishing industry was also severely affected, due to the loss of fishing gear (TCG, 2008). Better-off farmers who owned large areas of farmland, rice mills and fishing boats in Ayeyarwady division, and business firms in Yangon division, experienced huge losses. Assets in the Nargis-affected areas were seriously depleted, particularly in the rural Ayeyarwady Delta (Dapice, Vallely & Wilkinson, 2009). Figure 1.2 shows the slowing of the growth rate of GDP after the 2008 devastation (according to the revised GDP estimates of ADB, 2010 and ADB, 2015a).



Source: ADB (2010) and ADB (2015a)

Figure 1.2 Growth rate of GDP in Myanmar from 2005 to 2014

1.4 Poverty and inequality in Myanmar

Estimates of poverty incidence and income/expenditure inequality were not publicly made available before 2004/05, due to the lack of nationally representative household surveys and income/expenditure data. Thus, only qualitative statements about the poverty and distribution of income can be presented for the period prior to 2004/05. Kyi et al. (2000) state that Myanmar was very poor as the average annual growth rate of GNP per capita between 1985 and 1994 was very low (0.45%). Myanmar was in the least developed country category during the socialist period and in the imperfect open market economy period under the military government, even though the country is endowed with rich natural resources. Kyi et al. (2000) also speculate that income inequality may not be very high as the majority of the population of the country is homogeneous; they observe that the Myanmar population "is not sharply divided into different classes or castes with unequal access to property or unequal levels of income" (Kyi et al. 2000, p. 130).

In terms of land ownership, a nominal maximum of nine to ten acres was allocated to each owner, partly because of the land use policy under the parliamentary and socialist periods. In addition, the wealth of urban people was also equalized because of the nationalization of all local and foreign private business, enterprises and industries in those periods. Thus, Kyi et al. (2000) argue that a low level of both average income and poverty existed during those periods. However, they also state that income inequality is likely to increase following the opening up the market economy. Kyi et at. (2000) speculate that when the imperfect open market policy was introduced under the military government following the 1988 uprising, there was a negative impact on the poor, a consequence of the high inflation and economic stagnation caused by the weakness and defects of the macroeconomic policy then in place. In addition, a handful of people became richer by accumulating wealth through a huge share of rents from import licenses, access to rationed foreign exchange, and profiting from property development projects by obtaining property assets being undersold or leased cheaply. Thus, Kyi et al. (2000) claim that inequality may have widened within the population under the imperfect open market economy. However, unfortunately, there are no solid empirical estimates for poverty publicly available until 2004/05 nor for inequality in Myanmar until 2009/10.

The first poverty estimates for Myanmar were made available and published through the comprehensive IHLCA surveys across the country under the SPDC government. The

incidence of poverty overall, based on the Household Income and Expenditure Survey (HIES) in 2001 (Ministry of National Planning and Economic Development [MoNPED], 2006), was reported as 26.6%. The level of poverty reported by MoNPED and UNDP Myanmar for 2005 was 31.0% (IDEA & IHLCA, 2007a). However, it should be noted that the poverty incidences reported in 2001 and 2005 could not be meaningfully compared, as the methodologies applied are different between the two years. In 2010, after a five year interval, the same IHLCA survey estimated a lower poverty headcount of 25.6%.

There are considerable disparities in poverty estimates between states/divisions (regions) throughout the country. The incidence of poverty varies widely by rural-urban areas and states/divisions (regions) (IHLCA, 2011a). According to the IHLCA report in 2011, more than a quarter of the Myanmar people were poor, with the proportion of the poor higher in rural areas than in urban areas (29.2% vs. 15.7%). The poor are dispersed, especially in the country's hilly, plateau, dry zone, and delta regions and border areas. The incidence[9] is the highest in Chin state where three quarters of people are poor, and the lowest in Kayah state, where one out of ten is poor. Poverty varies not only across states/divisions (regions) but also within a state/division (region), suggesting that there are pockets of extreme poverty. Over the years, Myanmar has achieved reductions in the incidence of poverty, but these reductions vary greatly for the different states and regions.

With regard to inequality in Myanmar, IHLCA (2011a) finds both relative inequality measured by the consumption share of the poorest 20%, and absolute inequality measured by the consumption gap between the richest and poorest 20%, have fallen in Myanmar over the study period 2005-2010. In addition, the studies of the World Bank and the Organisation for Economic Co-operation and Development (OECD) report the Gini index in 2009/10 in Myanmar. Their reported Gini indices are varied, based on the methods they used when calculating consumption aggregates of the respondent households, and are available only for the year 2009/10.

It is noteworthy that while information on the incidence of poverty, the poverty gap and the severity of poverty are published for all levels (national, rural and region, and states

[9] Trends in poverty and food poverty incidence, 2005-2010 are described on page 16 of the poverty profile (IHLCA, 2011a).

and regions (divisions)), this is not the case for data on inequality. Haughton and Khandker (2009) argue that "inequality is a broader concept than poverty in that it is defined over the entire population, and does not only focus on the poor", p.101). Thus, an in-depth study on inequality in Myanmar is essential and a failure to conduct such a study may hinder poverty reduction as it is likely that widening inequality will undermine any reductions in the level of poverty. In addition, there was a noticeable change in Myanmar's political landscape when the allegedly civilian government was installed in 2011, after the first general election in 20 years was held in November, 2010. Subsequently, the opposition party, the National League for Democracy, won a landslide victory in the November 2015 election. Thus, this present study of inequality for the years 2004/05 and 2009/10 is now especially relevant as it will serve as a base line for further studies as the political and socio-economic reform process continues to develop. It is also crucial for researchers to observe this initial stage and record the pattern and trend of inequality in Myanmar over the years as this will assist the government in developing policies to address, or control any potential issue effectively and efficiently.

Therefore, this research investigates consumption expenditure inequality in Myanmar using nationally representative IHLCA survey data sets for 2004/05 and 2009/10. The thesis contributes to knowledge on this subject and adds to the prior literature on Myanmar by adding health expenditures and user costs of durables into the existing consumption aggregates to examine the level of, and changes in, consumption expenditure inequality over time. This is done within a framework of formal statistical inference. The analysis disaggregates total consumption expenditure inequalities in each year into their intra and inter components by population groups: ethnicity, employment, industry, occupation, and land ownership as a proxy for important structural changes over time. The study also reports the magnitude of the level of inequality in rural and urban areas, the states and regions, to decompose total consumption inequality of Myanmar into between-group and within-group inequalities of rural and urban areas, states and regions. The impact of Cyclone Nargis on consumption expenditure inequality is also thoroughly studied to determine whether it is a part of the explanation for the reduction in national inequality in Myanmar. The thesis is the first application to decompose the regression-based consumption inequality for Myanmar by using the Fields (2003) method to explore the factors contributing to the level of, and changes in, consumption expenditure inequality over time, and also the first study to identify the defects in the Yun (2006) approach.

Chapter 2 presents a literature review, and details the statistical tests, and outlines the methods used to measure inequality as applied in Chapter 3. Chapter 2 highlights how this research deals with the issues of negative real interest and depreciation rates when constructing user costs of durables. The composition of spending in Myanmar by consumption expenditure deciles for 2004/05 and 2009/10 is illustrated for and explained in detail. Chapter 3 reports the results of consumption expenditure inequalities along with statistical inference using different inequality measurements for 2004/05 and 2009/10 to check the robustness of the study. The results are also detailed for rural and urban areas, states and regions to check whether the growth has been uneven across areas, and across regions and states. The curves for basic dispersion measures and the charts for aggregate measures are presented to illustrate consumption expenditure inequality in Myanmar. In addition, the growth incidence curves between Nargis-affected households (HHs) and non-Nargis-affected HHs are presented to explore the impact of the cyclone on consumption expenditure inequalities.

Chapter 4 focuses on the spatial aspects of consumption expenditure inequality in Myanmar, by estimating the magnitude of the level of inequality in rural and urban areas, and in the states and regions, to provide for a deeper understanding of the contributions of rural and urban areas, states and regions inequality to total national inequality. Furthermore, the analysis verifies the robustness of the impact of Cyclone Nargis on the decline in measured inequality between 2004/05 and 2009/10 reported in Chapter 3. In addition, this research reveals data and analyses, which enable researchers and policy makers to understand and explain consumption expenditure differences among certain population groups such as those defined by ethnic groups, employment, occupations, industries and land ownership. This study also explores the 'maximum possible' between-group contributions of rural and urban areas, states and regions, and among the population groups to total national inequality.

After investigating the level of, and changes in, consumption expenditure distributions in 2004/05 and 2009/10, the critical questions remain to answer its underlying explanations. Thus, Chapter 5 examines the drivers of inequality in a dynamic context in terms of variables that are more relevant for policy. For this purpose, it adapts the Fields' (2003) regression based inequality decomposition technique which possesses a number of important advantages over traditional inequality decompositions. Knowing which factors determine the level of, and changes in, consumption expenditure inequality over time

"would highlight whether existing inequalities are due to intrinsic unchangeable characteristics, such as location or ethnicity, or due to variables whose distribution can be changed through policy, for instance, through broadening access to education services" (Naschold, 2009, p.747). And finally, this Chapter also demonstrates a flaw in the Yun (2006) approach.

Chapter 6 concludes with summaries and synthesis of the main empirical findings related to the key research questions of this thesis. The implications of the findings are identified. The key contributions and limitations of the research are outlined and the thesis includes invaluable empirical evidence for researchers and policy makers. Considerations for future research are provided, such as the need to improve the regression-based inequality decomposition techniques.

Chapter 2

Measuring inequality

This chapter consists of four sections: the literature review, background for the construction of the variables, the composition of spending by consumption expenditures in 2004/05 and 2009/10, and methods for data sources and measurement of inequality. Section 1 provides a literature review on the advantages of using consumption expenditure in measuring inequality, statistical tests and the composition of total expenditures in the inequality study. Section 2 details the background for construction of variables and explains how this research deals with some issues such as real interest and depreciation rates. Section 3 reports the composition of spending consumption expenditures for 2004/05 and 2009/10. Section 4 explains the methods used in Chapter 3.

2.1 Literature review

2.1.1 The advantages of using consumption expenditure in measuring inequality

Conceptually, there are several advantages to using consumption expenditure distribution as an indicator of welfare in measuring inequality. Data on consumption expenditure is preferred to data on income as it indicates the long-term economic status of households, particularly in low-income countries (Friedman, 1957). Households can dissave to finance current consumption by smoothing across seasons or years. They do this when income is temporarily high, or low in a cyclical downturn of the economy (Fields, 1994). Atkinson (1983), and Atkinson, Rainwater and Smeeding (1995) state that consumption may be a better proxy of wealth or life-time income according to the life-cycle hypothesis. Atkinson (1998) further affirms that "expenditures are thus supposed to better reflect 'long-term' or 'permanent' income and are from this point of view considered to be a better measure of economic well-being and respective inequalities" (p.32).

In terms of measurement errors in the surveys, Deaton (1997) notes that consumption expenditure data are less effected by measurement errors—especially for rural households—based on the empirical literature. Deaton and Zaidi (2002) explain that

"where self-employment, including small business and agriculture, is common, it is notoriously difficult to gather accurate income data, or indeed to separate business transactions from consumption transactions" (p.14). The World Bank (2000) also reports that people are paid very irregularly in many Commonwealth of Independent States (CIS) member countries, and that consumption is smoothed, when income is very erratic. Furthermore, income underreporting is marked, because survey respondents are not willing to disclose illegal or semi-legal income sources.

Most inequality studies concentrate on wages, earnings, or income. In particular, earnings and wages are major elements in determining inequality in the US for example (Juhn, Murphy & Pierce [JMP], 1993; Autor, Katz & Kearney, 2005, 2008). However, Meyer and Sullivan (2011) contend that consumption expenditure is the more appropriate measure if one is interested in studying inequality in well-being. On the other hand, studies of inequality in household expenditure are more limited than studies of household income inequality. Nevertheless, a measure of material well-being consumption is always favoured over income in terms of conceptual arguments. For example, Cutler and Katz (1991), Poterba (1991), and Slesnick (1994, 1998) argue that consumption better reflects long-run resources and is a more appropriate indicator of household well-being than either earnings or income.

Fisher, Johnson, and Smeeding (2015) also highlight the fact that "most inequality studies use annual income data" (p.632). They argue that "a difficulty with using annual income to measure inequality is that if everyone goes through a life-cycle current-income path in which income is low when young, higher in middle age, and low again when old, then annual snapshots of income would suggest greater inequality than that which actually exists in permanent income. It could be that all visible differences in the level of and trend in inequality may be attributable to demographics alone. In addition, people may experience many transitory changes in income that would cause the distribution of annual income to indicate more inequality than actually exists. Economists have suggested that consumption may be a more appropriate indicator of permanent income" (p. 633).

Within the inequality literature, differences between the distributions of income and consumption have been thoroughly studied. Danziger and Tausig (1979), Cutler and Katz (1991) and Slesnick (2001) are the pioneers (among others) who shifted the focus to the different trends in income and consumption expenditure inequality. Comparison studies

of income and consumption expenditure inequality were analysed by a number of researchers. They are, for the U.S., Cutler and Katz (1992), Johnson and Shipp (1997), Johnson, Smeeding, and Torrey (2005), Krueger and Perri (2006), Blundell, Pistaferri and Preston (2008), Heathcote, Perri and Violante (2010), Meyer and Sullivan (2010), Petev, Pistaferri and Eksten (2011); for the U.K, Blundell and Preston (1998) and Blundell and Etheridge (2010); for Canada, Pendakur (1998), Crossley and Pendakur (2006), and Brzozowski, Gervais, Klein, and Suzuki (2010); and for Mexico, Binelli and Attanasio (2010). In general, their studies find that consumption expenditures are widely found to be more equally distributed than current income at a point in time. Most research shows that the magnitude of income inequality, is higher compared with that of consumption inequality and its growth is also higher than the growth in consumption expenditure. In addition, other researchers interested in this research area are: Germany—Fuchs-Schündeln, Krueger, and Sommer (2010); Italy—Jappelli and Pistaferri (2010); Spain—Pijoan-Mas and S´anchez-Marcos (2010); Sweden—Domeij and Floden (2010); and for Russia—Gorodnichenko, Peter, and Stolyarov (2010). The similar findings of these studies are that much of the increase in consumption inequality occurred in the early 1980s.

The link between variations in consumption expenditure and income seems to be country-specific. Barrett, Crossley, and Worswick (2000) investigate trends in consumption inequality among Australian households between 1975 and 1993, and compare it with income inequality. Their findings also support the use of consumption expenditure in inequality studies. They "find that consumption is much less unequal than income. While there were significant increases in both income and consumption inequality, consumption inequality rose by much less" (p.116). In addition, they emphasize that "an increase in the dispersion of income over time due to greater temporary fluctuations may represent little or no change in the distribution of welfare if households smooth their consumption. Therefore, if social welfare depends on the distribution of individual or household well-being then it is more appropriate to examine inequality in the distribution of consumption" (p. 116).

In addition, Meyer and Sullivan (2010) say "income fails to capture other important dimensions of well-being including in-kind benefits, lifetime resources, housing quality, and access to medical care. Furthermore, income is likely to be more volatile than a more comprehensive measure of economic well-being. For these reasons, changes in income

inequality are not likely to capture accurately changes in the inequality of economic well-being. The consumption patterns of families provide a better indicator of economic well-being" (p.1). Apart from their conceptual arguments, Meyer and Sullivan, (2003, 2011, 2012) show empirical findings, that consumption is a better measure to capture well-being for the most disadvantaged households in the US. Brewer, Goodman, and Leicester (2006) also find a similar situation for Great Britain. In supporting to their findings, Perri and Steinberg (2012) present the following example: "consider two households with the same income but very different shocks to the value of their wealth. Looking only at income would not inform us about distributional changes between them, but looking at consumption would, as the households would adjust their consumption in response to changes in their net wealth. More concretely, when housing prices fall, households feel less wealthy and spend less—or even when their salaries and other income streams do not change. Alternatively, increases in house prices can have a wealth effect causing households to increase spending" (p.9).

In several developing countries, such as Vietnam and India, consumption expenditure surveys are comprehensively collected with the help of international organizations such as the World Bank. Those surveys are time-consuming, costly and require adjustment for regional price differences across space and time and for household composition and size. In the case of Mozambique, Silva (2007) asserts that for many households informal monetary transactions (such as bartering) can be captured by using consumption expenditure, as subsistence activities are widespread in the country. Liu (2008) also contends that the income of agricultural households can be changeable with respect to seasonality. In the case of Vietnam, most households are self-employed, and thus it is difficult to get a correct estimate of income compared to expenditure (p.414).

Some economists have suggested that a better measure of economic resources can be obtained by using both the maximum and minimum of consumption and disposable income, rather than by using either one alone (Fisher, Johnson, & Smeeding, 2012, for example). Attanasio, Battistin and Padula (2010) argue that "...the joint consideration of income and consumption can be particularly informative" (p.12). Stiglitz, Sen and Fitoussi (2010) also state a similar argument as "the most pertinent measures of the distribution of material living standards are probably based on jointly considering the income, consumption, and wealth position of households or individuals" (p.33). Fisher et al. (2013) also agree that the analyses with both income and consumption

measures on the level of, and the change in, economic well-being of individuals are potentially important contributions to the literature.

2.1.2 Statistical test in the inequality study

Measures of inequality are mostly computed based on the data observed from household surveys. As the research mainly deals with samples, statistical tests play an important role in obtaining the best estimates to represent true population when comparing inequality measures across time and space. The reporting of statistical measures of precision for large samples is also essential just as it is in the case of small samples, even though "larger sample sizes decrease the sampling error, however this decrease is not directly proportional"[10]. In the inequality literature, Barrett, Crossley, and Worswick (2000) find statistically significant increases in both income and expenditure between 1975 and 1993, but income inequality increased much more; they used four independent samples of Australian Bureau of Statistics Household Expenditures Surveys. For Canada, Gray, Mills, and Zandvakili (2003) observe an increase in income inequality of households from 1991 to 1997 by applying a bootstrapping technique to enable statistical inference using Theil-entropy measures. Gamboa, García, and Otero (2010) also assert a statistically significant increase in wage income inequality, measured as the Gini coefficients over the 1984-2005 period, after the adoption of the liberalization measures during the early 1990s in Colombia.

2.1.3 Composition of total consumption expenditure in the inequality study

The composition of total expenditure observed by the researchers varies according to their underlying assumptions. Excluding durable goods, education, or medical expenses from the measurement of consumption may bias the consumption inequality measure because households with high earnings are possibly spending more on luxury items, for example, limousines, and electronic appliances. In addition, the rich may have regular medical check-ups at high-end hospitals and they may spend substantial money on higher education for their children. However, Johnson, Smeeding and Torrey (2005) and Meyer and Sullivan (2010) use the consumption distribution, consisting of the service flows from vehicles and owned homes, but in a later paper Meyer and Sullivan (2013) exclude education and medical expenses. Heathcote et al. (2010) include education expenses but

[10] (http://www.nss.gov.au/)

preclude utilities, while Attanasio, Hurst and Pistaferri (2012) consider the composition of consumption expenditure to be the exact opposite. For their composition of total expenditure, Fisher, Johnson and Smeeding (2013) "subtract the purchase price of vehicles and the value of houses from total consumption, and add the service flow from vehicles, the reported rental equivalence of housing value, and the value of federal government rental assistance" (pp.184-187).

2.2 Background for construction of variables

2.2.1 Durables

In order to complete the welfare aggregate of IHLCA-I and IHLCA-II, this research calculates the user costs of durable goods consumed by households drawn from data of household assets. Deriving this user cost is conducted in several steps, following Deaton and Zaidi (2002), as follows. The depreciation rate δ for each type of durable goods is calculated using:

$$\delta - \pi = 1 - \left(\frac{\rho_t}{\rho_{t-T}}\right)^{1/T} \quad (2.1)$$

where:

π is the real rate of interest, that is, real interest rate is the lending interest rate adjusted for inflation as measured by the Consumer Price Index (CPI) over the period from 1949 to 2013

δ is the rate of depreciation of each consumer durable good

ρ_t is the price of each consumer durable good consumed by household *j* at current time *t*

ρ_{t-T} is price of each consumer durable good consumed by household *j* at time of acquisition *t*

T is age of the consumer durable good consumed by the household.

In order to measure the opportunity cost of using the durable good, the yearly user cost of each consumer durable good was calculated using:

$$V = (\delta + \pi) * S\rho_t / (1 - \delta) \quad (2.2)$$

where:

V is the yearly user cost for each consumer durable good for the household

π is the real rate of interest over the period

δ is the medium depreciation rate of each consumer durable good consumed by all households

$S\rho_t$ is the current value of each consumer durable good consumed by the household.

To estimate the consumption of better-off households, this study originally included other housing (aside from the main dwelling) and land for housing (except for land with a dwelling) only if households owned one extra house/land plot. However, these two variables were finally excluded as the questions asked for extra housing and land in the IHLCA 2009/10 survey were different from those in the 2004/05 surveys, and it was difficult to differentiate extra houses and land plots from the answers. Thus, only housing expenditures[11] calculated by the IHCLA technical team were included when comparing the data consistently between the IHLCA 2004/05 and 2009/10 surveys. Consequently, the consumption for better-off households in relation to owning extra houses and land may be underestimated.

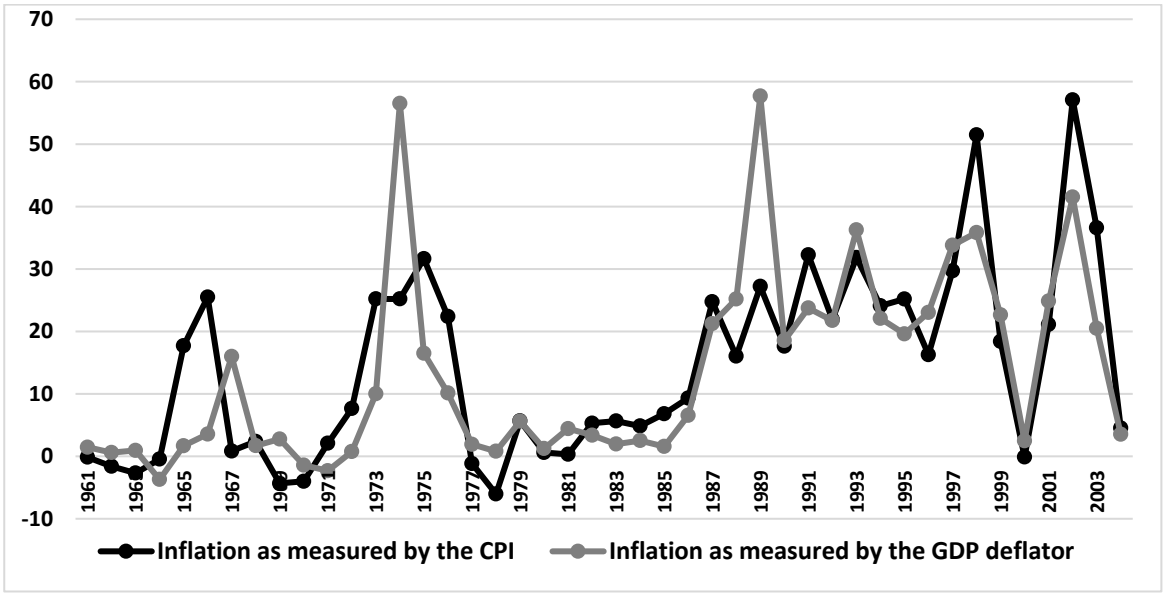
Two issues were addressed in order to calculate user costs of durable goods, as follows:

2.2.2 Issues with real interest rate

In Myanmar (Burma), nominal interest rates were stable before 1989 (Tin, 2000, p.83). With effect from 1 April 1976, a centralized system was established with the Union of Burma Bank (UBB) as the central bank. The UBB was empowered to issue currency, manage gold reserves, set the exchange rate, determine basic discount rates and interest rates, and supervise state financial investments. Adjustments to the interest rate were made in 1975, 1977 and then 1989 in conjunction with other stabilization measures. The bank rates were revised upwards on 1 April 1975 and again on 1 November 1977. The lending rates to State Economic Enterprises (SEEs), Co-operatives, and to Private (that is, Myanmar Agriculture Bank) were 3%, 4%, and 3% respectively (T. M. M. Than, 2007, p.185) before 1 April 1975. Therefore, to be able to compute real interest rates in long year series for this study, the lending rates from 1949 to 1975 were assumed to be 4%. The data for inflation (annual %), as measured by both the CPI and the GDP deflator, can

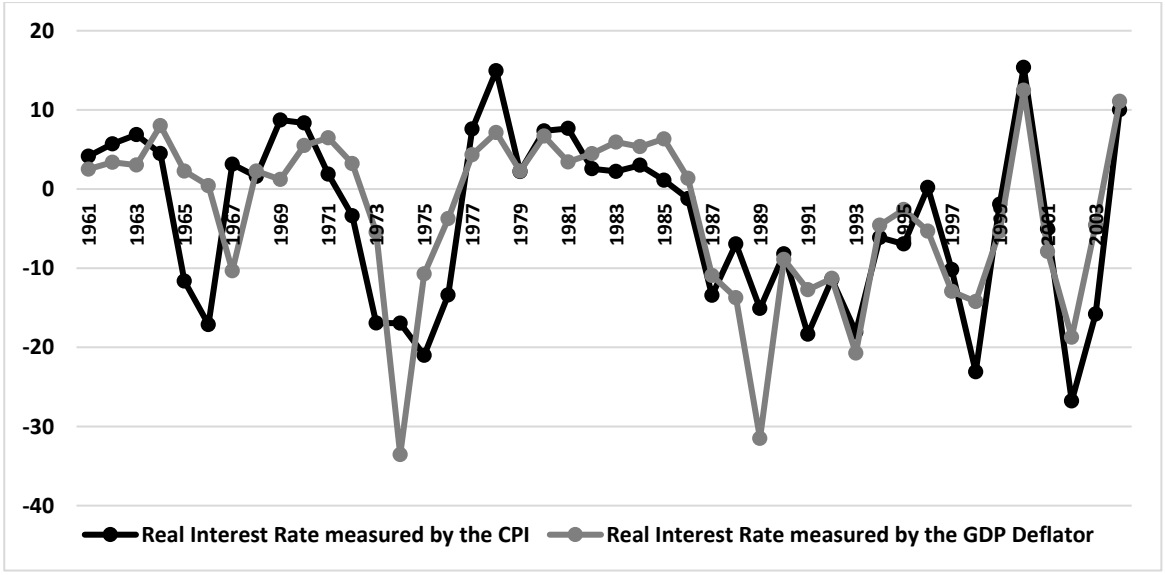
[11] See IHLCA (2011c, pp. 47-48) about step by step calculation for the housing expenditures which are the yearly user costs, best approximated by rental value. (http://www.mm.undp.org/content/myanmar/en/home/library/poverty/technicalreport-ihlca-ii.html).

be used to calculate the real interest rate. World Development Indicators (WDI)[12] report the real interest rate, that is, the lending interest rate adjusted for inflation as measured by the GDP deflator. However, the data are available only from 1976 to 2004, with missing data in 1990, 1991 and 1993. The IMF[13] reports inflation as measured by the CPI from 1949 to 2013 and the GDP deflator from 1961 to 2003. The trends of inflation measured by both the CPI and the GDP deflator, using IMF data between 1961 and 2003, are compared to check whether they are different.



Source: International Monetary Fund (IMF)

Figure 2.1 Inflation as measured by the CPI and the GDP deflator, (%) by year



Source: International Monetary Fund (IMF)

Figure 2.2 Real interest rates measured by the CPI and the GDP deflator, (%) by year

[12] (http://data.worldbank.org/data-catalog/world-development-indicators)

[13] International Monetary Fund (IMF) (http://elibrary-data.imf.org/DataExplorer.aspx)

Figure 2.1 shows that their trends are similar, and real interest rates adjusted for inflation as measured by the CPI and the GDP deflator show the same trend from 1961 and 2003, as shown in Figure 2.2. Gwartney, Stroup, Sobel and Macpherson (2013) argue that "the GDP deflator is thought to yield a slightly more accurate measure of changes in the general price level than the CPI" (p. 139). However, the life span of several items such as sewing machines and bicycles extend for more than 50 years and a few durables such as carts for non-agricultural use up to 90 years. In addition, the inflation data calculated by the GDP deflator are not available between 2004 and 2010. Therefore the inflation (annual %) as measured by the CPI is used to calculate the real interest rate in order to adjust the lending interest rate, as the trend of inflation measured by CPI is same as that of inflation calculated by the GDP deflator. The Fisher equation[14] (I., Fisher, 1930), (a method employed by WDI), is used to adjust the lending interest rate as follows:

$$\text{Real Interest Rate} = \frac{i-\pi}{1+\pi} \quad , \qquad (2.3)$$

where:

i is lending interest rate

π is inflation as measured by the Consumer Price Index (CPI).

Negative real interest rates were found between 1972 and 1976 during the periods when bank rates were increased (T. M. M. Than, 2007) and again from 1987 to 1999 after "the withdrawal of top three denominations (100, 50, and 20), was announced on 3 November" in 1987 (T. M. M. Than, 2007, p. 239). Tin (2000) argues that "the lingering mistrust of the banking system (a legacy from the Socialist era) and high inflation rates leading to negative real interest rates that prevailed throughout the decade of the 1990s appeared to have depressed the propensity to save" (as cited in T. M. M. Than, 2007, p.371). Therefore, an assumption is made that there is no economic incentive to deposit at the bank and also no one will lend their money at the bank lending rate when negative real interest rates prevail. Thus, the negative real interest rates are assumed to be '0' when computing real interest rates. Furthermore, when computing the user costs of durables, an average real interest rate of about 3.95% was used between 1949 and 1962 for the durables bought before 1949 because of the change of interest rates on loans after the

[14] "The Fisher equation in financial mathematics and economics estimates the relationship between nominal and real interest rates inflation. It is named after Irving Fisher, who was famous for his works on the theory of interest" (http://en.wikipedia.org/).

nationalization of banks in Myanmar. At the end of the "parliamentary democracy period: 1948–62" (Thein, 2004, p.3), "twenty-five commercial banks, of which fourteen were foreign-owned" (Thein, 2004, p.25) were nationalized in February 1963. Also "the system of accounting and interest rates on loans and deposits were also changed to be in line with the one used by the State Commercial Bank" (Thein, 2004, p.66).

2.2.3 Issues with depreciation rates

Medium depreciation rates of '0' are computed for subscriptions to fixed telephone lines and mobile/cellular phone lines in the IHLCA 2009/10 survey. There are some reasons to list why depreciation rates for those occur at '0'. Firstly, penetration of fixed telephone lines and mobile/cellular usage in Myanmar were very low because the telecom infrastructure development was poor, with coverage being more biased towards the cities (Nomura Equity Research, 2012). About 1% and 2% of the total population in Myanmar were fixed telephone subscribers in 2004/05 and 2009/10, respectively (Central Statistical Organization [CSO], 2012a, 2012b). However, most of the lines we can assume that were installed at government offices; in terms of the IHLCA surveyed data, only 0.5%, and about 1% of the sample population used fixed telephone lines in 2004/05 and 2009/10, respectively. For the same years, about 0.2 % and 1% of the total population (CSO, 2012a, 2012b) were able to use mobile/cellular phones due to the underdeveloped mobile network and expensive SIM cards, the supply of which is restricted (and controlled) (Galucci, M. & Scanlon, 2014). Nonetheless, the survey results show that only 0.1% and approximately 1% of respondents used mobile phones in 2004/05 and 2009/10, respectively.

Moreover, the prices of SIM cards and installation of land lines were incredibly high. Initially in 1993, the mobile network was only available to high-ranking government officers, and until 2000, a very limited number of people were granted its use. As rental costs of official SIM cards from the state-owned Myanmar Posts and Telecommunications (MPT) varied, the extreme limitations imposed caused the prices in the black market to be double the official rates, and they rose up to more than US$ 5,000 between 1993 and 2000. According to the survey results of IHLCA 2004/05 and 2009/10, the majority (about 80 %) of mobile phone users started using mobile phones less than 5 years ago. The prices of SIM cards varied between US$2,500 and US$3,000 from 2000 to 2005, while the price range of SIM cards was about US$2,000 between 2005 and 2010

(Galucci, M. & Scanlon, 2014, p.132). Therefore, medium depreciation rates turn out to be '0' as prices of SIM cards paid by most respondents were high and stagnant for several years.

A few items of home assets in IHLCA-I are excluded in order to be able to compare with the user costs of durables in IHCLA-II. They are 6-wheeled cars, motor boats, trawlargees[15], trishaws, and carts (any) for non-agricultural use. A few new items such as table, clock, electric lamp and heater included in IHLCA-II remain included, as their user costs are not high and also the respondents are presumably underreporting by observing the estimates of user costs of durables in IHLCA-II.

2.2.4 Adjustment for economies of scale

Ultimately, as the focus of this research is on individual welfare, not the welfare of a household, it is important to correct total consumption expenditures of households based on households' composition. In addition, in order to be able to compare consumption expenditures across households, it is essential to adjust family consumption levels to individual-equivalent levels by household size, or by an adult equivalent scale, as the IHLCA surveys collect the data at the household level. Several researchers assess the welfare of a household by dividing expenditures by household size. However, a household consists of adults and children. Deaton and Zaidi (2002) also argue "deflating by household size will understate the welfare of people who live in households with a high fraction of children" (p.46). Apart from household size, the age or gender of household members may also affect the amount of consumption needed to achieve a certain level of well-being. For example, the consumption needs of very young children are usually less than those of working-age adults (World Bank, 2000).

Furthermore, simply adjusting household expenditures by total family size may ignore any economies of scale in consumption expenditure within the household. Deaton and Zaidi (2002) stress that "some goods and services consumed by the household have a 'public goods' aspect to them, whereby consumption by any one member of the household does not necessarily reduce the amount available for consumption by another person within the same household. Housing is an important household public good, at

[15] The term trawlargee comes from the brand name 'Trilogy'. It is a kind of Chinese-made hand tractor with a two stroke engine which, with a trailer attached, can be used to shift large loads of produce/manure, and to transport people.

least up to some limit, as are durable items like televisions, or even bicycles or cars, which can be shared by several household members at different times" (p.46).

Use of the equivalence scales is a way to adjust aggregate consumption measures of households in order to compare welfare across households with different size and demographic composition. Unfortunately, there is no accepted way to estimate equivalence scales (Deaton 1997, Deaton & Paxson 1998) "either for the relative costs of children, or for economies of scale" (Deaton & Zaidi, 2002, p.48). A number of methods are used, but each has major disadvantages. Therefore, a wide variety of equivalence scales is used in different countries.

To verify the analyses of this study with the reports of IHLCA, and IDEA (2007a), and IHLCA (2011a), this research adopts the following formulae used by the IHLCA team, which are based on the nutritional norms of the National Nutritional Centre, Department of Health, Myanmar and on Deaton and Zaidi's (2002) recommendation. The household adult equivalent scales were calculated separately both for Round 1 and Round 2 in 2004/05 and 2009/10. IDEA and IHLCA (2007c, p.17) and IHLCA (2011c, p.49) describe the two scales as "one for food consumption expenditures (AEF) and another one for non-food consumption expenditures (AENF). For food consumption expenditures by adult equivalent, the formula is:

$$AEF_j = (MA_j + \alpha_1 FA_j + \alpha_2 C_j)^{\theta} \quad (2.4)$$

where:

AEF_j is number of adult equivalents for food consumption expenditures in household *j*

MA_j is number of male adults (15+ years) in household *j*

FA_j is number of female adults (15+ years) in household *j*

C_j is number of children (0-14 years) in household *j*

α_1 is food cost of a female adult relative to that of a male adult

α_2 is food cost of a child relative to that of a male adult

θ is elasticity of adult equivalents with respect to effective size (between 0 and 1). $(1 - \theta)$ measures the extent of economies of scale.

Following Deaton and Zaidi's (2002) recommendation, α_1, α_2 and θ were set to 0.9, 0.7 and 0.9 respectively for AEF and α and θ are set to 0.3 and 0.9 respectively for AENF. For non-food consumption expenditures by adult equivalent, the formula is:

$$AENF_j = (A_j + \alpha C_j)^{\theta} \quad (2.5)$$

where:

$AENF_j$ is number of adult equivalents for non-food expenditures in household j

A_j is number of adults (15+ years) in household j

Cj is number of children (0-14 years) in household j

α is non-food cost of a child relative to that of an adult

θ is elasticity of adult equivalents with respect to effective size (between 0 and 1).

$(1 - \theta)$ measures the extent of economies of scale".

Following IHLCA and IDEA (2007c), and IHLCA (2011c), in order to get aggregated nominal food consumption expenditures in adult equivalent per year, "total yearly nominal food consumption expenditures are adjusted by dividing total food consumption expenditures per year by AEF for each household" (IHLCA & IDEA, 2007c, p.18; IHLCA, 2011c, p.50). Similarly, total nominal non-food consumption expenditures, health expenditures and user costs of durables per year are adjusted by dividing total non-food consumption expenditures, health expenditures and user costs of durables per year by AENF for each household. The consumption aggregate or "total nominal consumption expenditures in adult equivalent per year for each household were calculated by adding total nominal food consumption expenditures in adult equivalent per year and total nominal non-food consumption expenditures" (IHLCA & IDEA, 2007c, p.18; IHLCA, 2011c, p.50) including health expenditures and user costs of durables in adult equivalent per year.

2.2.5 Adjustment for differences in prices across regions

To be able to compare household consumption aggregates across states and regions, it is necessary to adjust for differences in prices across regions. In order to be in line with the analyses of IHLCA and IDEA (2007a) and IHLCA (2011a), this research adopts the Paasche Price Index (PPI) (Paasche, 1874, p. 172, cited in Auer (2014)) used by the IHLCA teams. The nominal household expenditures per year per adult equivalent are deflated by PPI, which adjusts for "both variations in prices and quantities consumed

across space and time. A PPI was calculated for each household for both rounds separately" (IHLCA & IDEA, 2007c, p.19; IHLC A, 2011c, p.50), using the formula:

$$PPI_j = \frac{p^j * q^j}{p^0 * q^j} = \left(\sum_i w_{ij} * \left(P_i^0 / P_i^j\right)\right)^{-1} \quad (2.6)$$

where:

PPI_j is Paasche's price index for household *j*

p^j is vector of prices paid by household *j*

p^0 is vector of prices paid by the reference household[16] (median prices at Union[17] level)

q^j is vector of quantities consumed by household *j*

w_{ij} is budget share of food item *i* in total food expenditures per adult equivalent per year for household *j*

P_i^0 is implicit reference price of item *i*

P_i^j is implicit price of item *i* paid by household *j*

i is food item number.

To get total normalized consumption expenditures, including health expenditures and user costs of durables per year per adult equivalent for each household, total nominal consumption expenditures consisting of health expenditures and user costs of durables per year per adult equivalent for each household are divided by its PPI.

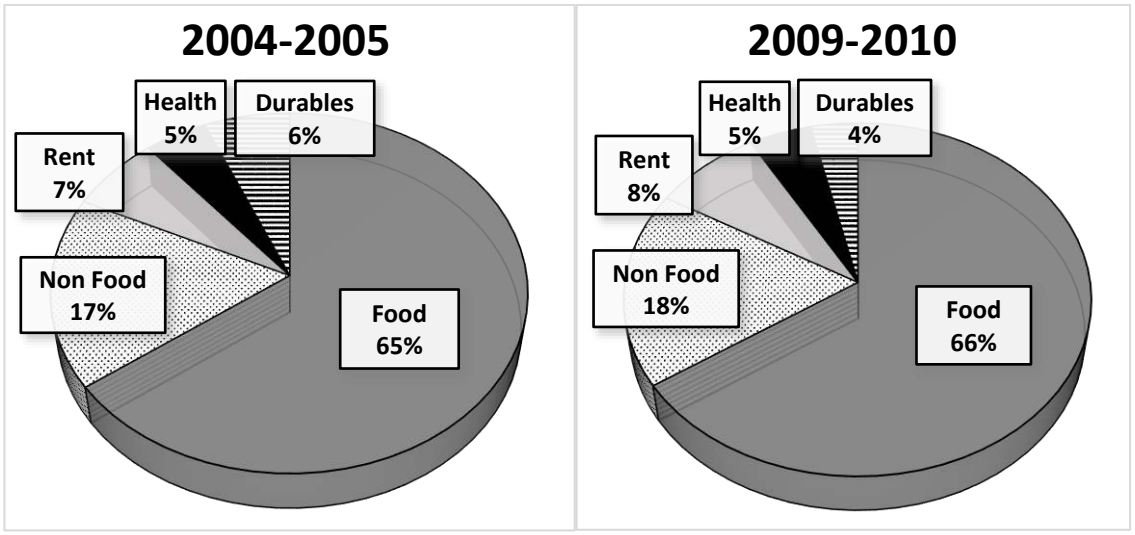
2.3 The composition of spending by consumption expenditures in 2004/05 and 2009/10

Comprehensive measures of household welfare are constructed for both 2004/05 and 2009/10 by adding health expenditures and user costs of durables to the consumption expenditures of the IHLCA project technical unit. The percentages of total consumption

[16] IHLCA and IDEA (2007c, p.20) and IHLCA (2011c, p.51) state that "the reference household was the average of consumption expenditures of households in the second quartile of normalized total consumption expenditures per adult equivalent" (http://www.mm.undp.org/content/myanmar/en/home/library/poverty/technical-report-ihlca-i.html).

[17] In this thesis, the word 'union' equals to 'national'.

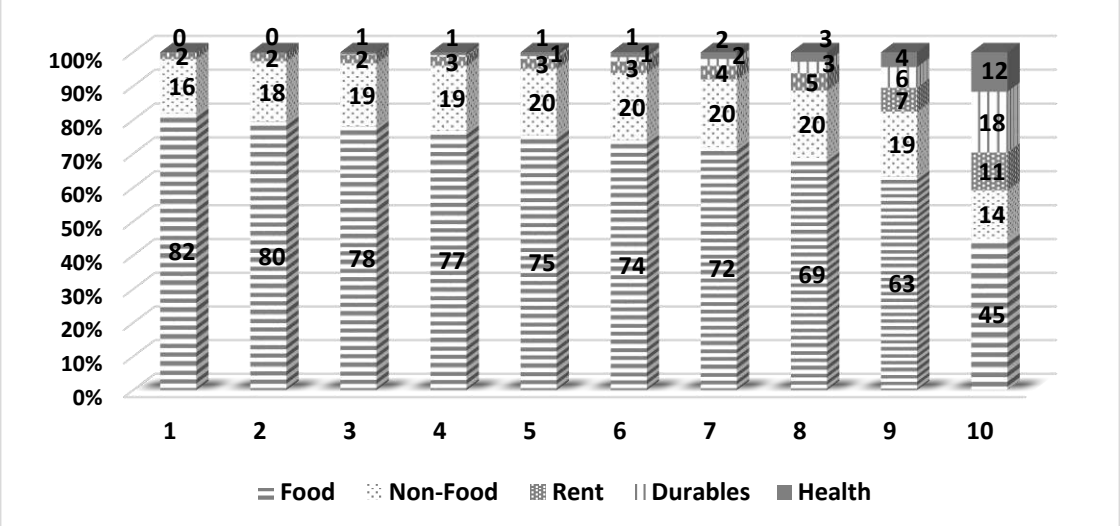
expenditures per adult equivalent in 2004/05 and 2009/10 are shown in pie charts in Figure 2.3.



Source: IHLCA and IDEA (2007a) and IHLA (2011a); Author's calculations

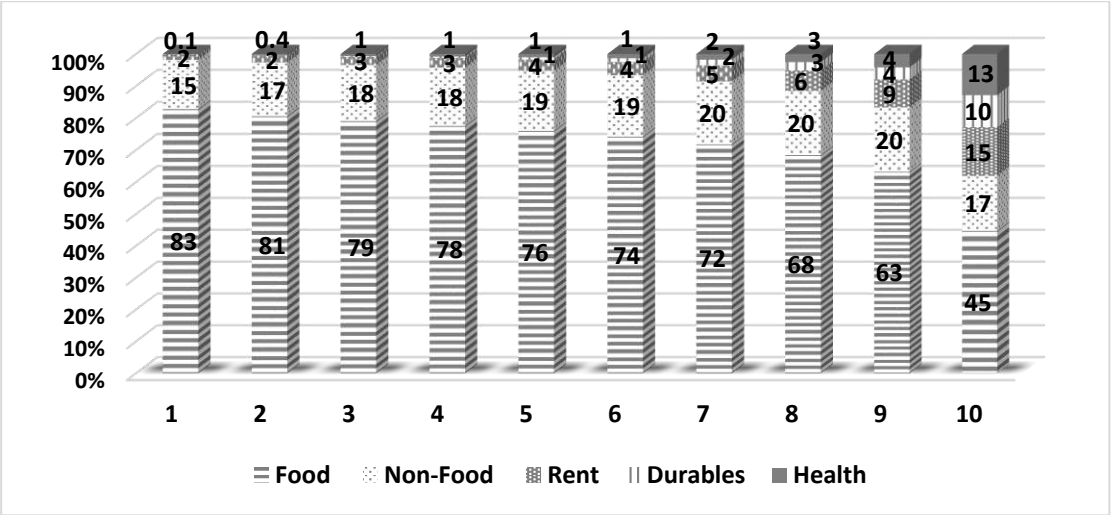
Figure 2.3 Percentage of reported spending devoted to food, non-food, health, durable goods, and rent, for Myanmar, 2004/05 and 2009/10

As illustrated in Figures 2.4 and 2.5, most of the consumption expenditures of the lowest deciles go to food at 82% and 83% in the 1st decile (the poorest) in 2004/05 and 2009/10 respectively. There is almost no spending at the 1st and the 2nd deciles in both survey years for durables. For durables and health expenditures, the 10th decile (the richest) spent up to 18% and 12% sequentially in 2004/05 and up to 10% and 13% respectively in 2009/10.



Source: IHLCA and IDEA (2007a) and IHLA (2011a); Author's calculations

Figure 2.4 The composition of spending by consumption expenditure decile in Myanmar 2004/05



Source: IHLCA and IDEA (2007a) and IHLA (2011a); Author's calculations

Figure 2.5 The composition of spending by consumption expenditure decile in Myanmar 2009/10

2.4 Methods

2.4.1 Data sources

The only source of comprehensive data utilized is from the two waves of a household panel survey of IHLCA-I (2004/05) and IHLCA-II (2009/10). The IHLCA-II sample design retains a panel (same households are surveyed in both years) of 50% from the IHLCA-I sample of households allowing for dynamic analysis. IHLCA-I is a nationwide representative sample of 18,660 households with two rounds of data collection (November/December 2004 and May 2005) to capture seasonal variations. To ensure comparability with IHLCA-I, IHLCA-II entailed monitoring household living conditions by utilising the same two-round data collection approach, with a sample of 18,609 households (December 2009/January 2010 and May 2010).

During the survey periods 2004/05 and 2009/10, the republic of the union of Myanmar was divided into 17 administrative states/regions (divisions). Myanmar's states and regions are subdivided into 61 districts, which are further subdivided into townships, wards, village tracts and villages. Altogether 1,555 street segments and villages are kept as the same sample for both IHLCA-I and II (IHLCA, 2011c, p. 10). Some areas were excluded from IHLCA-I due to inaccessibility. The estimated number of households in the excluded areas represents an estimated number of 343,130 households with a total

estimated population of 1,787,708 (5% of the total population). Some of these were accessible for IHLCA-II but not documented[18]. IHLCA and IDEA (2007c) stress that "the Survey covered both the urban and rural areas at the regional and national levels. The Survey aimed to produce data at the regional level for each of the 17 States/Divisions. No Township estimates were to be provided as this would necessitate too large a sample size. The sample was large enough to provide good sample estimates of a number of important living conditions characteristics at the national level, and reasonably good sample estimates at the States/Divisions level" (p.5).[19]

A household in the surveys is defined as "a group of one or more related or unrelated persons who normally sleep and eat most of their meals together in the same dwelling unit" (IDEA & IHLCA, 2007c, p.3). Household members "include all living persons, related or unrelated, who normally sleep and eat most of their meals together in the same dwelling unit. For the purposes of this assessment, hired workers, domestic workers and boarders who receive accommodation and meals are treated as part of the household. Temporary visitors as well as lodgers who do not receive meals are not treated as part of the household and will not be asked to participate in the survey" (IDEA & IHLCA, 2007c, p.3). A detailed list of persons who should be household members is presented in Table 3.1 on page 4 of the technical report (IDEA & IHLCA, 2007c).

The surveys conducted by the IHLCA team is in line with the professional work of household surveys conducted in other countries. When annual totals are calculated the two surveys observe respondents twice within the year to deal with seasonality. The questionnaires are comprehensive and record very detailed food items which include quantities and calorie contents for about 160 food items. Thus, the questions asked for household consumption expenditure are much more comprehensive than typical household surveys (Gibson, 2015). Furthermore, quality reports of the two survey years are published to describing how the surveys are conducted. IHLCA (2011b) discusses the respondent errors as "the literature indicates that recall error is less if the households are confronted with a detailed list of consumption and expenditure items than if a more summary list of groups of consumption items is used. This is the case in the IHLCA surveys and a way of mitigating the problem". In addition, it is reported that "a 99.7

[18] IHLCA (2011b, p.21-22) and IDEA and IHLCA (2007c, p.60-62) report coverage of the surveys with a map showing excluded and inaccessible townships during IHLCA survey operations.
[19] IHLCA (2011c) details the survey design and sampling units for the IHLCA-I and IHLCA-II surveys on pages 9-10, and 27-29.

percent response rate at the household level is reported for the IHLCA-II survey in spite of the challenge to both households and interviewers that the long complex interview represented" (p.9).

This research uses the consumption expenditures per year per adult equivalent for each household constructed by the IHLCA project technical unit. In the estimation of the consumption aggregate[20] by the IHCLA team, the following are included:

1) Food consumption expenditures
2) Non-food consumption expenditures, including clothing and other apparel, home appliances, house rent and repair, education, travel/trips (overnight travel) and other (household worker services, etc.)
3) Housing expenditures are the yearly user costs, best approximated by rental value which is measured by calculating actual monthly rental value, estimating monthly rental value by the households, and the regression estimate of rental value.

The IHLCA and IDEA (2007a) and IHLCA (2011a) did not include health expenditures (including traditional medicine) and the user costs of durable goods in the non-food consumption expenditures, even though the user costs of durable goods were calculated. The reasons given were that a number of important items showed negative user costs because of a negative depreciation rate. It was argued that the policy of import restrictions caused an increase in the prices of durable goods; for example, the value of used cars was higher than or equal to that of new cars[21]. In addition, the IHLCA and IDEA (2007a) and IHLCA (2011a) exclude health expenditures in non-food consumption; they argue that the health expenditures do not normally enhance household welfare but rather, these are mostly a reaction to a negative shock. They also show that households were in debt due to borrowing money for health reasons for 8.5% of loans in the first round and 11% of loans in the second round. Moreover, they claim that the elasticity of health expenditures with respect to total consumption expenditures is quite low (0.993). Finally, health expenditures are not included in total consumption aggregates calculated by the IHLCA

[20] See IHLCA & IDEA (2007c, pp. 11-16); IHLCA (2011c, pp. 45-48) for detailed steps of construction of the consumption aggregate.
[21] The tight import control of the government on issues of import licenses distorted the car prices in Yangon (and in Myanmar) and the used car prices were among the highest in the world during 2004/05 and 2009/10. For example, 1986/87 Nissan Sunny Super Saloon and 1988 Toyota Corolla SE Limited which were the two most popular cars in Yangon, cost the equivalent of about USD 20,000 and USD 29,000 respectively, in July 2008 (Kean, 2008, cited in Wikipedia (http://en.wikipedia.org/wiki/Yangon)).

technical team, based on the recommendation of Deaton and Zaidi (2002) that the higher the elasticity, the stronger the case for inclusion.

Therefore, this study uses the total consumption aggregates for 2004/05 and 2009/10 as calculated by the IHLCA technical team. Health expenditures and the user costs of durable goods per year per adult equivalent deflated by PPI are added in the non-food consumption expenditures of their total consumption aggregates, to get the total comprehensive consumption aggregates for the 2004/05 and 2009/10 surveys.

2.4.2 Measurement of inequality

Inequality is measured in various ways for the comparisons, of income distributions, based on criteria which may be developed from ethical principles, appropriate mathematical constructs or simple intuition (Cowell, 1995, 2000)[22]. The simplest measurement of inequality is reported in "the percentage of expenditure (or income) attributable to each fifth (quintile) or tenth (decile)" after sorting the population from the poorest to the richest (Haughton & Khandker, 2009, p.103). There are also two conceptually distinct definitions of income inequality: relative and absolute inequality (Kolm, 1976a, 1976b).

For Myanmar, IHLCA (2011a) reports on 'relative' and 'absolute' inequality. For relative inequality, the consumption share of the poorest 20% is measured and compared with the richest 20% of total income. The measure remains constant if everyone's consumption increases or decreases at the same rate. Absolute inequality is calculated on the consumption gap in terms of absolute Myanmar Kyat differences in expenditures between the richest and poorest 20%, which is related to the absolute value of the difference in consumption expenditure. Absolute inequality will increase if the consumption expenditures of the richest and poorest 20% both increase at the same rate, because the absolute gain of the richest 20% will be greater at a much higher level of consumption (IHLCA, 2011a, p.20).

A number of the relative and absolute inequality analyses below are reported in this thesis to show the robustness of the study. In order to compare the results of this study with the existing literature on consumption inequality in Myanmar, the consumption share of the

[22] Cowell (1995, 2000) presents details of at least 12 summary measures of inequality.

poorest 20%, and the consumption gap between the richest and poorest 20% are also calculated.

2.4.3 Basic dispersion measures[23]

Simple, commonly used indices of relative inequality which are scale invariant are dispersion ratios: quartile, quintile, decile, and percentile ratios of the consumption share of the poorest/richest (Cowell, 2000). The dispersion ratio in terms of decile and percentile ratios, and charting inequality for basic dispersion measures are presented.

2.4.3.1 Dispersion ratio

Dispersion ratios measure the 'distance' between two groups in the distribution of expenditure (or income). There are different alternatives: the most frequently used are for deciles and quintiles.

2.4.3.2 Decile ratio

This is a simple and straightforward measure of inequality, "the decile dispersion ratio is the ratio of the average consumption (or income) of the richest" X% of households to "the average consumption (or income) of the poorest" X% of households (Haughton & Khandker, 2009, p. 104). However, they ignore information about consumption expenditure in the middle of the distribution, and do not use information about the distribution of consumption within the top and bottom deciles. S90/S10 and S80/S20 ratios are also presented. OECD (2014) defines S90/S10 as the ratio of the average income of the 10% richest to the average income of 10% poorest. S80/S20 is the ratio of the average income of the 20% richest to the 20% poorest.

2.4.3.3 Percentile ratio

A percentile ratio is the ratio of the lower cut-off point for the top group to the upper cut-off point for the bottom group. The ratios of $90^{th}/10^{th}$, $90^{th}/50^{th}$, $10^{th}/50^{th}$ and $75^{th}/25^{th}$ percentiles are used for this research. Atkinson (1983) claims that this measure, although easy to interpret, is a very crude measure of inequality. P90/P10 is the ratio of the income of the household at the 90^{th} percentile (that is the household at the bottom of the top 10%) with that of the household at the 10^{th} percentile (that is the household at the top of the

[23] The World Bank (http://info.worldbankn.org/etools/docs/library/93518)

bottom 10%). OECD (2014) defines the P90/P50 ratio as "P90/P50 of the upper bound value of the ninth decile to the median income; and P50/P10 of median income to the upper bound value of the first decile" (p.64).

In other words, P90/P50 is the ratio of the expenditure of the household at the 90th percentile to the median expenditure, P50/P10 is the ratio of the expenditure of the household at the median expenditure to the 10th percentile, and P75/P25 is the ratio of the expenditure of the household at the 75th percentile with that of the household at the 25th percentile. Jenkins and Van Kerm (2009) note that "one oft-cited advantage of the P90/P10 ratio is that it avoids problems of 'top-coding'[24] in survey data" (p.50). Nevertheless, the percentile ratios also only use information from two points mainly percentiles selected in the distribution.

2.4.3.4 Charting inequality for basic dispersion measures

I. The Pen's parade

Alternatively, the Pen's parade can provide helpful visual aids when comparing expenditure (or income) distribution of two different areas or periods. This concept is captured by the famous story of the 'parade of dwarfs and a few giants' by Pen (1971). When applied to expenditure (or income), on the horizontal axis every person is lined up in ascending order of expenditure (or income), while the vertical axis shows the level of expenditure (or income) per capita. The resulting diagram features the presence of any extremely large expenditure (or income) per capita and to a certain extent abnormally small expenditure (or income) per capita. The graph is often shortened toward the upper end of the distribution, to focus on changes at the lower end where there is with low expenditure (or income) per capita. The graph of a Pen's parade would simply be a cumulative density function if the axes were flipped (Haughton & Khandker, 2009; Cowell, 2011).

II. Growth incidence curves (relative and absolute expenditure inequality)

When the distribution of national income (or expenditure) declines or rises, the income (or expenditure) of the poor or the rich may decline or rise more or less faster than that of

[24] Jenkins and Van Kerm (2009) note that "top-coding arises when data producers, to maximize confidentiality and minimize disclosure risk, replace all incomes above a particular value with that value (the 'top code')" (p.50). See also Burkhauser, Feng, and Jenkins (2009).

the country overall. A growth incidence curve is a visually persuasive way to show this effect, "which can be computed as long as data are available from surveys undertaken at two times. The procedure is as follows:

1) Divide the data from the first survey into centiles—for instance, using the xtile command in Stata—and compute expenditure per adult equivalent for each of the 100 centiles.
2) Divide the data from the second survey into centiles, and again compute expenditure per adult equivalent for each centile.
3) After adjusting for inflation, compute the percentage change in (real) expenditure per adult equivalent for each centile and graph the results.
4) After adjusting for inflation, compute the gap in real expenditure per adult equivalent for each centile and graph the results" (Haughton & Khandker, 2009, p.110).

2.4.4 Aggregate measures

2.4.4.1 Charting inequality for aggregate measures

I. Lorenz curve

The Lorenz dominance criterion is generally recognized as the basic tool for making inequality comparisons. It states that if the Lorenz curve (Lorenz, 1905) of a distribution lies at every point above the Lorenz curve of some other distribution, the former is classified as more equal than the latter (Ray, 1998; Barrett, Crossley & Worswick, 2000). Ray (1998) defines the Lorenz curve as "an inequality measure is consistent with the Lorenz criterion if and only if it is simultaneously consistent with the anonymity, population, relative income, and Dalton principles" (p.181).[25] These principles are generally regarded as fundamental to the theory of inequality measurement (Cowell, 2000). Four criteria for inequality measurement can be intuitively explained (Ray, 1998) as follows:

[25] S-concavity is necessary and sufficient for a summary measure of inequality to satisfy the Lorenz dominance criterion (Dasgupta, Sen & Starrett, 1973).

Anonymity principle

This principle states that it is not important who earns the income. It is labelled anonymity because the researchers care about the ranking from the lowest to the highest, but independent of any characteristic of each earner. Sometimes "this axiom is also referred to as 'Symmetry'" (Litchfield, 1999, p.2).

Population principle

The population principle states that the population size is unimportant as long as the composition of different levels of income remain the same in percentage terms.

Relative income principle

Ray (1998) stresses that "only relative incomes should matter and the absolute levels of these incomes should not" (p.176). If one income distribution is swapped for another when every person's income is scaled up or down by the same percentage, then there should be no change in the measure of inequality.

Dalton principles

The Dalton principle is fundamental to the comparisons of inequality measures and is a minimal property for normative measures of inequality (Atkinson, 1970 and Sen, 1973). Let $(y_1, y_2, \ldots y_n)$ be an income/consumption distribution and consider two incomes y_i and y_j with $y_i \leq y_j$. A transfer of income from household i to household j is called a regressive transfer and "the Dalton principle states that if one income distribution can be achieved from another by constructing a sequence of regressive transfers, then the former distribution must be deemed more unequal than the latter" (Ray, 1998, p.177).

To understand Lorenz dominance relations, and unambiguous differences in consumption expenditure inequality across measures of individuals' well-being and over time, the Lorenz curve $L(x)$ is estimated. The Lorenz curve is a simple diagrammatic way to depict the distribution of income. The curve shows the cumulative distribution of the population arranged in increasing order of income or consumption expenditure on the horizontal axis against the cumulative distribution of total income or consumption expenditure on the vertical axis in each year. The 45-degree line is called the perfect equality line because at each point along the line represents the relationship $y=x$, meaning for example, that

exactly 20% of total income or consumption expenditure is ascribed to the first 20% of the households, and so forth. Thus, in the case of perfect equality the Lorenz curve coincides with the 45-degree line, denoting that every person earns an equal proportion of total income. The Lorenz curve will be further from the 45-degree line if the inequality is greater. Hence, the extent of the inequality can be captured by intuitively studying the curve (Ray, 1998). Lorenz curves are scale invariant and provide a graphical form of the cumulative distribution function, and are independent of the location (Barrett, Crossley & Worswick, 2000, p.118).

II. Stochastic dominance

The assessment of changes in inequality in this research follows Araar (2007) by testing for significance of the difference in Lorenz curves at different points, building on the theory of stochastic dominance by Atkinson (1987), and Foster and Shorrocks (1988). Levine and Roberts (2013) note that "inequality dominance is determined by comparison of the difference between Lorenz curves. Inequality in the 2009/10 distribution dominates the 2004/05 distribution, in the second order (*i.e.* has lower inequality), if the Lorenz curve of 2009/10 is everywhere above the Lorenz curve of 2004/05, or:

$$\Delta L(p) = L_{2009-10}(p) - L_{2004-05}(p) > 0, \forall\, p \in [0;1]\,, \qquad (2.7)$$

where p refers to the percentile in the distribution" (p.174-175).

Davidson (2006) also states that "stochastic dominance is a term which refers to a set of relations that may hold between a pair of distributions" (p.1). Further, Litchfield (1999) notes that an alternative method of stochastic dominance can be applied when rankings are ambiguous. Three types of stochastic dominance discussed are 1) first order stochastic dominance, 2) second order stochastic dominance and 3) mean-normalised second order stochastic dominance. Litchfield (1999) argues that first and second orders of stochastic dominance are used mainly in comparisons of welfare distributions. Consider two consumption expenditure distributions E_1 and E_2 characterised by cumulative distribution functions $F_{(E1)}$ and $F_{(E2)}$. Then distribution E_1 displays the first order stochastic dominance over distribution E_2 if $F_{(E1)} \leq F_{(E2)}$ for all E. Hence all levels of consumption expenditure in distribution E_1 are not less than a given consumption expenditure level in distribution E_2. Litchfield (1999) explains that "the second order stochastic dominance is implied by the first order stochastic dominance, although the reverse is not true" (p.5).

The third concept, known as Lorenz dominance, is applied to rank distributions in terms of inequality alone, rather than welfare. In the Lorenz curve, the distribution 1 is said to Lorenz dominate another distribution 2 if the Lorenz curve of distribution 1 lies nowhere below and at least somewhere above the Lorenz curve of distribution 2. Then, there is less inequality in 1 than there is in 2. The two distributions will be ranked in the same way as the Lorenz curves if the inequality measure used satisfies the anonymity and the Pigou-Dalton transfer principles (Atkinson, 1970).

2.4.4.2 Aggregate inequality measures

In order to obtain a complete ranking of distributions, and to summarize the inequality by a unique numerical value for comparisons of changes in inequality over time, or differences in inequality between countries or regions, inequality indices are required. Cowell (2011) explains an inequality measure as "a scalar numerical representation of the interpersonal differences in income within a given population" (p.7). The indices this research use are the Gini coefficient, the family of Generalized Entropy (GE) inequality measures and Atkinson's inequality measures. The conventional measures of inequality such as the Gini index and Theil index also use relative inequality concepts (Milanovic, 2007). In addition, the Atkinson index, which uses inequality aversion parameter $\varepsilon \geq 0$ is a relative inequality measure (Cowell, 2000).

I. Gini index

The Gini index is the most widely used indicator of inequality. The Gini coefficient (also known as Gini Ratio, and Gini's Concentration Ratio) was developed by Gini Corrado in 1912 (Dorfman, 1979; Osberg, 1984). The Gini coefficient can be derived from the estimation of the function of the estimated parameters of the Lorenz curve (Kakwani & Podder, 1976 for example). Gastwirth (1972) also shows that the Gini index can be accurately estimated without fitting curves to data whenever the data are grouped properly, while Dorfman (1979) proposes a simple formula for the Gini coefficient that will apply to both discrete and continuous distributions of income with proof.

The Gini coefficient is also defined as a summary statistic of inequality derived from the Lorenz curve. Barrett, Crossley, and Worswick (2000) state that "the difference between two Gini coefficients is simply the area between the two corresponding Lorenz curves" (p.119). The value of the Gini coefficient varies from 0 to 1, and the closer a Gini

coefficient is to one, the more unequal is the expenditure distribution. There are different formulae. However, "if the Lorenz curve is approximated on each interval as a line between consecutive points"[26], the Gini index can be approximated with

$$Gini = 1 - \sum_{i=1}^{N} (X_i - X_{i-1})(E_i + E_{i-1}), \tag{2.8}$$

where

X_i is the cumulative proportion of the population variable, for $i = 0,...,n$, with $X_0 = 0$, $X_n = 1$.

E_i is the cumulative proportion of the expenditure variable, for i = 0,...,n, with $E_0 = 0$, $E_n = 1$.

X_i and E_i are indexed in increasing order ($X_i > X_{i-1}$) and ($E_i > E_{i-1}$).

The Gini index is sensitive to income values in the middle of the distribution. Its disadvantage is that it is not defined for negative incomes (Kovacevic & Binder, 1997). The Gini coefficient has desirable properties and it satisfies all four principles/axioms: the anonymity, the population, the relative income and the Pigou-Dalton Transfer principles and thus is Lorenz-consistent (Ray, 1998). However, it will fail the decomposability axiom if the sub-vectors of income overlap (Litchfield, 1999) as it has a non-zero residual K besides the within-group and between-group inequalities (Bellù & Liberati, 2006b). A good measure of inequality distributions satisfies the following axioms[27]:

Decomposability

Overall inequality is related consistently to population groups, or income sources, or in other dimensions. For instance, overall inequality is expected to rise if inequality among each sub-group increases. Haughton and Khandker (2009) state that "the Gini index is not easily decomposable or additive across groups. That is, the total Gini of the total population is not equal to the sum of the Gini coefficients of its subgroups" (p.106). However, "the Generalised Entropy class of measures are easily decomposed and into intuitively appealingly components of within-group inequality and between-group inequality"[28]. The Atkinson's inequality measures can be decomposed but not additively.

[26] (https://en.wikipedia.org/wiki/Gini_coefficient)
[27] See Cowell (1985, 2000) on the axiomatic approach and Haughton and Khandker (2009).
[28] (http://web.worldbank.org/)

In other words, total inequality is not equal to the sum of the two components of within-group inequality and between-group inequality (Litchfield, 1999).

Statistical testability

The statistical significance of changes in the inequality index over time should be testable. A number of researchers discuss bootstrapping techniques to measures of inequality to enable statistical inference (Mills & Zandvakili, 1997; Jolliffe & Krushelnytskyy, 2000; Biewen, 2002; Gray et al., 2003; Davidson & Flachaire, 2007, for example). Duclos and Araar (2006) have developed DAD which stands for 'Distributive Analysis/Analyse Distributive', a very useful software to test the difference between inequality indices and also delivered DASP which stands for 'Distributive Analysis Stata Package' as a user version to apply in Stata. Clarke and Roy (2012) test "inference for Generalized Entropy and Atkinson inequality measures with complex survey data using Wald statistics with variance-covariance matrices estimated from a linearization approximation method" (p.499).

II. Generalized Entropy measures

Cowell (2000) argues that "it is almost essential to attempt to 'account for' the level of, or trend in, inequality by components of the population" (p.123). Any measure $I(E)$ that satisfies all axioms is a member of the GE class of inequality measures (Cowell,1995). The general formula is:

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{E_i}{\bar{E}}\right)^{\alpha} - 1\right], \tag{2.9}$$

where N is the number of individuals in the sample, E_i is the expenditure of individual i, while $i \in (1, 2,...,n)$, and $\bar{E} = \frac{1}{N}\sum E_i$ represents the arithmetic mean of expenditure of individual i. Finally, α is a parameter representing the weight given to levels of wellbeing at different parts of the distribution. The value of the $GE(\alpha)$ ranges from 0 (showing an equal distribution of expenditure) to 1 (showing increasing levels of expenditure inequality).

GE class measures are sensitive to changing weight values of α which capture the differences of expenditure (or income) at various parts of the expenditure (or income) distribution. The values commonly used for α are 0, 1 and 2, though it can take all possible real values. A positive and small value of α makes $GE(\alpha)$ highly sensitive to changes in the lower tail of the expenditure (or income) distribution, while a positive and higher value such as 2 makes GE(α) sensitive at the upper tail of the expenditure (or income) distribution. *GE* (1) and *GE* (0) are the Mean Log Deviation and the Theil'sT index of Theil's measures of inequality (Theil, 1967).

Theil (1967) set a readily decomposable inequality measure. Several empirical applications have been subsequently conducted by illustrating with the measure (Theil, 1972). Foster (1983) state that "the Theil index of inequality is derived from Shannon's entropy measure of information" (p.113) theory. The Theil L index (Mean Log Deviation) of consumption inequality can be calculated (Theil, 1967, pp. 125-127) as follows:

$$GE(0) = \frac{1}{N}\sum_{i=1}^{N} \ln\left(\frac{\overline{E}}{E_i}\right). \tag{2.10}$$

The Theil L index (Mean Log Deviation) ranges from 0 to infinity, and the higher the value of Theil L (Mean Log Deviation), the higher the inequality is. The Theil T index of inequality is calculated (Theil (1967, pp. 91-95) as:

$$GE(1) = \frac{1}{N}\sum_{i=1}^{N} \frac{E_i}{\overline{E}} \ln\left(\frac{E_i}{\overline{E}}\right). \tag{2.11}$$

The Theil T index ranges from 0 (lowest inequality) to ln (N) (highest inequality). With α = 2 the GE measure becomes 1/2 the squared coefficient of variation, CV:

$$GE(2) = \frac{CV^2}{2} \quad \text{where} \quad CV = \frac{1}{\overline{E}}\left[\frac{1}{N}\sum_{i=1}^{N}(E_i - \overline{E})^2\right]^{\frac{1}{2}}. \tag{2.12}$$

It is stated that "measures from the GE class are sensitive to changes at the lower end of the distribution for α close to zero, equally sensitive to changes across the distribution for α equal to one (which is the Theil index), and sensitive to changes at the higher end of the

distribution for higher values"[29]. In other words, as Biewen and Jenkins (2003) also explain, "the indices differ in their sensitivities to differences in different parts of the distribution. The more positive that α is, the more sensitive GE(α) is to differences at the top of the distribution; the more negative that α is, the more sensitive it is to differences at the bottom of the distribution"[30].

III. Atkinson's inequality measures

Atkinson (1970) "derives a new measure of inequality based on the concept of Equally Distributed Equivalent (EDE) income with the underlying assumption of an additive, homothetic and symmetric welfare function" (as cited in Das & Parikh, 1982, p.23). Bellù and Liberati (2006a) note that "EDE is that level of income that, if obtained by every individual in the income distribution, would enable the society to reach the same level of welfare as actual incomes" (p.3). The general formula is:

$$A_{\varepsilon} = 1 - \left[\frac{1}{N} \sum_{i=1}^{N} \left(\frac{\mathrm{E}_i}{\overline{\mathrm{E}}} \right)^{1-\varepsilon} \right]^{1/(1-\varepsilon)} \quad , \varepsilon \neq 1 \ , \tag{2.13}$$

$$A_{\varepsilon} = 1 - \frac{\prod_{i=1}^{N} \mathrm{E}_i^{\left(\frac{1}{N}\right)}}{\overline{\mathrm{E}}} \quad , \varepsilon = 1 \ , \tag{2.14}$$

where ε is an inequality aversion parameter, $0 < \varepsilon < \infty$: that is, the higher the value of ε the more society is concerned about inequality (Atkinson, 1970, cited in Litchfield, 1999). The Atkinson class of measures range from 0 to 1, with zero representing no inequality. Cowell (1995, cited in Litchfield, 1999) shows that setting $\alpha = 1 - \varepsilon$, the GE class becomes ordinally equivalent to the Atkinson class, for values of $\alpha < 1$. Biewen and Jenkins (2003) stress that the larger that ε is, the more sensitive that A (ε) becomes to differences at the bottom of the distribution.

[29] (http://siteresources.worldbank.org/)
[30] (http://fmwww.bc.edu/repec/bocode/s/svygei.html)

2.4.5 Statistical test for inequality indices

2.4.5.1 Variance estimations

Steel and McLaren (2009) emphasize that the sample overlap induces a correlation structure in the sampling errors of the time series of estimates, which affects the analysis of changes in them and estimates. Having overlap in the sample will reduce the sampling variance of estimates of change. If the correlation is low and positive, the reduction in variances is small. In addition, if the correlation is positive, the standard error of the difference between estimates normally will be smaller when samples are dependent[31] than when samples are independent. A negative correlation will increase sampling variances, although such cases are not common. The effects of the complex design (that is, for this study a stratified multi-stage sample design) and estimation usually take into account in the estimation of sampling variances. Coladarci and Cobb (2013) also contend that "the reduction in the standard error is the major statistical advantage of using dependent samples. The smaller the standard error, the more the sample results will reflect the extent of the 'true' or population difference" (p.280). Steel and McLaren (2009) provide the following formula for the variance of the estimate of change as a basic theory of estimation for repeated surveys, using $E_t - E_{t-s} = \Delta^{(s)} E_t$ for the change *s* time periods.

$$Var(\Delta^{(s)} E_t) = Var(E_t) + Var(E_{t-s}) - 2\sqrt{Var(E_t)}\sqrt{Var(E_{t-s})}corr(E_t, E_{t-s}) \text{ . (2.15)}$$

If the samples are independent between the two time periods, then $Corr(E_t, E_{t-s}) = 0$. The degree of overlap is a factor influencing the correlation. Consider the simple situation of a stable population (that is, no births and deaths), and a simple random sample with negligible sampling fractions. Let *m* and *n* be the sample sizes at time *t* and *t - s*, *q* is the size of the sample in common between the two time periods (*t* and *t - s*), then *q/m* is the proportion of the sample at time *t* that is common between the two periods, and *q/n* is the proportion of the sample at time *t - s* that is also common between the two periods. Then,

$$corr(E_t, E_{t-s}) = \sqrt{\frac{q}{m} * \frac{q}{n} * r_{t,t-s}} \text{ , } \quad (2.16)$$

[31] They are also called related or correlated samples (Howell, 2013) as "observations from one sample are related in some way to those from the other" (Coladarci & Cobb, 2013, p.278).

where $r_{t,t-s}$ is the individual level correlation between values at time *t* and *t – s.* If the variance (E_t) changes, the variance of the estimate of change for different degrees of overlaps between two samples will be:

$$Var(\Delta^{(s)}E_t) = Var(E_t) + Var(E_{t-s}) - 2\sqrt{Var(E_t)}\sqrt{Var(E_{t-s})}\sqrt{\frac{q}{m} * \frac{q}{n} * r_{t,t-s}} \quad . \quad (2.17)$$

Steel and McLaren (2009) affirm that if there is no sample overlap, the variance of the estimate of change will be the sum of the variances. Zheng and Cushing (2001) also propose an asymptotically distribution-free inference for comparing inequality indices with dependent samples. The concept for testing dependent samples, and partially dependent samples applied by Zheng and Cushing (2001) is the same as the basic theory of estimation used by Steel and McLaren (2009). Thus, this research uses the basic estimation concepts described above for hypothesis testing of the relative and absolute inequality indices over the survey years.

Several researchers deal with large sample properties when analysing the classic inequality indices. Some are Gastwirth (1974), Gail and Gastwirth (1978), Gastwirth and Gail (1985), Cowell (1989) and Thistle (1990). These researchers "show that estimates of inequality indices are asymptotically normal and, hence, conventional inference procedures can be applied directly" (Zheng & Cushing, 2001, 316). Simulations and applications to the Current Population Surveys (CPS) and the Panel Study of Income Dynamics (PSID) data "indicates that failure to correct for sample dependency may increase the standard error by 3.3% to 17.1%" (Zheng & Cushing, 2001, p. 329).

Moreover, Duclos and Araar (2006) emphasize that "omitting sampling weights in distributive analysis will systematically bias both the estimators of the values of indices and points on curves as well as the estimation of the sampling variance of these estimators" (p.274). Bhattacharya (2007) also points out that standard errors are hardly reported on measures of inequality in applied work. It is important to obtain "correct standard errors for the purpose of valid inequality comparisons across time as the observed movement in inequality through time is usually very small" (p.675). The author proves that "by taking only stratification (and not clustering) into account the estimate of the standard errors has fallen by 23.51% of the naïve standard error for a consistent estimate of the Gini for urban India in 1993–1994" (p.692). The author also reports that

"cluster effects are larger than stratum effects and also they are also much larger in urban areas relative to rural ones" (p.693).

Davidson (2009) argues that all standard errors suggested for the Gini index are either complicated or questionable even though several researchers have paid attention to obtain reliable standard errors. Davidson (2009) demonstrates that the jackknife estimator is not a consistent estimator of the asymptotic variance of the Gini coefficient. Gamboa et al. (2010) affirm that "the application of the jackknife method results much larger estimates of the variance of the bias-corrected Gini coefficients. When using the data for all seven cities in Colombia, the estimated jackknife variance is almost 1.8 times the estimated asymptotic variance derived by the formula given in Davidson (2009)" (p.233).

Clarke and Roy (2012) argue that several theoretical papers consider standard asymptotic methods for classic inequality measures. However, the methods used are within the independent and identically distributed (i.i.d.) framework and the effects of complex survey design features such as stratification and clustering are not considered to adjust the variance formulae. In this study, the variance estimation methods which allow for probability weights and for complex survey design are employed.

2.4.5.2 Adjustments to the sampling weights

Probability/sampling weights which are calculated by taking the inverse of the sampling fraction for households are provided for the IHLCA data for 2004/05 and 2009/10. According to Haughton and Khandker (2009), "various postsampling adjustments to the weights are sometimes necessary and a household sampling weight is the right weight to use when summarizing data that relate to households. However, we are often interested in the individual, rather than the household, as the unit of analysis" (p.374). "In estimating individual-level parameters such as per capita expenditure, we need to transform the household sample weights into individual sample weights" (p. 375). Therefore, in this study, the household observational weights are multiplied by household size (the number of household members), to make the resulting expenditure distribution representative of individuals (rather than representative of the distribution across households) at a point in time.

2.4.5.3 Variance estimation of the Gini coefficient, GE and the Atkinson indices

The results of statistical inferences for variance estimation of the Gini coefficient are reported by using the 'svylorenz' Stata code of Jenkins (2008) to take into account the complex survey designs used in the IHLCA surveys. Jenkins (2008) states that 'svylorenz' derives variance estimates using the methods of Kovacevic and Binder (1997) for cumulative shares allowing for probability weights and for complex survey design. Kovacevic and Binder (1997) use linearization methods based on estimating equation methodology to obtain variance estimators for a few inequality measures such as the Gini coefficient and Lorenz curve ordinates. In addition, Biewen and Jenkins (2003) who, based on Woodruff (1971), use a linearization method to obtain asymptotic variances for the GE and the Atkinson families with complex survey data. Thus, the sampling variances of GE and Atkinson inequality indices were derived by using the 'svygei' and 'svyatk' Stata commands of Biewen and Jenkins (2006) with version 8.2. The derivations assume that the sample considered is sufficiently large that a Taylor series approximation to the index holds.

For generating standard errors of coordinates of Lorenz curves of total expenditures per adult equivalent in 2004/05 and 2009/10, DASP version 2.3 (developed by Araar & Duclos (2013)) is used. Stata command 'clorenzs' draws the curves with its lower-bounded or upper-bounded confidence interval, and this research reports asymptotic standard errors on a large number of estimators of distributive statistics for Lorenz curves by taking into account of the complex design of the surveys.

2.4.5.4 Hypothesis testing based on the standard normal test statistic

The hypothesis tests are conducted on two samples (one with half of the sample is independent {that is not in the 2009/10 survey}) and half is dependent (the overlap portion between the 2 surveys {both in 2004/05 and 2009/10}). In other words, the 2nd survey (2009/10) is mixed with 50% of the households of the 1st survey (2004/05). Hypothesis tests for the difference of two values of relative and absolute inequality indices (D=0) over the survey years are conducted after estimating linearized standard errors for comparing:

1) the mean incomes of a set of ordered quantile groups—such as deciles—between two distributions.

2) S90/S10 and S80/S20 ratios, shares of the consumption of the poorest/richest, and consumption gaps between the rich and poor
3) Lorenz curve ordinates
4) Gini coefficient, GE and Atkinson indices
5) Between-group and within-group inequality indices.

For two samples drawn from independent populations, the two-tailed test of the null hypothesis that the two distributions are 'equally unequal' is based on the standard normal test statistic (Barrett & Pendakur, 1995; Davidson & Duclos, 2000) as follows:

$$z = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{\frac{V(I_{2004/05})}{N_{2004/05}} + \frac{V(I_{2009/10})}{N_{2009/10}}}} = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{SE(I_{2004/05})^2 + SE(I_{2009/10})^2}} \quad . \qquad (2.18)$$

Following the concepts of Steel and McLaren (2009) and Zheng and Cushing (2001), the test for dependent samples is given:

$$z = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{\frac{V(I_{2004/05})}{N_{2004/05}} + \frac{V(I_{2009/10})}{N_{2009/10}} - \left[2r * \frac{S(I_{2004/05})}{N_{2004/05}} * \frac{S(I_{2009/10})}{N_{2009/10}}\right]}} \quad , \qquad (2.19)$$

$$z = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{SE(I_{2004/05})^2 + SE(I_{2009/10})^2 - 2r * SE(I_{2004/05}) * SE(I_{2009/10})}} \quad . \qquad (2.20)$$

To take account of the degree of overlapping between the two samples (Steel & McLaren, 2009; Zheng & Cushing, 2001), the test for partially dependent samples[32] is given as

$$z = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{\frac{V(I_{2004/05})}{N_{2004/05}} + \frac{V(I_{2009/10})}{N_{2009/10}} - \left[2r * \frac{\boldsymbol{q}}{\boldsymbol{N_{04/05}}} * \frac{\boldsymbol{q}}{\boldsymbol{N_{09/10}}} * \frac{S(I_{2004/05})}{N_{2004/05}} * \frac{S(I_{2009/10})}{N_{2009/10}}\right]}} \quad , \qquad (2.21)$$

$$z = \frac{\hat{I}_{2004/05} - \hat{I}_{2009/10}}{\sqrt{SE(I_{04/05})^2 + SE(I_{09/10})^2 - 2r * \frac{\boldsymbol{q}}{\boldsymbol{N_{04/05}}} * \frac{\boldsymbol{q}}{\boldsymbol{N_{09/10}}} * SE(I_{04/05}) * SE(I_{09/10})}} \quad , \qquad (2.22)$$

[32] The combined samples of correlated (dependent) and uncorrelated (independent) data.

where I_i is the estimated inequality index, $V(I_i)$ is the sampling variance of the index, $SE(I_i)$ is the standard error of the index, r is correlation between consumption aggregates of households over the survey years, q/N_{05} and q/N_{10} are the proportions of matched portions of the two samples and N_i is the sample size for year i. The test statistic, Z, for the null hypothesis of two distributions being 'equally unequal' has a standard normal distribution.

2.4.5.5 Hypothesis testing based on bootstrapping

Cowell and Flachaire (2013) deal with finite samples as asymptotic inference can be unreliable. They note that when asymptotic inference does not perform well in a finite sample, bootstrap methods can be used to perform accurate inference. The bootstrap appears to be an ideal method for inference with inequality and poverty indices, when the observations of the sample are independently and identically distributed (iid). Bootstrap inference on inequality measures is expected to perform reasonably well in moderate and large samples, unless the tails are quite heavy.

In the context of inequality measurement, the bootstrap was first applied by Mills and Zandvakili (1997) for the Gini coefficient and the two Theil (1967) measures. It was expanded to all GE and Atkinson measures by Biewen (2002). Biewen (2002) explains that "the bootstrap provides an estimate of the sampling distribution of a given statistic by resampling from the original sample" (p.318). Clarke and Roy (2012) sate that "bootstrapping offers a viable alternative, albeit less computationally friendly. Standard error estimates and hypothesis test p values can be provided from a bootstrap experiment that allows for the complex sampling design" (p.502). Mills and Zandvakili (1997) consider the fact that the difference (the statistic $D= H1-H2$) of two values of the inequality measures (*H1 and H2*) can be bootstrapped in the same manner used to obtain distributions for each inequality index for each time period. They conduct hypothesis tests for $D=0$[33] for the Gini coefficient and Theil's entropy measures of inequality from the Panel Study of Income Dynamics. Mills and Zandvakili (1997) find that the larger the sample, the more accurate the asymptotic estimates, and when the sample is large, the asymptotic standard errors are very similar to those obtained from bootstrapping.

[33] See Efron and Tibshirani (1993) for this approach.

Biewen (2002) shows that the bootstrap provides a valid procedure to test whether inequality has changed in a statistically significant way from one period to another in many situations of inequality such as longitudinal correlation, panel attrition or non-response. If panel data are used the incomes (expenditures) of a particular observational unit will be correlated across time periods and also income (expenditure) data may be lacking for some units in one of the periods. Biewen (2002) notes that "the resampling procedure automatically takes into account the covariance structure as well as the stochastic patterns of non-response or attrition in the inter-temporal population" (p.324).

Clarke and Roy (2012) also "compare the linearization complex survey outcomes with those from an incorrect iid assumption and a bootstrap that accounts for the survey design" (p.499). They note that similar variance estimates are found for both the bootstrap and linearization approaches given the large sample size used in their study, "which makes a case for using the linearization method given its lower programming demands" (p.502).

Following Mills and Zandvakili's (1997) approach, the difference of two values of the inequality measures of panel households of the IHLCA surveys is bootstrapped to conduct tests of the hypothesis that the difference is zero. According to Mooney and Duval (1993), "a total of 50–200 replications is generally adequate for estimates of standard error and thus is adequate for normal-approximation confidence intervals. Estimates of confidence intervals using the percentile or bias-corrected methods typically require 1,000 or more replications" (p. 11). Therefore, this research uses 100 replications to estimate standard errors of inequality indices, and replicates the order of 1,000 to produce very good estimates for testing the difference of inequality indices. This research also compares the results of bootstrap and linearization approaches.

2.4.6 Trimming and winsorizing

In some studies, trimming and winsorizing a fixed percentage of the data at either, or both, ends of the income distribution are common in order to minimize the potential influence of measurement error and to ensure the results are not sensitive to outliers in the data. Trimming the data is removing from the dataset a given number or a given percentage of the highest and/or lowest incomes (see, for example, Barrett et al., 2000). Cowell and Victoria-Feser (2006) contend that "the trimming approach offers a practical

tool for comparing income distribution when one wants an explicit control for taking into account the influence of outliers" (p.4). With winsorizing, the extreme data are not removed from the dataset, but are replaced by the value of the trimming thresholds (see, for example, Atkinson et al., 1995, Gottschalk & Smeeding, 2000). Van Kerm (2007) notes that winsorizing "is also referred to as 'top-coding' or 'bottom-coding' which is often applied with respect to data confidentiality issues" (p.7).

Burkhauser, Jenkins, Feng and Larrimore (2011) propose multiple-imputation methods to estimate income inequality for the US Current Population Survey (CPS) data as "all CPS data on sources of income are subject to censoring"[34] (p.2) and "top coding in the CPS public use files is common to maximize confidentiality and to minimize disclosure risk, data producers do not release files containing complete survey responses. Even the internal CPS data used by the US Census Bureau to produce official income distribution statistics are also top coded to a substantially lesser degree" (p.1-2). However, Burkhauser et al. (2011) also argue that "right censoring is a problem for estimation of levels of inequality because it suppresses genuine income dispersion, and it is a problem for estimation of trends in inequality if top code values are not adjusted consistently over time. Top coding also affects estimates of standard errors of inequality statistics because variance estimates depend on second and higher order moments, and their calculation is affected by right censoring" (p.1). Therefore, this study does not do trimming or winsorizing of the consumption expenditure distributions of Myanmar data sets.

[34] The term used in the paper of Burkhauser et al. (2011). Censoring is that "if someone in authority censors letters or the media, they officially examine them and cut out any information that is regarded as secret" (http://www.collinsdictionary.com/dictionary/english).

Chapter 3

Inequality estimates for Myanmar

3.1 Introduction

The current trends and patterns of income inequality are shocking globally (for example, 40.5[35] in 2010 in the US[36]) and intense even in some Asian countries (for example, 47.2 in 2010 in Singapore[37]). Global inequality between individuals has reached 0.70 on the Gini coefficient, based on the new Purchasing Power Parity (PPP) in 2005 (Milanovic, 2011). Coinciding with this, there has been a decline in inequality between countries, and an increase within countries (Bourguignon, 2015). Myanmar has a different story, as IHLCA (2011a) reports that "both relative and absolute inequality have fallen in Myanmar over the period 2005-2010"(p.20) based on their analyses on the consumption expenditures of IHLCA surveys in 2004/05 and 2009/10. This conclusion is based on two measures: the expenditures on the bottom 20% (relative change) and the absolute consumption gap between the top and the bottom 20% (absolute change). The IHLCA study did not report analyses of classic inequality measures. Following the surveys, a prominent change in the political landscape in Myanmar occurred when a civilian government was installed in 2011, after the first general election in 20 years was held in November, 2010. This began a process of social and economic reform, along with the establishment of democratic reforms, liberalization of trade and investment, facilitation of private sector development and financial sector reform. On the other hand, the free market economy has led to an increase of inequality in almost all countries (Milanovic, 1998). Thus, it is time to investigate the base level of inequality in Myanmar, a summary indicator of the level of welfare, before we see other changes due to economic liberalization starting from 2011.

[35] "If all people have non-negative income (or wealth, as the case may be), the Gini coefficient can theoretically range from 0 (complete equality) to 1 (complete inequality)" (https://en.wikipedia.org/).
[36] The World Bank (http://data.worldbank.org/)
[37] UNU-WIDER World Income Inequality Database, V3.0B from 2009 Family Income and Expenditures Survey

IHLCA (2011a) finds faster growth rates of consumption expenditures in the poorest population, and an inverse relationship between levels and growth rates of consumption expenditures among all deciles of the expenditure distributions. However, the consumption expenditures used by the IHLCA team are not comprehensive. They are composed only of food, 'non-food' and rent expenditures, which does not include user costs of durables and health expenditures. A few studies of the World Bank and the Organisation for Economic Co-operation and Development (OECD) report the Gini index in 2009/10 in Myanmar, but only a study of the World Bank in 2014 is clear about their construction of the components of consumption expenditures. However, there are so far no studies comparing inequality over the years of the two available surveys. Therefore, in order to compare the different aspects of inequality, a number of alternative classic inequality indices—the Gini coefficient, the Generalized Entropy (GE), and the Atkinson classes—are used to help check the robustness of the results.

Furthermore, in spite of several empirical studies on inequality being available, little research is found to test whether estimated results of income or expenditure inequality of cross-sectional comparisons between groups or regions or estimated trends in income or expenditure inequality are statistically significant. Therefore, this research also aims to investigate whether the changes in inequality over the study period are statistically significant, knowing the magnitudes of expenditure-related inequality in Myanmar. The 2-year household expenditure data sets of the IHLCA surveys, collected for 2004/05 and 2009/10, also enable this research to investigate the levels of, and changes in, expenditure inequality at the union level, and rural and urban areas. Thus, to estimate the magnitudes of inequality at the union level, and in rural and urban areas, this research uses a number of inequality measurement tools to provide a deeper understanding for geographic targeting with the following research questions:

1) What is the level of expenditure inequality in Myanmar?
2) How did expenditure inequalities change between 2004/05 and 2009/10?

This research contributes to the inequality literature of Myanmar by adding health expenditures and user costs of durables into the existing consumption aggregates calculated by the IHLCA team, to investigate expenditure inequality in both surveyed years. The study also deals with the issues of negative depreciation rates of durables and negative real interest rates when constructing the user costs of durables, as explained in

detail in Chapter 2. In addition, in order to compare with the existing results of IHLCA (2011a), this research follows the methods of IHLCA (2011a). They include the concept of adult equivalent for food and non-food, and adjust for differences in prices across regions by a price index called the Paasche Price Index (PPI), described in Chapter 2, to normalize the health and user costs of durables. Moreover, this study reports the statistical precision of differences of inequalities over the study period, following a basic theory of estimation for repeated surveys used by Steel and McLaren (2009), Zheng and Cushing (2001), Barrett and Pendakur, (1995), and Davidson and Duclos (2000), by taking into account the positive correlation between the samples of 2004/05 and 2009/10, as 50% of sample households of 2004/05 survey are repeated in 2009/10.

The analyses of distributions of revised comprehensive total household expenditures per adult equivalent in 2004/05 and 2009/10 indicate the decline in different measures of expenditure inequality. Nationally, the decreases in inequality indices (the Gini coefficient, the Theil index, the Mean Logarithmic Deviation (MLD), and the Atkinson indices) over time are statistically significant. The low inequality indices found in Myanmar, particularly the Gini index, could be due to several reasons. One possibility is that survey designs may exclude poor people in urban slums and very rich people in cities, and also rich households may under-report their consumption expenditures and thus urban inequality may be under-estimated. Another possibility is that, because of the conditions under which Myanmar existed during the socialist period as noted by Kyi et al. (2000), the majority of the population in Myanmar was likely to have remained homogeneous around 2004/05 and 2009/10. Even though the open market economy was introduced imperfectly in 1990 in the post-socialist era, the inequality among the population may not be apparent because of the impact of increased ownership of land and asset holdings. On the other hand, Thein (2004) argues that the government intervention in the open market economy has increased since 1997, which provides a setting for rent-seeking activities and corruption, and breeding of crony capitalists (as in neighboring countries). However, these ‘cronies’ may not have been captured in the household surveys conducted in 2004/05 and 2009/10 to reflect the true inequality in Myanmar.

Furthermore, the growth incidence curve compares the percentage changes in real expenditures per adult equivalent of union of all households, as well as rural and urban households separately, between 2004/05 and 2009/10. The graph shows that expenditure declined for those in the top part of the expenditure distribution, while expenditure rose

for those who were poor. The absolute changes in real expenditures per adult equivalent of all households, as well as rural and urban households separately, between 2004/05 and 2009/10 show that the larger drops of real expenditures per adult equivalent are found among higher centile groups, starting with the 91 to 100 centiles.

In addition, to illustrate the expenditure inequality in Section 3.3.5, this research presents the Lorenz curves. The Lorenz curves for real expenditures between 2004/05 and 2009/10 do not cross; thus the distributions are unambiguously ranked. The Pen's parade is also presented, to display the welfare of households in 2004/05 and 2009/10 expenditure distributions. The curves of Pen's parade cross for all households and panel households near the top end. This finding highlights the fact that the decline in real expenditure per adult equivalent at the top part of expenditure distributions in 2009/10 can lead to a decrease in expenditure inequality at the national level.

The central findings of this research are statistically significant. For a comparison of inequality indices over the study years, the standard errors (SEs) of differences are calculated with and without taking into account covariance terms. In general, the SEs reported without consideration of covariance terms are slightly higher than the SEs reported taking account covariance. However, statistical significances are similar for almost all inequality indices reported in 2004/05 and 2009/10 as well as the SEs of the differences of two values of inequality indices between the two assumptions applied. In addition, a comparison of the asymptotic and bootstrap standard errors of the inequality indices of each year indicates that they are similar within the panel household component of the datasets. However, the bootstrapping of the differences of inequality indices between 2004/05 and 2009/10 produces more significant results compared with the results based on asymptotic standard errors using the standard normal test statistic for panel households. This could be due to the resampling procedure of bootstrapping, which automatically takes into account the covariance structure (Biewen, 2002), even though the linearization approach based on the standard normal test statistic for dependent samples also removes the correlation between panel households. Horowitz (2001) also argues that bootstrapping asymptotic pivotal statistics provides a powerful test (the 'bootstrap t method'). However, this approach is not further employed in this research due to the complexity of the IHLCA survey design.

The impact of Cyclone Nargis on the expenditure distributions of households is also investigated over the study period. In terms of relative and absolute consumption inequality of households, illustrated by the growth incidence curves between the Nargis- and all non-Nargis-affected areas, the expenditure inequality declined, especially in the top part of the expenditure distribution in the Nargis-affected region, compared with the smaller reduction that would likely have occurred anyway as in the non-Nargis-affected regions. The results of the classic inequality measurement also confirm that Cyclone Nargis lowered expenditure inequality in the affected region, compared with the smaller reduction that would have occurred anyway. Therefore, Cyclone Nargis contributed to the decline in real expenditure per adult equivalent that occurred in the Nargis-affected area between 2004/05 and 2009/10, and it also contributed to the observed decline in national inequality. Of course, the reduction in consumption expenditure inequality in the Nargis-affected area is not a socially desirable outcome as the poverty incidences in Ayeyarwady and Yangon regions increased, while poverty incidence declined substantially in the non-Nargis-affected areas over the study period.

This chapter is arranged as follows. Section 2 explores literature reviews about the study on inequality in Myanmar. Section 3 mainly presents the analyses of inequality measures and reports the empirical results. The conclusions are drawn in Section 4. The consumption share of the top 20%, 2004/05 and 2009/10 is reported in Appendix: 3-A.

3.2 Inequality study in Myanmar

The study of inequality in Myanmar is very limited, due to lack of reliable data before 2004/05. However, MoNPED (2005) affirms that Myanmar has commitments to address global challenges related to education, health, gender and poverty, which are essential elements of Millennium Development Goals (MDGs), by implementing National Development Plans. Thus, MoNPED (2006) claims that the Government of the Union of Myanmar has taken a number of initiatives to assess income, expenditure, and social welfare conditions of the Myanmar people since the Millennium Declaration at the United Nations Millennium Summit in September 2000 (MoNPED, 2006). Even though the Household Income and Expenditure Survey was conducted in 2001 (with a sample size of 30,000 households from 75 sample townships) by the Central Statistical Organization (CSO) under the MoNPED, the inequality condition of individuals was not reported (MoNPED, 2006). By observing the poverty profile report of IHLCA (2011a), the

Integrated Household Living Conditions Assessment Projects were conducted, presumably to report the poverty incidences and key MDG indicators with the financial and technical support of the UNDP Myanmar and national and international stakeholders, by the agreements of the MoNPED. The IHLCA data sets provide data values for 16 and 23 MDG indicators for 2004/05 and 2009/10 respectively, to report the conditions of Myanmar to the UN. However, public access to the IHLCA survey data was difficult, and the IHLCA data sets were not made available until 2013.

According to IHLCA (2011a, p.20), "poorer population groups have increased their consumption faster than richer ones across the entire consumption distribution (though high standard errors urge caution when interpreting trends among the top 20%)" over time. The consumption expenditure share of the poorest 20% (a measure of relative inequality) and the absolute real consumption gap between the richest and the poorest 20% (a measure of absolute inequality), both declined between 2005 and 2010. The World Bank (2014) revisited the IHLCA survey data set of 2009/10 and constructed new poverty lines for Myanmar. The revised IHLCA in 2009/10 dropped 311 households out of the sample of 18,609 if kilocalorie/adult equivalent per day was less than 800 or more than 8000. In addition, adult equivalents were also simplified: rice consumption was readjusted to be consistent with the estimates of the World Food Program in Myanmar, food basket and calories were based on single national standard (2300 Kcals), and spatial cost of living deflators were calculated for 8 regions for rural and urban areas. The welfare aggregate (per adult equivalent consumption expenditures) is redefined by adding health expenditures and user costs of durables. The World Bank (2014) argues that the earlier estimate of a very low Gini index (0.20) based on the consumption bundles normalized by the Paasche price index (IHCLA, 2011a) is caused by inappropriate regional cost-of-living adjustments. The World Bank (2014) contends that the price deflators used in the IHLCA surveys do not take into account quality differences in the commodities consumed by the households. The Gini index calculated by the World Bank (2014) was 0.29 at the union level, and 0.36 and 0.25 in urban and rural areas respectively in 2009/10.

This research attempts to replicate the regional price deflators and the simplified adult equivalents used by the World Bank (2014) for the IHLCA 2009/10 data set. However, the results are not much different compared to the ones which followed the methods of the IHLCA technical team. Therefore, the higher Gini index obtained in 2009/10 by the World Bank (2014) could be largely due to dropping 311 households out of the sample

of 18, 609, which could affect significant changes in the expenditure distributions of households. Furthermore, OECD (2013a) reports the Gini index as 0.30 in 2001, but no further information is available about how the index is derived. The OECD (2013b), in measuring inequality in Myanmar, defines household consumption as cash purchases of goods. The Gini coefficient for household consumption was reported as 0.38 in 2009/10, but the detailed composition of consumption expenditures is not discussed in the report of the OECD (2013b).

3.3 Results and discussions

Fields (2001) points out, "absolute inequality and relative inequality are not alternative measures of the same underlying concept; they measure fundamentally different concepts" (p. 16). However, the ADB (2007) stresses that "while most economists would prefer to analyze inequality using measures that satisfy scale independence (i.e., they prefer measures of relative inequality), the issue is tied to value judgments about distributive justice" (p.17). To be able to see whether the trend changes after adding health expenditures and user costs of durables, the present results of relative and absolute inequality measures, and consumption expenditure by decile are reported together with the results of IHLCA (2011a). The data presented are for December 2009 Kyat, to allow for consistent comparisons over time as in the study of IHLCA (2011a).[38] However, current calculated results of IHLCA (2011a) without health expenditures and user costs of durables are not exactly the same as in the results reported in the poverty profile of IHLCA (2011a), as the current calculations are weighted by (survey weights X household size).

3.3.1 Consumption expenditure by decile

Table 3.1 reports mean consumption expenditure of different deciles (10%) of the whole consumption expenditure distribution. Table 3.1 includes the results of IHLCA (2011a) and the present study, to compare the findings with and without health expenditures and user costs of durables. The poorer deciles grow faster, even after adding health expenditures and user costs of durables. Furthermore, the changes of the poorest two deciles are still quite large at 12% and 9%, respectively, after adding health expenditures and user costs of durables, while those of the richest three deciles are negative. According

[38] CPI (Dec, 2004)=428.55 (CSO, 2005), and CPI (Dec, 2009)=995.19 (CSO, 2010)

to the study of IHLCA (2011a), the large standard errors mean interpreting trends at the top end should be approached with caution. However, a downward trend is statistically significant at the 1% level and is evident throughout the distribution of the present study including health expenditures and user costs of durables. The changes in distribution of IHLCA's study without health expenditures and user costs of durables between the study periods are also statistically significantly different from zero at the 1% level, apart from the top two deciles. In the present study, consumption expenditure has increased from the 1st decile to the 7th decile especially at a higher rate in the lower deciles, but consumption expenditure has increased in the top three deciles. However, at the union level, the changes of consumption expenditures over the study period fail to be significant.

Table 3.1 Consumption expenditure by decile, 2005-2010 (in Dec, 2009 Kyat)

	IHLCA (June, 2011) (without health expenditures and user costs of durables)					Present study (with health expenditures and users costs of durables)				
Consumption Deciles	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**
1st decile (Lowest 10%)	237,975 (1,303)	269,243 (1,498)	13	31,269*** [1,911]	0.000	248,285 (1,276)	278,846 (1,549)	12	30,561*** [1,932]	0.000
2nd decile	303,981 (528)	334,790 (311)	10	30,809*** [602]	0.000	318,390 (445)	346,744 (438)	9	28,354*** [601]	0.000
3rd decile	348,715 (298)	373,587 (326)	7	24,872*** [425]	0.000	366,813 (498)	389,627 (387)	6	22,814*** [608]	0.000
4th decile	387,806 (313)	410,356 (311)	6	22,550*** [425]	0.000	410,146 (376)	429,729 (366)	5	19,583*** [505]	0.000
5th decile	425,840 (407)	444,731 (257)	4	18,891*** [465]	0.000	452,640 (421)	467,626 (350)	3	14,986*** [528]	0.000
6th decile	465,255 (341)	481,188 (337)	3	15,932*** [461]	0.000	497,832 (386)	508,546 (434)	2	10,714*** [559]	0.000
7th decile	511,326 (567)	523,733 (415)	2	12,406*** [678]	0.000	552,711 (524)	557,300 (373)	1	4,589*** [620]	0.000
8th decile	569,438 (703)	577,382 (552)	1	7,945*** [861]	0.000	625,204 (835)	619,818 (641)	-1	-5,386*** [1,014]	0.000
9th decile	662,945 (1,682)	660,362 (1,056)	0	-2,583 [1,919]	0.178	741,722 (1,295)	720,766 (1,251)	-3	-20,956*** [1,732]	0.000
10th decile (Highest 10%)	934,223 (37,580)	911,582 (21,886)	-2	-22,641 [42,059]	0.590	1,241,957 (34,189)	1,110,998 (26,799)	-11	-130,959*** [41,843]	0.002
UNION	**484,733 (11,411)**	**498,661 (7,095)**	**3**	**13,928 [11,395]**	**0.222**	**545,555 (13,442)**	**542,971 (8,854)**	**0**	**-2,584 [13,584]**	**0.849**
Number of Sample HHs	**18,634**	**18,609**								

Source: IHLCA (2011a) and Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction.[39] Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated by taking into account correlation following Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z -statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
6) The calculations for consumption deciles of IHLCA data without health expenditures and user costs of durables (June, 2011) are also weighted by (survey weights X household size). Therefore, the results are slightly different from the reports of IHLCA (2011a).

[39] For example, if you have a population of 100 and you select 3 into your sample, your sampling fraction would be 3/10 and your p-weight would be 10/3 = 3.33.
(http://www.ats.ucla.edu/stat/stata/faq/weights.htm)

3.3.2 Consumption share of the bottom 20%

Table 3.2 presents one measure of relative inequality. Table 3.2 also includes the results of IHLCA (2011a) and the present study, to compare the findings including and excluding health expenditures and user costs of durables.

Table 3.2 Consumption share of the bottom 20%, 2005-2010

	IHLCA (June, 2011) (without health expenditures and user costs of durables)					Present study (with health expenditures and user costs of durables)				
State/ Region	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**p-value**
Kachin	10.9 (2.61)	12.4 (0.99)	13	1.5 [2.72]	0.592	10.1 (1.99)	12.1 (1.25)	19	2.0 [2.27]	0.386
Kayah	12.1 (2.78)	13.9 (0.04)	14	1.7 [2.78]	0.533	11.8 (3.34)	12.7 (0.52)	8	0.9 [3.35]	0.792
Kayin	13.0 (4.91)	13.1 (0.85)	1	0.2 [4.92]	0.973	12.5 (4.73)	13.2 (0.48)	5	0.7 [4.72]	0.885
Chin	9.3 (3.67)	13.6 (2.66)	46	4.2 [4.37]	0.332	8.6 (2.73)	13.8 (1.93)	62	5.3 [3.22]	0.102
Sagaing	11.9 (2.24)	13.3 (1.21)	12	1.4 [2.47]	0.568	11.3 (1.99)	12.8 (0.99)	13	1.5 [2.15]	0.490
Taninthayi	10.5 (3.39)	11.3 (4.64)	7	0.7 [5.53]	0.893	9.8 (2.89)	10.8 (4.55)	10	1.0 [5.21]	0.850
Bago (East)	12.4 (3.90)	12.8 (2.57)	4	0.4 [4.51]	0.922	11.6 (4.02)	12.3 (2.77)	6	0.7 [4.71]	0.875
Bago (West)	12.6 (4.31)	13.1 (1.35)	4	0.5 [4.42]	0.909	12.3 (4.50)	12.5 (0.30)	2	0.3 [4.49]	0.953
Magwe	12.0 (2.82)	13.0 (2.19)	9	1.0 [3.44]	0.763	11.4 (3.04)	12.5 (1.80)	10	1.1 [3.42]	0.746
Mandalay	11.8 (1.88)	11.8 (3.31)	0	0.0 [3.68]	0.998	10.7 (1.75)	11.0 (3.14)	3	0.3 [3.48]	0.936
Mon	12.3 (5.02)	13.2 (1.37)	7	0.8 [5.11]	0.871	11.7 (4.68)	12.3 (0.58)	5	0.6 [4.67]	0.899
Rakhine	12.2 (1.62)	12.8 (4.25)	6	0.7 [4.43]	0.878	12.0 (1.51)	12.6 (4.41)	5	0.6 [4.55]	0.890
Yangon	10.1 (4.62)	11.5 (1.97)	14	1.4 [4.89]	0.774	9.0 (3.99)	10.7 (2.17)	19	1.7 [4.39]	0.698
Shan (South)	11.6 (6.82)	12.1 (10.02)	4	0.5 [11.69]	0.967	10.8 (6.22)	11.4 (8.11)	5	0.6 [9.85]	0.952
Shan (North)	11.2 (2.81)	11.9 (4.27)	7	0.8 [4.93]	0.876	10.5 (2.92)	11.5 (4.52)	10	1.0 [5.19]	0.848
Shan (East)	11.6 (5.82)	13.9 (1.21)	19	2.3 [5.85]	0.699	10.5 (7.34)	12.7 (3.15)	20	2.1 [7.77]	0.785
Ayeyawaddy	11.3 (1.30)	12.5 (1.95)	11	1.2 [2.26]	0.581	10.6 (1.49)	11.9 (2.11)	12	1.3 [2.49]	0.603
UNION	**11.2 (0.85)**	**12.1 (0.88)**	**8**	**0.9 [1.18]**	**0.428**	**10.4 (0.81)**	**11.5 (0.82)**	**11**	**1.1 [1.11]**	**0.308**
Number of Sample HHs	**18,634**	**18,609**								

Source: IHLCA (2011a) and Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses and how z-statistics are calculated.
3) For a two tailed t-test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
4) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
5) The calculations for consumption share of the bottom 20% of IHLCA data without health expenditures and user costs of durables in 2004/05 and 2009/10 surveys are also weighted by (survey weights X household size). Therefore, the results are slightly different from the reports of IHLCA (2011a).

The consumption share of the bottom 20% at the union level slightly increased from 10.4% to 11.5%, though this difference could be because of sampling errors. Consumption expenditures at the bottom 20% in all states and regions increased, and Chin, Shan (East), Yangon, and Kachin had higher in changes between 2004/05 and 2009/10, at 62%, 20%, 19% and 19% respectively. However, the changes are not significant at the union level, nor in states and regions between 2004/05 and 2009/10.

3.3.3 Consumption share of the top 20%

To be able to provide detailed patterns across different levels of consumption expenditures, the consumption share of the top 20% is analysed. Table 3.19 at Appendix: 3-A shows the consumption share at the union level of the top 20% of the expenditure distribution including the health expenditures and user costs of durables declined by 7% over the study period. This downward trend is investigated across all states/regions. The consumption share of the top 20% in all states and regions declined, and Chin, Shan (East) and Yangon had higher changes between 2004/05 and 2009/10, at 30%, 12%, and 11% respectively. However, the changes are not statistically significant at the union level, nor in all states and regions.

3.3.4 Consumption gap between the richest and poorest 20% (in Dec, 2009 Kyat)

Table 3.3 presents changes in absolute inequality. Table 3.3 also includes the results of IHLCA (2011a) and the present study, to compare the findings including and excluding health expenditures and user costs of durables. As shown in the table, the consumption gap between the richest and the poorest 20% decreased in most states/regions between 2004/05 and 2009/2010 though the consumption gap in Bago (West), Kayah, and Mon increased. In addition, Chin, Yangon, Shan (East) and Bago (West) have the highest changes in absolute inequality at 55%, 31%, 24% and 21% respectively. The changes are statistically significantly different from zero at the 1% level in Kayah and Yangon, and at the 5% level in Chin, Taninthayi, Shan (East), and Ayeyawaddy, at the 10% level in Kachin, Bago (West), and Bago (East). These results confirm that the changes in consumption expenditure of the top 20% must have been significantly lower than that of the poorest 20% over time. In addition, the consumption gap between the richest and the poorest 20% drops by around 15% at the union level, and the difference is statistically significant from zero at the 1% level.

Table 3.3 Consumption gap between the richest and poorest 20% (in December, 2009 Kyat)

	IHLCA (June, 2011) without health expenditures and user costs of durables					Present study with health expenditures and user costs of durables				
State/ Region	**2005**	**2010**	**% Δ '05 -'10**	**Mean Difference**	**P value**	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**
Kachin	487,381 (13,224)	459548 (19,458)	-6	-27,833 (22,698)	0.220	647541 (44,077)	559799 (12,813)	-14	-87,743* (44,978)	0.051
Kayah	421,279 (35,466)	453965 (17,542)	8	32,686 (38,380)	0.394	545504 (1,646)	583772 (10,319)	7	38,268*** (10,328)	0.000
Kayin	457,523 (7,537)	424627 (24,465)	-7	-32,896 (25,059)	0.189	538305 (14,882)	475882 (43,537)	-12	-62,422 (44,951)	0.165
Chin	505,168 (133,248)	252791 (13,323)	-50	-252,377* (132,923)	0.058	626783 (149,108)	283581 (16,413)	-55	-343,202** (148,791)	0.021
Sagaing	450,517 (8,640)	419830 (15,790)	-7	-30,686* (17,426)	0.078	579834 (35,383)	514917 (29,648)	-11	-64,918 (44,441)	0.144
Taninthayi	563,137 (24,043)	511941 (18,468)	-9	-51,196* (29,208)	0.080	744334 (46,296)	637108 (31,889)	-14	-107,226** (54,228)	0.048
Bago (East)	430,769 (13,083)	405301 (23,652)	-6	-25,468 (26,164)	0.330	600340 (18,404)	523779 (37,317)	-13	-76,561* (40,363)	0.058
Bago (West)	395,789 (9,880)	434898 (22,414)	10	39,109 (23,814)	0.101	461883 (4,579)	559298 (53,922)	21	97,414* (53,776)	0.070
Magwe	413,451 (25,552)	396621 (22,913)	-4	-16,830 (33,028)	0.610	509581 (29,617)	486388 (31,553)	-5	-23,194 (41,639)	0.578
Mandalay	454,107 (27,013)	509343 (13,217)	12	55,236* (29,177)	0.058	676477 (61,610)	669380 (51,018)	-1	-7,097 (77,016)	0.927
Mon	434,731 (9,744)	406829 (6,684)	-6	-27,902** (11,399)	0.014	564852 (13,783)	568830 (62,343)	1	3,979 (62,840)	0.950
Rakhine	393,493 (12,703)	378170 (16,941)	-4	-15,323 (20,405)	0.453	444286 (16,134)	415677 (12,933)	-6	-28,608 (19,913)	0.151

Continued over

Continued

	IHLCA (June, 2011) without health expenditures and user costs of durables					Present study with health expenditures and user costs of durables				
State/ Region	**2005**	**2010**	**% Δ '05 -'10**	**Mean Difference**	**P value**	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**
Yangon	822,375 (77,399)	690523 (69,620)	-16	-131,852 (100,182)	0.188	1248755 (105,949)	859853 (78,793)	-31	-388,902*** (127,250)	0.002
Shan (South)	464,468 (31,751)	474511 (32,075)	2	10,043 (43,423)	0.817	614508 (48,911)	551977 (32,096)	-10	-62,530 (56,472)	0.268
Shan (North)	459,096 (17,315)	458859 (19,760)	0	-236 (25,287)	0.993	602835 (44,645)	539268 (25,312)	-11	-63,567 (49,658)	0.201
Shan (East)	415,956 (18,554)	320655 (25,785)	-23	-95,301*** (30,627)	0.002	613641 (35,615)	463806 (63,174)	-24	-149,835** (70,178)	0.033
Ayeyawaddy	500,432 (12,207)	421634 (30,073)	-16	-78,798** (31,604)	0.013	652734 (15,825)	535738 (52,177)	-18	-116,995** (53,387)	0.028
UNION	**527,645** **(26,307)**	**483919** **(14,684)**	**-8**	**-43,725** **(29,159)**	**0.134**	**708504** **(28,144)**	**603096** **(19,763)**	**-15**	**-105,408***** **(33,166)**	**0.001**
Number	**18,634**	**18,609**								

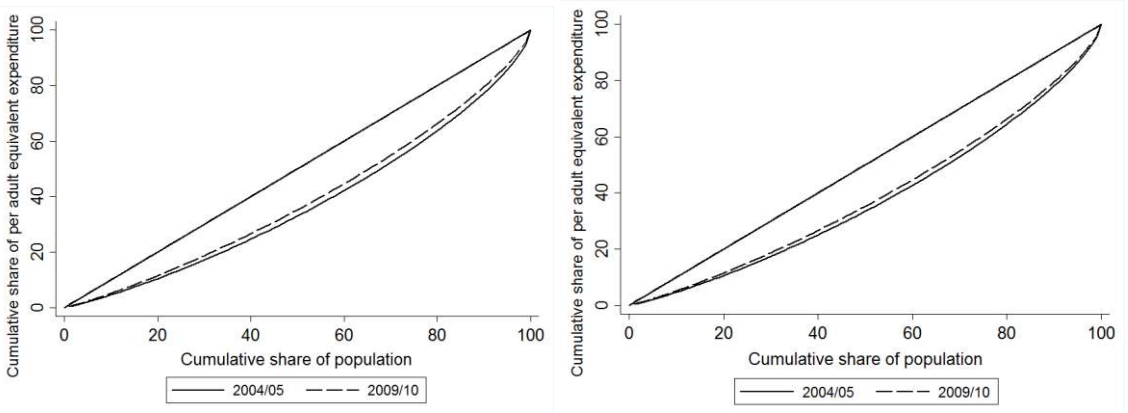
Source: IHLCA (2011a) and Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses and how z-statistics are calculated.
3) For a two tailed t-test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
4) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
5) The calculations for consumption gap between the richest and poorest 20% of IHLCA data without health expenditures and user costs of durables in 2004/05 and 2009/10 surveys are also weighted by (survey weights X household size). Therefore, the results are slightly different from the reports of IHLCA (2011a).

3.3.5 Lorenz curve for Myanmar between 2004/05 and 2009/10

To illustrate the real expenditure inequality in Myanmar, the Lorenz curve is presented. Jenkins and Van Kerm (2009) define the Lorenz curve as "the graph of cumulative income shares against cumulative population shares", p.49). As shown in the graphs[40] in Figure (3.1), the curve starts from ordinates (0, 0) and ends at (100,100) ordinates.



All households Panel households

Figure 3.1 Lorenz curves for Myanmar between 2004/05 and 2009/10

Figure 3.1 shows that the Lorenz curve[41] of 2009/10 dominates the Lorenz curve of 2004/05 of real consumption expenditure distribution, and also the dominating distribution has less expenditure inequality. The important aspect of Lorenz dominance is a partial ordering (Atkinson, 1970). It is clear from the graph that the inequality of real total consumption expenditures per adult equivalent in 2004/05 is higher than the inequality in 2009/10, as the distribution of 2004/05 is below that of 2009/10. The trend is also true for panel households between the two years.

[40] Bellù and Liberati (2005) note that "the x-axis records the cumulative proportion of the population ranked by income level. Its range is therefore (0,100). The y-axis records the cumulative proportion of income for a given proportion of population. In Lorenz curve representations, less inequality means a less pronounced convexity. Lorenz dominance of one income distribution over another occurs when, for any given cumulative proportion of population p, the Lorenz curve of a given income distribution is above the Lorenz curve(s) of the other distribution(s). Given the Lorenz curve and its properties, the dominating Lorenz curve implies an income distribution with less inequality. However, there is no guarantee that given two income distributions one would Lorenz-dominate. It may be the case that Lorenz curves intersect. In this case, by considering only Lorenz curves, nothing can be said about which income distribution has less inequality." (pp. 2, 6-7).

[41] Further, Jenkins and Van Kerm (2009) explain that "the curvature of the Lorenz curve summarizes inequality: if everyone had the same income (the perfect equality case), the Lorenz curve would lie along a 45 degree ray from the origin and, if all income were held by just one person (complete inequality), the curve would lie along the horizontal axis" (p.49).

3.3.6 Testing for statistical significance in differences of Lorenz curves

Benjamin, Brandt and Giles (2005) state that "a direct comparison of Lorenz curves yields a nonparametric comparison of changes in inequality" (p.782). To be able to test the differences of Lorenz curves, this research reports the fraction of total real expenditures per adult equivalent consumed by the bottom 1st–5th percentile, 10th percentile, 25th percentile, the middle 50th percentile, the 75th, 90th, 95th and 99th percentiles of the population, for all households and panel households. The testing between rural and urban areas in 2004/05 and in 2009/10, and the analyses of rural areas between 2004/05 and 2009/10, and urban households over time are calculated but not presented in this Chapter. Standard errors of a subset of the Lorenz ordinates from the empirical Lorenz curves are generated using the Distributive Analysis Stata Package (DASP), a distribution analysis software developed by Araar and Duclos (2013), by taking into account the sampling designs of the two distributions. The test statistic for the null hypothesis (that two Lorenz curves were equal at different cumulative population shares) is calculated using basic theory of estimation for repeated surveys used by Steel and McLaren (2009) and Zheng and Cushing (2001). Barrett, Donald, and Bhattacharya (2014) note that "this was a test of Lorenz equality, rather than dominance, at a fixed set of population proportions" (p.1).

3.3.7 Do the Lorenz curves (LC) for annual per adult equivalent expenditure in December 2009 Kyat for all Households (HHs) differ significantly?

Foster (1985) states that "Lorenz curves have a useful role to play other than as descriptive devices. A key result is that if the Lorenz curves of two distributions do not cross, that is, $L(p; A) \leq L(p; B)$ for any cumulative population share p (and the two Lorenz curves are not identical), then one can conclude unambiguously that inequality is higher in distribution A than in distribution B according to any inequality index that respects the properties of scale invariance, replication invariance, symmetry, and the Principle of Transfers" (as cited in Jenkins and Van Kerm, 2009, p.53).

As shown in Figure 3.1 above, the Lorenz curves for real expenditures between 2004/05 and 2009/10 do not cross; thus the distributions are unambiguously ranked. The Lorenz ordinates of the 2009/10 distribution are higher than that of corresponding Lorenz ordinates of the 2004/05 distribution for all households, and the differences between them are positive, as shown in Table 3.4. As the tests fail to reject the null hypothesis (equality of the vectors of Lorenz ordinates), this study concludes that the differences for the

bottom 75% of the population are highly statistically significant at the 1% level, the differences at the top 3 percentiles selected are statistically significant at the 5% level.

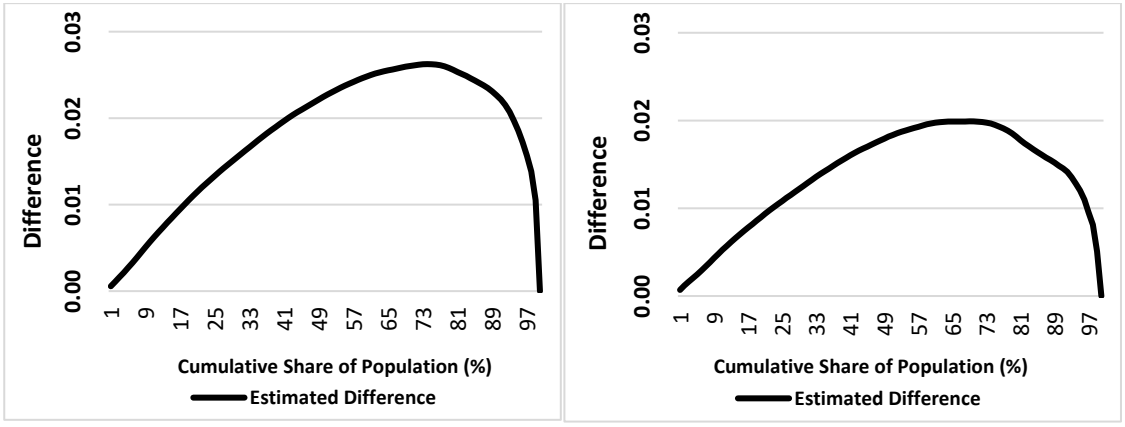
Table 3.4 Differences of Lorenz curves for all households between 2004/05 and 2009/10

Cumulative Share of Population (%)	2004/05 LC	2009/10 LC	Difference 2009/10 LC – 2004/05 LC	Lower Bound	Upper Bound	P value
1	0.0032	0.0037	**0.0006*** **	0.0003	0.0008	0.0000
	(0.0001)	(0.0001)	**[0.0001]**			
2	0.0071	0.0082	**0.0011*** **	0.0006	0.0016	0.0000
	(0.0002)	(0.0002)	**[0.0002]**			
3	0.0113	0.0129	**0.0016*** **	0.0009	0.0023	0.0000
	(0.0003)	(0.0003)	**[0.0004]**			
4	0.0158	0.0179	**0.0021*** **	0.0012	0.0031	0.0000
	(0.0004)	(0.0003)	**[0.0005]**			
5	0.0204	0.0231	**0.0027*** **	0.0015	0.0039	0.0000
	(0.0005)	(0.0004)	**[0.0006]**			
10	0.0457	0.0513	**0.0057*** **	0.0033	0.0080	0.0000
	(0.0010)	(0.0008)	**[0.0012]**			
25	0.1368	0.1501	**0.0133*** **	0.0071	0.0196	0.0000
	(0.0026)	(0.0021)	**[0.0032]**			
50	0.3298	0.3522	**0.0225*** **	0.0089	0.0360	0.0012
	(0.0058)	(0.0043)	**[0.0069]**			
75	0.5777	0.6039	**0.0262*** **	0.0064	0.0460	0.0094
	(0.0085)	(0.0061)	**[0.0101]**			
90	0.7727	0.7954	**0.0226** **	0.0029	0.0424	0.0249
	(0.0086)	(0.0060)	**[0.0101]**			
95	0.8564	0.8750	**0.0186** **	0.0022	0.0349	0.0263
	(0.0069)	(0.0053)	**[0.0083]**			
99	0.9488	0.9593	**0.0105** **	0.0014	0.0197	0.0244
	(0.0040)	(0.0027)	**[0.0047]**			
100	1.0000	1.0000	**0.0000**	0.0000	0.0000	
	(0.0000)	(0.0000)	**[0.0000]**			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses and how z-statistics are calculated.
3) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.
4) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
5) Lorenz curve (LC)



All Households Panel Households

Figure 3.2 Differences between Lorenz curves between 2004/05 and 2009/10

Table 3.5 Differences of Lorenz curves for panel households between 2004/05 and 2009/10

Cumulative Share of Population (%)	2004/05 LC	2009/10 LC	Difference 2009/10 LC – 2004/05 LC	Lower Bound	Upper Bound	P value
1	0.0031	0.0038	**0.0007*** **	0.0005	0.0009	0.0000
	(0.0001)	(0.0001)	**[0.0001]**			
2	0.0070	0.0082	**0.0012*** **	0.0007	0.0017	0.0000
	(0.0002)	(0.0002)	**[0.0002]**			
3	0.0114	0.0130	**0.0016*** **	0.0009	0.0023	0.0000
	(0.0003)	(0.0003)	**[0.0003]**			
4	0.0159	0.0180	**0.0020*** **	0.0012	0.0029	0.0000
	(0.0004)	(0.0004)	**[0.0004]**			
5	0.0207	0.0231	**0.0024*** **	0.0014	0.0035	0.0000
	(0.0005)	(0.0004)	**[0.0005]**			
10	0.0464	0.0512	**0.0048*** **	0.0027	0.0069	0.0000
	(0.0010)	(0.0009)	**[0.0011]**			
25	0.1388	0.1497	**0.0108*** **	0.0053	0.0163	0.0001
	(0.0027)	(0.0021)	**[0.0028]**			
50	0.3342	0.3523	**0.0182*** **	0.0061	0.0302	0.0032
	(0.0060)	(0.0043)	**[0.0062]**			
75	0.5846	0.6041	**0.0195** **	0.0015	0.0375	0.0341
	(0.0089)	(0.0063)	**[0.0092]**			
90	0.7802	0.7951	**0.0149**	-0.0038	0.0335	0.1186
	(0.0093)	(0.0064)	**[0.0095]**			
95	0.8630	0.8750	**0.0120**	-0.0042	0.0283	0.1466
	(0.0080)	(0.0058)	**[0.0083]**			
99	0.9542	0.9592	**0.0051**	-0.0053	0.0155	0.3370
	(0.0051)	(0.0038)	**[0.0053]**			
100	1.0000	1.0000	**0.0000**	0.0000	0.0000	
	(0.0000)	(0.0000)	**[0.0000]**			

Source: Author's estimations

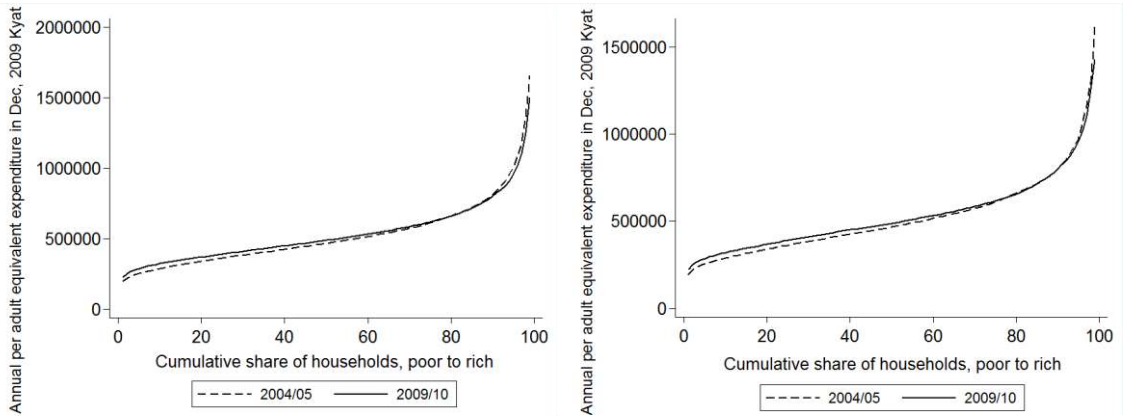
Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses and how z-statistics are calculated.
3) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the Z-statistic is 1.96.
4) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
5) Lorenz curve (LC)

As demonstrated in Table 3.5, the differences of Lorenz ordinates between panel households of 2004/05 and 2009/10 distributions for the bottom 50% of the population are highly statistically significant at the 1% level. In addition, the difference at the 75th percentile is statistically significant at the 5% level, but not significantly different at the top 3 percentiles. Therefore, these results support the conclusion that changes in distributions of real expenditures are found mainly in the bottom 50% of the population.

3.3.8 The Pen's parade

One of the useful graphs in comparing distributions over time is Pen's parade[42], which is a form of quantile graph (Haughton & Khandker, 2009). Litchfield (1999) states that "in practice comparing incomes at every income level proves too laborious, hence some degree of aggregation is usually employed and quantiles are compared" (p.4). As shown in Figure 3.3, individuals from the poorest to the richest, are lined up on the horizontal axis by re-scaling their heights to represent their income (expenditure) level on the vertical axis. Jenkins and Van Kerm (2009) also assert that "the quantile function highlights the presence of very large incomes as there is a dramatic increase in heights at the very end of the parade as the representatives of the very rich" (p.48).



All households Panel households

Figure 3.3 Pen's parade for annual per adult equivalent expenditure in December 2009 Kyat, Myanmar, 2004/05 and 2009/10

Figure 3.3 illustrates the expenditure per adult equivalent for Myanmar for all households and panel households between 2004/05 and 2009/10. Over this five-year period, inequality decreased on average. The curves cross for all households and panel households near the top end. As shown in Table 3.6, expenditures were higher in 2009/10 than they were in 2004/05 from the bottom to 78th percentile, but expenditures were lower in 2009/10 than they were in 2004/05 at the top percentiles, especially at the 99th percentile. Similarly, the consumption expenditures of panel households in 2009/10 were unambiguously above those of same households in 2004/05 up to 77% of the population. At the top percentiles, starting from the 78th percentile, the panel households in the

[42] Litchfield (1999) gives Pen's example as "if these individuals were to be paraded one would typically see a large number of dwarves (poor people), eventually followed by individuals of average height (income) and finally followed by a small number of giants (very rich people)" (p.4).

2004/05 distribution are unambiguously ranked above the 2009/10 distribution, as reported in Table 3.7. This finding highlights the fact that the decline in real expenditure per adult equivalent at the top part of expenditure distribution in 2009/10 led to a decrease in expenditure inequality at the union level.

Table 3.6 Differences of Pen's parades for annual per adult equivalent real expenditure in December 2009 Kyat for all households between 2004/05 and 2009/10

Cumulative Share of Population (%)	2004/05 PPC	2009/10 PPC	Difference 2009/10 PPC – 2004/05 PPC
1	198,160	225,587	27,427
2	217,543	250,826	33,283
3	232,836	265,185	32,349
4	243,160	276,409	33,249
5	252,143	286,636	34,493
10	286,865	323,158	36,294
25	360,421	389,932	29,510
50	464,314	487,413	23,099
75	611,231	618,278	7,048
79	649,798	649,340	-458
90	811,263	800,363	-10,900
95	1,006,097	952,722	-53,375
99	1,658,229	1,502,962	-155,267

Source: Author's estimations
Notes: Pen's parade curve (PPC)

Table 3.7 Differences of Pen's parades for annual per adult equivalent real expenditure in December 2009 Kyat for panel households between 2004/05 and 2009/10

Cumulative Share of Population (%)	2004/05 PPC	2009/10 PPC	Difference 2009/10 PPC – 2004/05 PPC
1	194,732	224,238	29,506
2	220,665	250,335	29,670
3	236,431	265,281	28,850
4	247,451	275,427	27,975
5	255,673	284,003	28,330
10	287,959	319,824	31,865
25	361,947	389,947	28,000
50	465,190	487,646	22,457
75	610,659	614,907	4,248
78	641,107	639,458	-1,650
90	799,110	798,945	-166
95	971,191	955,388	-15,802
99	1,612,046	1,427,983	-184,063

Source: Author's estimations
Notes: Pen's parade curve (PPC)

3.3.9 Inequality measurement in Myanmar, between 2004/05 and 2009/10

The consumption expenditure inequality in Myanmar is quantitatively compared between 2004/05 and 2009/10 to observe whether the inequality has increased or decreased. In addition, two dimensions of unequal growth, which are especially relevant in accounting

for inequality in many parts of Myanmar, are discussed. First, growth has been unequal across areas (that is, in all parts of the rural and urban areas). Second, growth has been unequal across subnational locations (that is, throughout regions and states), and these results are presented in the next chapter.

Table 3.8 Inequality measurement in Myanmar between 2004/05 and 2009/10 (1)

Measure of Inequality	'04-'05	'09-'10	Difference '09/10-'04/05	% Δ ('04/05 vs. '09/10)
P90/P10 ratio	2.865	2.477	-0.388	-14
P90/P10 ratio (Urban)	3.621	2.941	-0.680	-19
P90/P10 ratio (Rural)	2.580	2.263	-0.317	-12
P90/P50 ratio	1.761	1.642	-0.119	-7
P90/P50 ratio (Urban)	2.067	1.866	-0.201	-10
P90/P50 ratio (Rural)	1.606	1.529	-0.077	-5
P50/P10 ratio	1.627	1.508	-0.118	-7
P50/P10 ratio (Urban)	1.752	1.576	-0.176	-10
P50/P10 ratio (Rural)	1.607	1.480	-0.127	-8
P75/P25 ratio	1.697	1.586	-0.111	-7
P75/P25 ratio (Urban)	1.904	1.720	-0.184	-10
P75/P25 ratio (Rural)	1.633	1.543	-0.090	-6
Number of Sample HHs (All)	**18,634**	**18,609**		

Source: Author's estimations

Table 3.8 reports different percentile ratios for 2004/05 and 2009/10 distributions of total expenditure per adult equivalent. All reported percentile ratios indicate decreasing inequality from 2004/05 to 2009/10. Four percentile ratios such as the ratio of the 90th percentile to 10th percentile are presented. The change between the P90/P10 ratios over the study period is the highest (14%) at the union level and (19%) at urban areas among the percentile ratios reported. As shown in Table 3.8, a ratio of 3 in 2004/05 means that the consumption expenditures of the wealthiest 10% of the population were 3 times higher (on average) than the expenditures of the 10% least wealthy. The changes of P90/P50, P50/P10 and P75/P25 ratios are about 7% between the two years at the union level.

In terms of the decile and quintile ratios, the S90/S10 and the S80/S20 ratios are presented in Table 3.9. Over the study period, differences between the S90/S10 and S80/S20 ratios are highly statistically significant at the 1% level in both rural and urban areas, and at the union level. The nationwide Gini coefficient for expenditure per adult equivalent decreased from 0.256 to 0.220 between 2004/05 and 2009/10 at the union level. The difference in the Gini coefficients is statistically significantly different from zero at the

1% level at the union level. For urban areas, the changes in the Gini coefficient are statistically significant at the 5% level, but for rural areas, the changes are significant at the 1% level between 2004/05 and 2009/10, as shown in Table 3.9.

Table 3.9 Inequality measurement in Myanmar between 2004/05 and 2009/10 (2)

Measure of Inequality	'04-'05	'09-'10	Difference '09/10-'04/05	P- value Pr(|T| > |t|)	% Δ ('04/05 vs. '09/10)
S90/S10 ratio	5.002	3.984	**-1.018*** **		-20
	(0.142)	(0.099)	**[0.167]**	**0.000**	
			[0.174]	**0.000**	
S90/S10 ration (Urban)	6.869	4.988	**-1.880*** **		-27
	(0.371)	(0.155)	**[0.392]**	**0.000**	
			[0.403]	**0.000**	
S90/S10 ration (Rural)	3.820	3.265	**-0.555*** **		-15
	(0.043)	(0.049)	**[0.063]**	**0.000**	
			[0.065]	**0.000**	
S80/S20 ratio	3.500	2.928	**-0.572*** **		-16
	(0.101)	(0.066)	**[0.117]**	**0.000**	
			[0.121]	**0.000**	
S80/S20 ratio (Urban)	4.546	3.528	**-1.019*** **		-22
	(0.190)	(0.127)	**[0.221]**	**0.000**	
			[0.229]	**0.000**	
S80/S20 ratio (Rural)	2.888	2.537	**-0.351*** **		-12
	(0.023)	(0.030)	**[0.037]**	**0.000**	
			[0.038]	**0.000**	
Gini Coefficient	0.256	0.220	**-0.036*** **		-14
	(0.010)	(0.007)	**[0.012]**	**0.003**	
			[0.012]	**0.004**	
Gini Coefficient (Urban)	0.315	0.262	**-0.052** **		-17
	(0.019)	(0.014)	**[0.023]**	**0.023**	
			[0.024]	**0.029**	
Gini Coefficient (Rural)	0.212	0.188	**-0.024*** **		-11
	(0.003)	(0.004)	**[0.005]**	**0.000**	
			[0.005]	**0.000**	
Number of Sample HHs (All)	**18,634**	**18,609**			
Number of Sample HHs (Urban)	**5,529**	**5,523**			
Number of Sample HHs (Rural)	**13,105**	**13,086**			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses. Standard errors for the Gini coefficients are based on the Stata code of Jenkins (2008), which uses the method of Kovacevic and Binder (1997).
3) Z-statistics of the first line are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001). Z-statistics of the second line are calculated without taking into account correlation, using the standard normal test statistic (Barrett & Pendakur, 1995; Davidson & Duclos, 2000).
4) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.
5) P-values are reported at the first and second rows using Equations (2.21) and (2.18) on page 49 respectively, based on the standard normal test statistic.
6) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

This research also reports the Gini coefficients using the comprehensive consumption expenditures in 2004/05 and 2009/10 with the Adult Equivalent (AE) and 2009/10 price deflators proposed by the World Bank in 2014. As shown in Table-A, the Gini

coefficients are the highest for the comprehensive consumption expenditures without any price deflators except for AE of the IHLCA technical team.

A) Gini indices produced with different price deflators and without price deflators

No.	Price deflators and Adult Equivalent (AE)	Gini index		Weight
		2004/05	2009/10	
1.	Price unadjusted except for AE of the IHLCA team	0.294	0.253	Population weight
2.	PPI and AE of the IHLCA team	0.256	0.220	Population weight
3.	PPI of the IHLCA team and AE of the World Bank	0.241	0.207	Population weight
4.	AE of the IHLCA team and Price deflators of the World Bank	0.269	0.236	Population weight
5.	PD and AE of the World Bank	0.257	0.225	Population weight

Source: Author's estimations

Notes:

1) In No. 1, total expenditures including health expenditures and user costs of durables are adjusted using the Adult Equivalent Method (AE) of the IHLCA team, but not by any price deflators.
2) In No. 2, total expenditures including health expenditures and user costs of durables are adjusted using the Adult Equivalent Method (AE) and PPI of the IHLCA team.
3) In No. 3, total expenditures including health expenditures and user costs of durables are adjusted by PPI of the IHLCA team, and the Adult Equivalent (AE) Method of the World Bank.
4) In No. 4, total expenditures including health expenditures and user costs of durables are adjusted by AE of the IHLCA team and 2009/10 Price Deflators (PD) of the World Bank.
5) In No. 5, total expenditures including health expenditures and user costs of durables are adjusted by 2009/10 Price Deflators (PD), and the AE Method proposed by the World Bank.

In addition, the Gini coefficients are slightly higher for the expenditures using the AE method and 2009/10 price deflators proposed by the World Bank (as reported in Table B) than the Gini coefficients reported by the comprehensive consumption expenditures in 2004/05 and 2009/10 using the method of AE and PPI of the IHLCA technical team.

B) Delta/urban used as reference region (includes Yangon), spatial cost of living deflators used by the World Bank

Regions	2009/10	
	Urban	Rural
Hills	**.950**	**.792**
Dry Zone	**.849**	**.691**
Coastal	**.797**	**.783**
Delta	**1.000**	**.713**

Source: The World Bank (2014)

For a comparison of inequality indices over the study years, the standard errors (SEs) of differences are calculated with and without taking into account covariance terms when calculating inequality indices, by using consumption aggregates of households in 2004/05 and 2009/10 surveys. In general, the SEs reported without considering covariance are slightly higher than the SEs reported taking account covariance. However, the statistical significances shown in Tables 3.9, 3.10 and 3.11 are similar for almost all inequality indices reported in 2004/05 and 2009/10, as well as the SEs of the differences of two values of inequality indices between the two applied assumptions.

Table 3.10 Inequality measurement in Myanmar between 2004/05 and 2009/10 (3)

Measure of Inequality	'04-'05	'09-'10	Difference	P- value	% Δ (2004/05 vs. 2009/10)
GE(1), Theil's T	0.140	0.097	**-0.044*** **		-31
	(0.014)	(0.009)	**[0.016]**	**0.008**	
			-0.044**		
			[0.017]	**0.010**	
GE(1), Theil's T (Urban)	0.222	0.141	**-0.081****		-37
	(0.037)	(0.019)	**[0.040]**	**0.043**	
			-0.081*		
			[0.041]	**0.050**	
GE(1), Theil's T (Rural)	0.078	0.062	**-0.016*** **		-20
	(0.003)	(0.004)	**[0.005]**	**0.001**	
			[0.005]	**0.002**	
GE(0), Theil's L (Mean Log Deviation)	0.111	0.081	**-0.029*** **		-27
	(0.008)	(0.006)	**[0.010]**	**0.002**	
			[0.010]	**0.003**	
GE(0), Theil's L (Urban) (Mean Log Deviation)	0.165	0.114	**-0.052****		-31
	(0.019)	(0.012)	**[0.022]**	**0.019**	
			[0.023]	**0.023**	
GE(0), Theil's L (Rural) (Mean Log Deviation)	0.073	0.058	**-0.015*** **		-21
	(0.002)	(0.003)	**[0.003]**	**0.000**	
			[0.003]	**0.000**	
GE(2)	0.395	0.174	**-0.221**		-56
	(0.173)	(0.035)	**[0.174]**	**0.202**	
			[0.176]	**0.208**	
GE(2) (Urban)	0.745	0.286	**-0.459**		-62
	(0.411)	(0.080)	**[0.413]**	**0.266**	
			[0.419]	**0.273**	
GE(2) (Rural)	0.096	0.081	**-0.015**		-16
	(0.008)	(0.014)	**[0.016]**	**0.346**	
			[0.016]	**0.359**	
Number of Sample HHs (All)	**18,634**	**18,609**			
Number of Sample HHs (Urban)	**5,529**	**5,523**			
Number of Sample HHs (Rural)	**13,105**	**13,086**			

Source: Author's estimations

Notes:

1) See notes to Table 3.1 on the meaning of round and square parentheses, z-statistics, P-values, and ***, ** and *.
2) Standard errors for GE inequality indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).
3) Z-statistics of the first line are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001). Z-statistics of the second line are calculated without taking into account correlation, using the standard normal test statistic (Barrett & Pendakur, 1995; Davidson & Duclos, 2000).

The other inequality indices estimated are the Generalized Entropy class GE(α) for α = 0, 1, 2. Jenkins (1999) explains that "the indices differ in their sensitivities to differences in different parts of the distribution. The more positive α, the more sensitive GE(α) is to income differences at the top of the distribution; the more negative α, the more sensitive it is to differences at the bottom of the distribution. GE(0) is the MLD, GE(1) is the Theil's T index, and GE(2) is half the square of the coefficient of variation" (p.8). The GE indices with weighting parameters 2 show the greatest decrease (56%) in expenditure inequality but not significant for the changes of GE(2) indices between 2004/05 and 2009/10 in Table 3.10. The differences of the GE(0) and the GE(1) indices are statistically significant at the 1% at the union level, and this suggests that most of the changes in the distributions occur at the bottom. In addition, changes in the MLD [GE(0)] and the Theil's T [GE(1)] are also highly statistically significant at the 1 % level in rural areas, and 5% level in urban areas, based on the reported linearized standard errors. However, the GE(2) indices present higher levels of inequality in both surveyed years.

The Atkinson classes are also analysed at different levels of 'inequality aversion'. Jones and Weinberg (2000) note that "the Atkinson index becomes more sensitive to changes at the lower end of the income distribution as the larger the ε is. Conversely, as the level of inequality aversion falls (that is, as ε approaches 0) the Atkinson becomes more sensitive to changes in the upper end of the income distribution" (p.11). As shown in Table 3.11, the general decline in inequality using the larger inequality aversion was much smaller over the study period.

At the union level, the decreases are in the range of 27%, 25% and 23% for $\boldsymbol{\varepsilon}$= 0.5, $\boldsymbol{\varepsilon}$= 1.0 and $\boldsymbol{\varepsilon}$= 2.0 respectively, and the differences of Atkinson indices are statistically significant at the 1% level for all aversions at the union level. In rural areas, the declines of Atkinson indices are statistically significant at the 1% level for all aversion parameters. In urban areas, the differences of Atkinson indices ($\boldsymbol{\varepsilon}$= 0.5, $\boldsymbol{\varepsilon}$= 1.0, and $\boldsymbol{\varepsilon}$= 2.0) over the study period are significant at the 5% level. The magnitudes of the differences of Atkinson indices ($\boldsymbol{\varepsilon}$= 2.0) at the union level, and rural and urban areas, are substantially higher than those of other Atkinson indices, with ($\boldsymbol{\varepsilon}$= 1.0 and $\boldsymbol{\varepsilon}$= 0.5). Therefore, the conclusion can be made that changes between the 2004/05 and 2009/10 expenditure distributions occur at the lower part of distributions at the union level, and rural and urban areas.

Table 3.11 Inequality measurement in Myanmar between 2004/05 and 2009/10 (4)

Measure of Inequality	'04-'05	'09-'10	Difference	P- value	% Δ (2004/05 vs. 2009/10)
Atkinson (*ε= 0.5)*	0.059	0.043	**-0.016*** **		-27
	(0.005)	(0.003)	**[0.006]**	**0.003**	
			[0.006]	**0.005**	
Atkinson (*ε= 0.5)* (Urban)	0.089	0.060	**-0.028** **		-32
	(0.011)	(0.007)	**[0.012]**	**0.020**	
			[0.013]	**0.024**	
Atkinson (*ε= 0.5)* (Rural)	0.037	0.029	**-0.008*** **		-21
	(0.001)	(0.001)	**[0.002]**	**0.000**	
			[0.002]	**0.000**	
Atkinson (*ε= 1.0)*	0.105	0.078	**-0.027*** **		-25
	(0.007)	(0.005)	**[0.009]**	**0.002**	
			[0.009]	**0.003**	
Atkinson (*ε= 1.0)* (Urban)	0.152	0.107	**-0.045** **		-30
	(0.016)	(0.011)	**[0.019]**	**0.017**	
			[0.020]	**0.022**	
Atkinson (*ε= 1.0)* (Rural)	0.071	0.056	**-0.014*** **		-21
	(0.002)	(0.002)	**[0.003]**	**0.000**	
			[0.003]	**0.000**	
Atkinson (*ε= 2.0)*	0.179	0.137	**-0.042*** **		-23
	(0.011)	(0.008)	**[0.013]**	**0.001**	
			[0.013]	**0.001**	
Atkinson (*ε= 2.0)* (Urban)	0.249	0.182	**-0.068** **		-27
	(0.025)	(0.016)	**[0.029]**	**0.018**	
			[0.030]	**0.022**	
Atkinson (*ε= 2.0)* (Rural)	0.132	0.106	**-0.027*** **		-20
	(0.003)	(0.004)	**[0.005]**	**0.000**	
			[0.005]	**0.000**	
Number of Sample HHs (All)	**18,634**	**18,609**			
Number of Sample HHs (Urban)	**5,529**	**5,523**			
Number of Sample HHs (Rural)	**13,105**	**13,086**			

Source: Author's estimations

Notes:

1) See notes to Table 3.1 on the meaning of round and square parentheses, z-statistics, P-values, and ***, ** and *.
2) Standard errors for Atkinson inequality indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).
3) Z-statistics of the first line are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001). Z-statistics of the second line are calculated without taking into account correlation, using the standard normal test statistic (Barrett & Pendakur, 1995; Davidson & Duclos, 2000).

Overall, it is obvious that inequality within urban areas of Myanmar was much greater than inequality within rural areas, as was reported by all inequality measures, though they are not tested statistically. Overall, inequality measured by real expenditure per adult equivalent decreased in the range from 10% to 62% in urban areas between 2004/05 and 2009/10 while the changes in rural areas varied from 5% to 21% depending on the measures of inequality. All reported percentile ratios for panel households show a decline in inequality from 2004/05 to 2009/10, as presented in Table 3.12. The change between P90/P10 ratios for panel households over the study period is the highest (16%) in urban areas and (11%) at the union level among the percentile ratios reported.

Table 3.12 Inequality measurement in Myanmar between 2004/05 and 2009/10 (Panel HHs)

Measure of Inequality	'04-'05	'09-'10	Δ '09/10-'04/05	% Δ ('04/05 vs. '09/10)
P90/P10 ratio	2.798	2.497	-0.301	-11
P90/P10 ratio (Urban)	3.539	2.970	-0.569	-16
P90/P10 ratio (Rural)	2.538	2.290	-0.248	-10
P90/P50 ratio	1.723	1.638	-0.085	-5
P90/P50 ratio (Urban)	1.998	1.878	-0.120	-6
P90/P50 ratio (Rural)	1.599	1.529	-0.070	-4
P50/P10 ratio	1.624	1.524	-0.100	-6
P50/P10 ratio (Urban)	1.771	1.581	-0.190	-11
P50/P10 ratio (Rural)	1.587	1.498	-0.090	-6
P75/P25 ratio	1.689	1.577	-0.112	-7
P75/P25 ratio (Urban)	1.844	1.693	-0.151	-8
P75/P25 ratio (Rural)	1.609	1.549	-0.061	-4
Number of Sample HHs (All)	**9,102**	**9,102**		

Source: Author's estimations

3.3.10 Inequality measurement in Myanmar between 2004/05 and 2009/10: A comparison of the asymptotic and bootstrap standard errors for panel households

A comparison of the asymptotic and bootstrap standard errors of each year for panel households in this study indicates that they are similar for the Gini coefficient, the GE and the Atkinson indices. This confirms the study of Clarke and Roy (2012) that "the results from the easy to implement linearization method and the more computationally burdensome bootstrap are typically quite similar" (p.499). However, the study of Mills and Zandvakili (1997) shows that for the Theil measure these estimates are similar, whereas for the Gini coefficient there is a substantial difference. For hypothesis testing, the bootstrapping of the differences of the Gini coefficient, the GE, and the Atkinson indices provides stronger significant results than the results reported using Equation (2.21) described in Chapter 2, based on the standard normal test statistic. This could be due to the resampling procedure of bootstrapping, which automatically takes into account the covariance structure (Biewen, 2002), though the linearization approach based on the test for dependent samples also removes the correlation between panel households. Horowitz (2001) argues that bootstrapping asymptotic pivotal statistics provides a powerful test (the 'bootstrap t method'). In other words, the t-ratio calculated by using asymptotic method for the difference in two inequality indices can be bootstrapped. However, this approach is not further employed in this research as bootstrapping the t-ratio constructed based on the asymptotic method in Stata is very complicated due to the complexity of the IHLCA survey design. This issue may be investigated further in my future research.

Table 3.13 Inequality measurement in Myanmar between 2004/05 and 2009/10: A comparison of the asymptotic and bootstrap standard errors for panel households (1)

Measure of Inequality	'04-'05	'09-'10	Difference '09/10-'04/05	P- value Pr(|T| > |t|)	% Δ ('04/05 vs. '09/10)
S90/S10 ratio	4.766	4.003	**-0.762*** **		-16
ASE	(0.161)	(0.117)	**[0.191]**	**0.000**	
S90/S10 ratio	4.766	4.003	**-0.762*** **		
BSE	(0.137)	(0.099)	**[0.097]**	**0.000**	
S90/S10 ration (Urban)	6.348	5.106	**-1.242*** **		-20
ASE	(0.354)	(0.228)	**[0.358]**	**0.001**	
S90/S10 ration (Urban)	6.348	5.106	**-1.242*** **		
BSE	(0.298)	(0.180)	**[0.286]**	**0.000**	
S90/S10 ration (Rural)	3.782	3.316	**-0.467*** **		-12
ASE	(0.062)	(0.068)	**[0.079]**	**0.000**	
S90/S10 ration (Rural)	3.782	3.316	**-0.467*** **		
BSE	(0.044)	(0.049)	**[0.082]**	**0.000**	
S80/S20 ratio	3.380	2.940	**-0.440*** **		-13
ASE	(0.106)	(0.071)	**[0.123]**	**0.000**	
S80/S20 ratio	3.380	2.940	**-0.440*** **		
BSE	(0.092)	(0.061)	**[0.058]**	**0.000**	
S80/S20 ratio (Urban)	4.284	3.554	**-0.730*** **		-17
ASE	(0.205)	(0.148)	**[0.213]**	**0.001**	
S80/S20 ratio (Urban)	4.284	3.554	**-0.730*** **		
BSE	(0.166)	(0.124)	**[0.108]**	**0.000**	
S80/S20 ratio (Rural)	2.858	2.569	**-0.289*** **		-10
ASE	(0.031)	(0.041)	**[0.044]**	**0.000**	
S80/S20 ratio (Rural)	2.858	2.569	**-0.289*** **		
BSE	(0.022)	(0.029)	**[0.042]**	**0.000**	
Gini Coefficient	0.248	0.221	**-0.027** **		-11
ASE	(0.011)	(0.008)	**[0.013]**	**0.029**	
Gini Coefficient	0.248	0.221	**-0.027*** **		
BSE	(0.009)	(0.007)	**[0.005]**	**0.000**	
Gini Coefficient (Urban)	0.295	0.264	**-0.032**		-11
ASE	(0.022)	(0.016)	**[0.023]**	**0.160**	
Gini Coefficient (Urban)	0.295	0.264	**-0.032*** **		
BSE	(0.019)	(0.014)	**[0.009]**	**0.001**	
Gini Coefficient (Rural)	0.210	0.190	**-0.020*** **		-9
ASE	(0.004)	(0.005)	**[0.005]**	**0.000**	
Gini Coefficient (Rural)	0.210	0.190	**-0.020*** **		
BSE	(0.003)	(0.003)	**[0.005]**	**0.000**	
Number of Sample HHs (All)	9,102	9,102			
Number of Sample HHs (Urban)	2,706	2,706			
Number of Sample HHs (Rural)	6,396	6,396			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses.
3) SEs of the differences of the first and second lines are asymptotic and bootstrap SEs respectively.
4) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009) for the asymptotic SEs.
5) For a two tailed t-test of 2004/05=2009/10, the 5 % critical value for the z-statistic is 1.96.
6) P-values are reported at the first row based on the standard normal test statistic, by using Equation (2.22). At the second row, P-values are reported by bootstrapping the differences of two inequality indices.
7) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 3.14 Inequality measurement in Myanmar between 2004/05 and 2009/10: A comparison of the asymptotic and bootstrap standard errors for panel households (2)

Measure of Inequality	'04-'05	'09-'10	Difference '09/10-'04/05	P- value Pr(|T| > |t|)	% Δ ('04/05 vs. '09/10)
GE(1), Theil's T	0.120	0.098	**-0.022**		-19
ASE	(0.014)	(0.010)	**[0.017]**	**0.185**	
GE(1), Theil's T	0.120	0.098	**-0.022****		
BSE	(0.012)	(0.009)	**[0.009]**	**0.013**	
GE(1), Theil's T (Urban)	0.170	0.142	**-0.028**		-16
ASE	(0.030)	(0.022)	**[0.031]**	**0.371**	
BSE	(0.025)	(0.017)	**[0.019]**	**0.146**	
GE(1), Theil's T (Rural)	0.078	0.066	**-0.013***		-16
ASE	(0.004)	(0.007)	**[0.007]**	**0.065**	
GE(1), Theil's T (Rural)	0.078	0.066	**-0.013****		
BSE	(0.003)	(0.005)	**[0.006]**	**0.036**	
GE(0), Theil's L (MLD)	0.102	0.081	**-0.021**		-20
ASE	(0.009)	(0.006)	**[0.010]****	**0.044**	
GE(0), Theil's L (MLD)	0.102	0.081	**-0.021**		
BSE	(0.008)	(0.005)	**[0.005]*****	**0.000**	
GE(0), Theil's L (MLD) U	0.144	0.115	**-0.030**		-21
ASE	(0.021)	(0.014)	**[0.021]**	**0.166**	
GE(0), Theil's L (MLD) U	0.144	0.115	**-0.030*****		
BSE	(0.018)	(0.012)	**[0.010]**	**0.004**	
GE(0), Theil's L (MLD) R	0.073	0.059	**-0.013*****		-18
ASE	(0.003)	(0.003)	**[0.004]**	**0.001**	
BSE	(0.002)	(0.002)	**[0.004]**	**0.000**	
GE(2)	0.192	0.181	**-0.011**		-6
ASE	(0.040)	(0.042)	**[0.056]**	**0.845**	
BSE	(0.031)	(0.031)	**[0.039]**	**0.777**	
GE(2) (Urban)	0.283	0.292	**0.009**		3
ASE	(0.078)	(0.094)	**[0.102]**	**0.933**	
BSE	(0.064)	(0.067)	**[0.084]**	**0.918**	
GE(2) (Rural)	0.102	0.095	**-0.006**		-6
ASE	(0.014)	(0.027)	**[0.027]**	**0.815**	
BSE	(0.009)	(0.019)	**[0.023]**	**0.781**	
Number of Sample HHs (All)	**9,102**	**9,102**			
Number of Sample HHs (Urban)	**2,706**	**2,706**			
Number of Sample HHs (Rural)	**6,396**	**6,396**			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses.
3) SEs of the differences of the first and second lines are asymptotic and bootstrap SEs respectively.
4) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009), for the asymptotic SEs.
5) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.
6) P-values are reported at the first row based on the standard normal test statistic using Equation (2.22). At the second row, P-values are reported by bootstrapping the differences of two inequality indices.
7) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 3.15 Inequality measurement in Myanmar between 2004/05 and 2009/10: A comparison of the asymptotic and bootstrap standard errors for panel households (3)

Measure of Inequality	'04-'05	'09-'10	Difference '09/10-'04/05	P- value Pr(|T| > |t|)	% Δ ('04/05 vs. '09/10)
Atkinson (*ε= 0.5)*	0.053	0.043	**-0.010***		-20
ASE	(0.005)	(0.004)	**[0.006]**	**0.087**	
Atkinson (*ε= 0.5)*	0.053	0.043	**-0.010*****		
BSE	(0.004)	(0.003)	**[0.003]**	**0.000**	
Atkinson (*ε= 0.5)* (Urban)	0.075	0.061	**-0.014**		-18
ASE	(0.011)	(0.008)	**[0.012]**	**0.236**	
Atkinson (*ε= 0.5)* (Urban)	0.075	0.061	**-0.014****		
BSE	(0.010)	(0.006)	**[0.006]**	**0.029**	
Atkinson (*ε= 0.5)* (Rural)	0.037	0.030	**-0.006*****		-17
ASE	(0.002)	(0.002)	**[0.002]**	**0.006**	
BSE	(0.001)	(0.002)	**[0.002]**	**0.002**	
Atkinson (*ε= 1.0)*	0.097	0.078	**-0.019****		-20
ASE	(0.008)	(0.006)	**[0.009]**	**0.043**	
Atkinson (*ε= 1.0)*	0.097	0.078	**-0.019*****		
BSE	(0.007)	(0.005)	**[0.004]**	**0.000**	
Atkinson (*ε= 1.0)* (Urban)	0.134	0.108	**-0.026**		-19
ASE	(0.018)	(0.012)	**[0.019]**	**0.163**	
Atkinson (*ε= 1.0)* (Urban)	0.134	0.108	**-0.026*****		
BSE	(0.016)	(0.010)	**[0.009]**	**0.003**	
Atkinson (*ε= 1.0)* (Rural)	0.070	0.058	**-0.012*****		-18
ASE	(0.003)	(0.003)	**[0.004]**	**0.001**	
BSE	(0.002)	(0.002)	**[0.003]**	**0.000**	
Atkinson (*ε= 2.0)*	0.171	0.137	**-0.033****		-20
ASE	(0.011)	(0.008)	**[0.013]**	**0.010**	
Atkinson (*ε= 2.0)*	0.171	0.137	**-0.033*****		
BSE	(0.009)	(0.007)	**[0.006]**	**0.000**	
Atkinson (*ε= 2.0)* (Urban)	0.231	0.184	**-0.047***		-20
ASE	(0.027)	(0.018)	**[0.027]**	**0.082**	
Atkinson (*ε= 2.0)* (Urban)	0.231	0.184	**-0.047*****		
BSE	(0.022)	(0.015)	**[0.011]**	**0.000**	
Atkinson (*ε= 2.0)* (Rural)	0.131	0.107	**-0.024*****		-18
ASE	(0.004)	(0.005)	**[0.005]**	**0.000**	
BSE	(0.003)	(0.004)	**[0.005]**	**0.000**	
Number of Sample HHs (All)	**9,102**	**9,102**			
Number of Sample HHs (Urban)	**2,706**	**2,706**			
Number of Sample HHs (Rural)	**6,396**	**6,396**			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) See notes to Table 3.1 on the meaning of round and square parentheses.
3) SEs of the differences of the first and second lines are asymptotic and bootstrap SEs respectively.
4) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009), for the asymptotic SEs.
5) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.
6) P-values are reported at the first row based on the standard normal test statistic, using the Equation (2.22) of this research. At the second row, P-values are reported by bootstrapping the differences of two inequality indices.
7) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

As presented in Tables 3.13, 3.14 and 3.15, a similar decreasing trend also reveals differences in the 2004/05 and 2009/10 distributions between panel households. In terms

of the bootstrap method, at the union level, and in rural and urban areas between 2004/05 and 2009/10, the differences of the Gini coefficient for panel households are highly statistically significant at the 1 % level, as reported in Table 3.13. Similarly, the changes in the MLD [GE(0)] are highly significant at the 1% level at the union level, and in urban and rural areas. Also, the differences of GE (1) are statistically significant at the 5% level at the union level and in rural areas. According to Table 3.15, the differences of Atkinson indices (ε= 1.0) and (ε= 2.0) at the union level, and in urban and rural areas, and the differences of Atkinson indices (ε= 0.5) at the union and rural areas, reported with bootstrap standard errors, are statistically significant at the 1 % level. The rates of changes of the MLD and Atkinson indices are the fastest among all inequality indices measured, varying from 17% to 21%, as presented in Tables 3.14 and 3.15.

3.3.11 The impact of Cyclone Nargis in 2008 on consumption expenditure inequality in Myanmar

Did Cyclone Nargis contribute to, or even cause, the decline in measured inequality between 2004/05 and 2009/10? Firstly, mean, median, and the S90/S10 ratios for the 2004/05 and 2009/10 distributions of per adult equivalent household expenditure of total population, urban and rural areas, all non-Nargis areas (which consists of non-Nargis Hills, non-Nargis Dry zone, and non-Nargis Coastal areas), and the Nargis-affected area, are presented in Table 3.16.

Yangon, the business-capital city, is included in the Nargis-affected area. Thus, the level of mean expenditure per adult equivalent of the Nargis-affected area is higher, compared with that of all non-Nargis areas in both study years. However, the mean expenditure per adult equivalent of the Nargis-affected area was reduced substantially, with a negative growth of 13%, while that of all non-Nargis areas had an increase 7%. A similar trend is also found for the median of expenditure per adult equivalent of the Nargis- and the non-Nargis-affected areas. The S90/S10 ratio indicates that the reduction in expenditure inequality of the Nargis-affected area (26%) is faster than that of the non-Nargis-affected area (13%).

Table 3.16 Real consumption expenditure per adult equivalent in the Nargis- and the non-Nargis-affected areas in Myanmar between 2004/05 and 2009/10

Real consumption expenditure per adult equivalent	'04-'05	'09-'10	Difference '09/10-'04/05	% Δ ('04/05 vs. '09/10)
Mean (Total Population)	**534,826**	**542,971**	**8,144**	**1.5**
Mean (Urban)	690,392	670,972	-19,420	-2.8
Mean (Rural)	480,098	497,924	17,826	3.7
Mean (All non-Nargis)	**493,059**	**527,612**	**34,553**	**7.0**
Mean (non-Nargis Hills)	487,118	514,161	27,043	5.6
Mean (non-Nargis Dry Zone)	498,980	546,424	47,444	9.5
Mean (non-Nargis Coastal)	500,683	499,760	-923	-0.2
Mean (Nargis)	**679,283**	**594,154**	**-85,130**	**-12.5**
Median (Total Population)	**464,329**	**487,447**	**23,118**	**5.0**
Median (Urban)	555,280	570,990	15,711	2.8
Median (Rural)	444,378	466,111	21,733	4.9
Median (All non-Nargis)	**443,445**	**481,279**	**37,834**	**8.5**
Median (non-Nargis Hills)	428,602	474,243	45,641	10.6
Median (non-Nargis Dry Zone)	444,714	495,575	50,860	11.4
Median (non-Nargis Coastal)	464,537	454,202	-10,336	-2.2
Median (Nargis)	**561,378**	**511,164**	**-50,214**	**-8.9**
S90/S10 ratio (Total Population)	**5.002**	**3.984**	**-1.018**	**-20**
S90/S10 ratio (Urban)	6.869	4.988	-1.880	-27
S90/S10 ratio (Rural)	3.820	3.265	-0.555	-15
S90/S10 ratio (All non-Nargis)	**4.294**	**3.728**	**-0.566**	**-13**
S90/S10 ratio (non-Nargis Hills)	4.943	3.743	-1.200	-24
S90/S10 ratio (non-Nargis Dry Zone)	4.244	3.689	-0.555	-13
S90/S10 ratio (non-Nargis Coastal)	3.931	3.700	-0.231	-6
S90/S10 ratio (Nargis)	**6.238**	**4.634**	**-1.605**	**-26**
No. of Sample HHs (Total Population)	**18,634**	**18,609**		
No. of Sample HHs (Urban)				
No. of Sample HHs (Rural)				
No. of Sample HHs (Nargis)	**2,673**	**2,660**		
No. of Sample HHs (All non-Nargis)	**15,961**	**15,949**		
No. of Sample HHs (non-Nargis Hills)	**4,027**	**4,020**		
No. of Sample HHs (non-Nargis Dry Zone)	**8,419**	**8,426**		
No. of Sample HHs (non-Nargis Coastal)	**2,735**	**2,730**		

Source: Author's estimations

3.3.12 Growth incidence curves

The expenditure incidence curves are constructed in Figure 3.4, showing the changes in real expenditure for the total population, and rural and urban centile groups. Each centile category may be affected differently by a shock, such as Cyclone Nargis in 2008 or the global recession in 2009. Sample households are divided into all (union), and rural and urban categories. Warr and Yusuf (2014) detail the method used: "for each of these categories the data on real household expenditures per adult equivalent are sorted according to expenditures per adult equivalent, from the poorest to the richest, creating a

smooth cumulative distribution of expenditures per capita. These data are then divided into centile groups, with equal population in each of the 100 categories. The poorest sub-category (centile 1) is on the left, the richest (centile 100) on the far right. The vertical height of the points shown is the percentage change in that centile group's real expenditure" (pp. 581, 584).

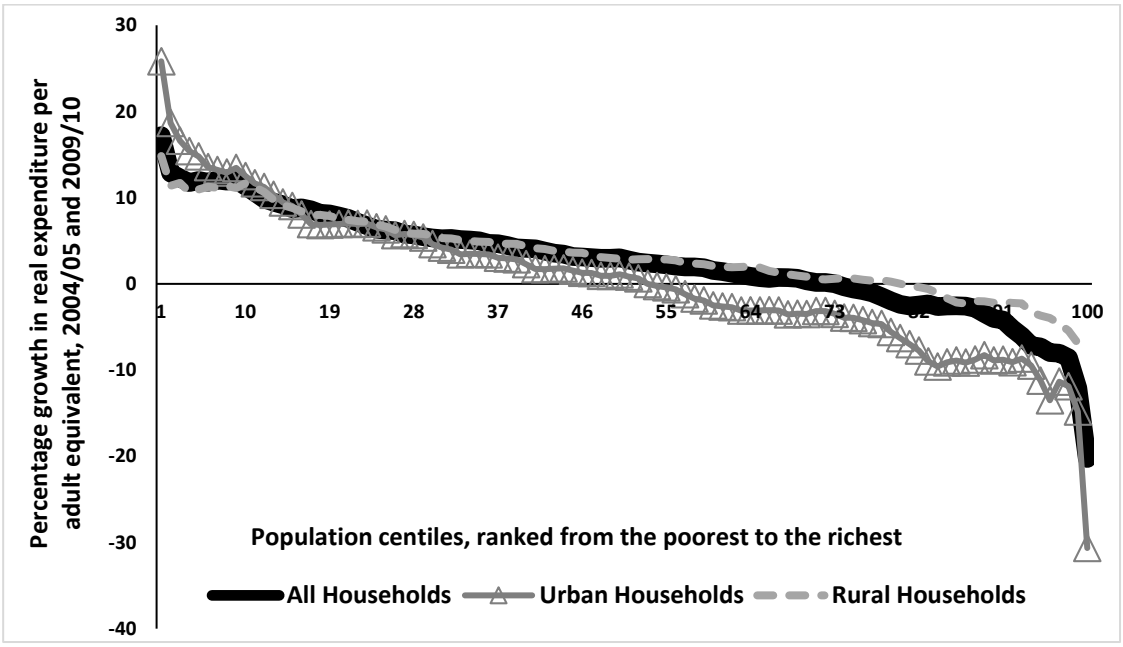


Figure 3.4 Growth incidence curve for real consumption expenditure per adult equivalent, Myanmar, 2004/05 and 2009/10

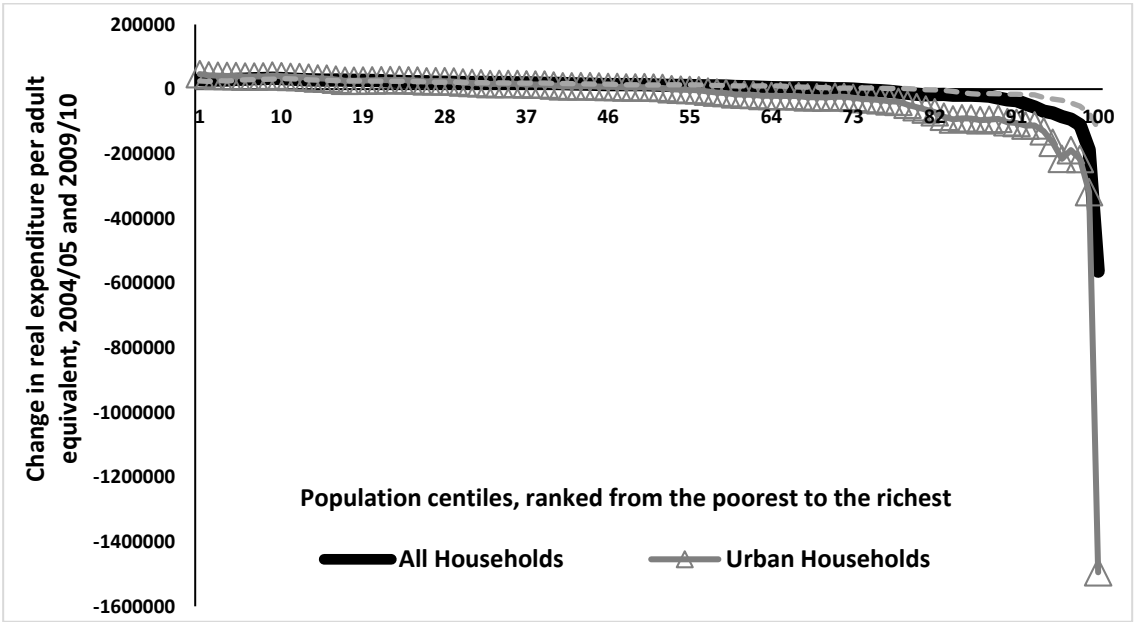


Figure 3.5 Absolute change in real consumption expenditure per adult equivalent, Myanmar, 2004/05 and 2009/10

Figure 3.4 shows the growth incidence curve for Myanmar and compares the percentage changes in real expenditures per adult equivalent between 2004/05 and 2009/10 of all households, rural, and urban households. For urban households, from centile 1 to about centile 55, the changes in real expenditures are positive, while for all and rural households, from centile 1 up to about the centile 73, the changes in real expenditures are positive. It is clear from the graph that expenditure declined for those in the top part of the expenditure distribution, while expenditure rose for those who were poor. The expenditures rose considerably even for the middle part of the expenditure distribution in all households, and the households in the rural category. The growth incidence curve reflects averages. The absolute change in real expenditures per adult equivalent of all households, rural, and urban households between 2004/05 and 2009/10 is shown in Figure 3.5. The larger drops of real expenditures per adult equivalent are found among higher centile groups, starting from the 91 to 100 centiles.

3.3.13 Growth incidence curves between the Nargis-affected HHs and the non-Nargis-affected HHs

What would have happened if Cyclone Nargis had not occurred? The Cyclone Nargis-affected area would have seen changes anyway, even without the cyclone. Hence, this research is looking for the counterfactual: what would have happened in the Nargis-affected area if Cyclone Nargis had not occurred? In reality, this counterfactual cannot be observed. However, it can be estimated, using non-Nargis-affected regions similar to the Nargis-affected area. The assumption made in this analysis is that if Cyclone Nargis had not occurred, the expenditure distribution of the Nargis-affected area would have changed in a manner similar to other non-Nargis-affected regions. The most comparable region would seem to be the non-Nargis affected Costal ecological zone as the non-Nargis-affected Hills and Dry zones have very different agro-ecological characteristics from the Nargis-affected area and include no coastal areas. Therefore, this research selects the non-Nargis-affected Costal ecological zone, which has similar agro-ecological characteristics to the Nargis-affected area. The counterfactual is estimated using this zone.

It could be argued that there may be spillover effects in areas where a large scale disaster, such as Cyclone Nargis, did not directly impact. For example, the idiosyncratic, external shock of Cyclone Nargis may have affected prices and/or incomes in surrounding regions of Myanmar, more specifically in non-Nargis-affected areas. Thus, a geographic region

in neighbouring nations such as Thailand or Bangladesh where there is no significant trade links with the Nargis-impacted area should be considered as the counterfactual comparison group. In reality, it is not feasible to get the household survey data from those countries for 2004/05 and 2009/10. In addition, even if the data for the study years are available in those countries, survey design and methodology are different. Piketty (2014) argues that "data from other countries or other periods are not directly comparable because, for example, the tops of the distribution have been truncated or because income from capital is omitted for some countries but not others" (p.267). "Furthermore, different capital taxation laws may bias international comparisons" (p.283).

In addition, the counterfactual (that is, the most comparable region) is the non-Nargis-affected Costal ecological zone, composed of Taninthary, Mon and Rahine. They are not immediate neighbours of the Nargis-affected area. Taninthary region and Mon state are adjacent to the Thailand border, while Rakhine state is in northern part of Myanmar and borders with Bangladesh. Those areas are exposed to Andaman Sea and Bay of Bengal and often prone to natural disasters. Of the major trading commodities from Ayarwaddy in Nargis-affected region to other parts of Myanmar are rice and fishery products. From Yangon, agricultural commodities (other than rice and fishery products) and manufactured products are sent to the rest of Myanmar. However, spillover effects are weak in the counterfactual area as agricultural commodities and fishery products are available in Taninthary, Mon and Rahine. Also, manufactured products from Thailand and Bangladesh are available in the non-Nargis-affected Costal ecological zone through border trade (Kudo & Mieno, 2007).

In this study, by comparing the changes in real expenditures between Nargis- and non-Nargis-affected areas, the effect of Cyclone Nargis can be approximated. Thus, the impact of Nargis is investigated using expenditure growth incidence curves, as explained above. The analysis compares the changes in real consumption expenditures of the Nargis and non-Nargis households between 2004/05 and 2009/10 to estimate the effects of Cyclone Nargis on the consumption expenditure distributions. Sample households in the non-Nargis-affected areas are also divided into:

1) Non-Nargis Hills ecological zone, consisting of Kachin, Kayah, Kayin, Chin and Shan States
2) Non-Nargis Dry ecological zone, comprising Sagaing, Mandalay, Magway and Bago
3) Non-Nargis Costal ecological zone, containing Taninthary, Mon and Rahine.

Figure 3.6 compares the outcomes of the percentage changes in real expenditures per adult equivalent of the Nargis and non-Nargis households between the IHLCA Surveys of 2004/05 and 2009/10. For the non-Nargis and non-Nargis Dry zone centile groups, the changes in real expenditures are positive up to the centile 95, and for the non-Nargis Hills centile group, up to the centile 79. For the non-Nargis Coastal areas, the change in real expenditures is mostly negative, starting from the centile 22 to the centile 99, and becomes positive at the centile 100 group. For the Nargis households, in each centile group, starting from the centile 10 all the way to 100, the changes in real expenditures are negative, and drop sharply at the centile 100 group. It is obvious from the graph that expenditure declined for those in the top part of the expenditure distribution, while expenditure rose for those who were poor. The real expenditures declined significantly even for the middle part of the expenditure distribution, in households in the Nargis category.

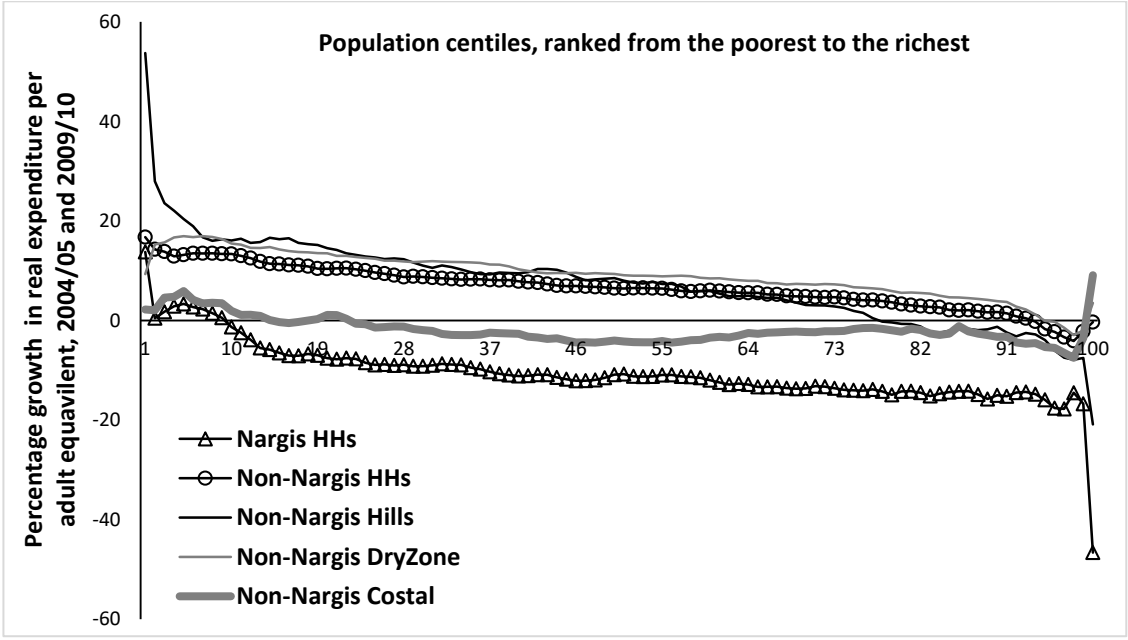


Figure 3.6 Growth incidence curve for real consumption expenditure per adult equivalent, Myanmar, 2004/05 and 2009/10

The differences of the percentage changes in real expenditures per adult equivalent between the Nargis households and all non-Nargis households, and non-Nargis households in three ecological zones, illustrate that the decline in consumption expenditures of the Nargis households are more severe as shown in Figure 3.7.

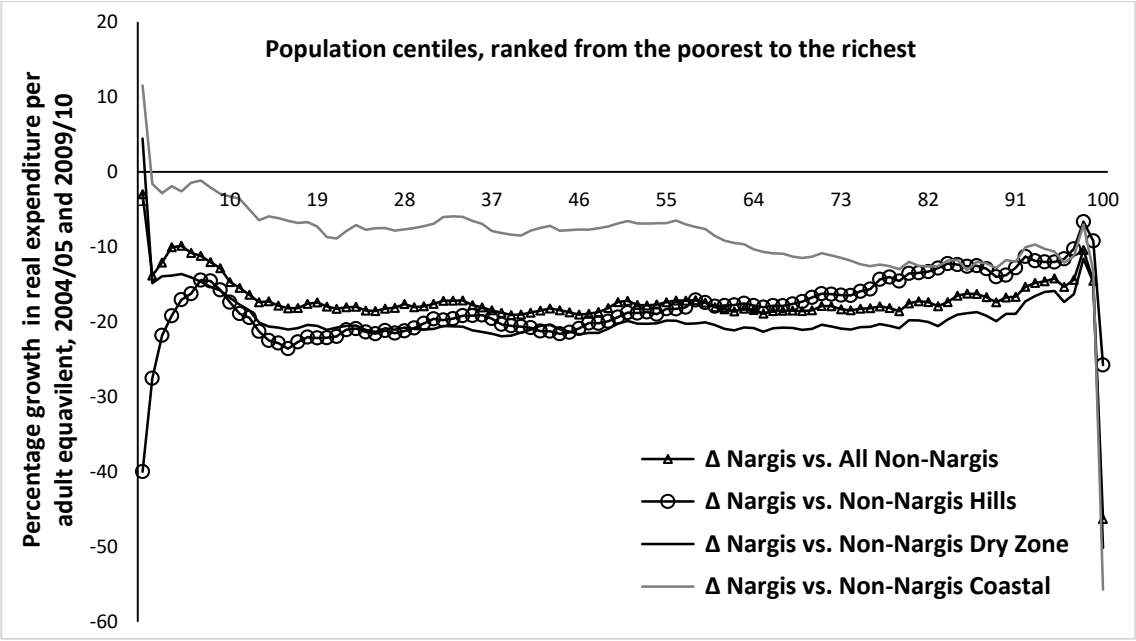


Figure 3.7 Growth incidence curve for real consumption expenditure per adult equivalent, the differences between Nargis- and non-Nargis-households, 2004/05 and 2009/10

In terms of absolute inequality, the absolute change in real expenditures per adult equivalent of the Nargis households between 2004/05 and 2009/10, the larger drop of real expenditures per adult equivalent is found from the 95 to 100 centiles, as shown in Figure 3.8. There are generally measurement errors in the top and the bottom 1%; thus to eliminate measurement errors, the top and the bottom 1% are trimmed in the distributions of real expenditures per adult equivalent (Cowell & Victoria-Feser, 2006).

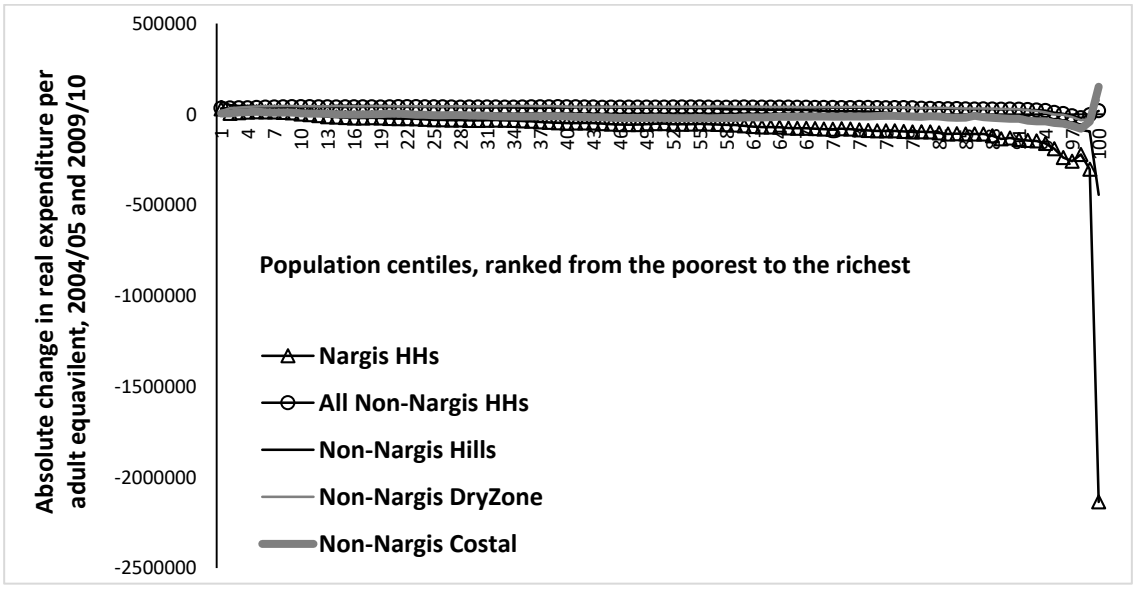


Figure 3.8 Absolute change in real consumption expenditure per adult equivalent, Myanmar, 2004/05 and 2009/10

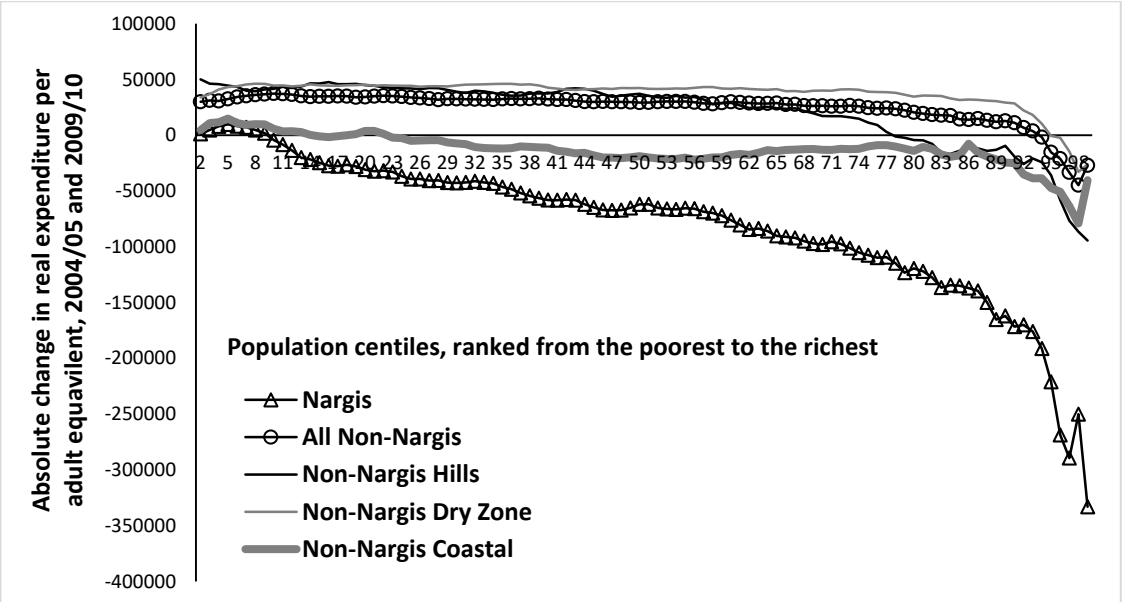


Figure 3.9 Absolute change in real consumption expenditure per adult equivalent after trimming the top and bottom 1%, Myanmar, 2004/05 and 2009/10

As reported in Figure 3.9, the absolute change of the Nargis-affected area is in the negative, starting from the centile 10 to 100 groups, and the expenditure distribution declined drastically from the centile 50 to the centile 100 groups.

In terms of relative and absolute inequality shown by the growth incidence curves among Nargis and all non-Nargis households, non-Nargis Hills, non-Nargis Coastal, and non-Nargis Dry zone households, the impact of Cyclone Nargis was that expenditure inequality declined, especially in the top part of the expenditure distribution, in the Nargis-affected region, compared with the smaller reduction that would have occurred anyway, as in the non-Nargis regions. Therefore, Cyclone Nargis contributed to the decline in real expenditures per adult equivalent that occurred in the Nargis-affected area between 2004/05 and 2009/10, and it also contributed to the observed decline in national inequality.

3.3.14 Inequality measurement in the Nargis- and the non-Nargis-affected areas in Myanmar between 2004/05 and 2009/10

This study also employs the classic inequality measurements of the Gini coefficient, the GE, and Atkinson indices, to study the impact Cyclone Nargis had on measured inequality. As reported in Table 3.17, in terms of the classic inequality measurement (Gini coefficient), the reduction in inequality, was larger in the Nargis-affected area than all

non-Nargis-affected areas. This was also so for the inequality indices with different weighting values in the GE and the Atkinson indices.

In the GE measurement, a small value of α makes the GE measure highly sensitive to changes in the lower tail of the expenditure (or income) distribution (Biewen & Jenkins, 2003). The changes in the GE(0) index of the non-Nargis affected area including the non-Nargis Hills and the Nargis-affected area between 2004/05 and 2009/10 are statistically significant at the 1 % level in Table 3.17. Therefore, the analysis of the GE measurement confirms that changes mainly occur in the lower parts of the expenditure distributions. The larger the parameter, the more sensitive that A (ε) becomes to differences at the bottom of the distribution (Biewen & Jenkins, 2003). As shown in Table 3.18, the changes of Atkinson index with aversion parameter 2 also support the findings, as it is highly significant at the 1 % level. Therefore, there are significant changes in the lower parts of the expenditure distributions in both the Nargis- and the non-Nargis-affected areas.

In terms of percentage changes, the larger changes are found in the GE(2) (about 78%), and the Atkinson (ε= 0.5) index (about 33%) of the Nargis-affected area, indicating that the reduction in expenditure inequality among higher income groups was more intense. However, as shown in Tables 3.17 and 3.18, the change in the GE(2) index of the Nargis-affected area is not statistically significant, but the change in the Atkinson (ε= 0.5) index is significant at the 5% level. Therefore, the results of classic inequality measurement confirm that Cyclone Nargis lowered expenditure inequality in the Nargis-affected region, compared with the smaller reduction that would have occurred anyway.[43]

[43] The measurements for panel households are not reported, as the results would be distorted. The reason is that altogether 11 sample villages in two sample townships (nine sample villages in Lapputta and two sample villages in Bogalay sample township) in the Ayeyarwady Region were replaced by villages of comparable status in terms of houses, livelihood and occupation from the same village tract or from nearby villages tracts, due to the severe effects of Cyclone Nargis (IHLCA, 2011c).

Table 3.17 Inequality measurement in Nargis- and non-Nargis-affected areas in Myanmar between 2004/05 and 2009/10 (1)

Measure of Inequality	'04-'05	'09-'10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Gini Coefficient (Total Population)	0.256	0.220	**-0.036*** **		**-14**
	(0.010)	(0.007)	**[0.012]**	**0.003**	
Gini Coefficient (All non-Nargis)	0.231	0.209	**-0.022*** **		**-10**
	(0.007)	(0.005)	**[0.008]**	**0.007**	
Gini Coefficient (non-Nargis Hills)	0.253	0.209	**-0.044*** **		**-18**
	(0.010)	(0.008)	**[0.013]**	**0.000**	
Gini Coefficient (non-Nargis Dry Zone)	0.230	0.208	**-0.023***		**-10**
	(0.010)	(0.008)	**[0.013]**	**0.069**	
Gini Coefficient (non-Nargis Coastal)	0.215	0.212	**-0.004**		**-2**
	(0.006)	(0.009)	**[0.011]**	**0.725**	
Gini Coefficient (Nargis)	0.292	0.250	**-0.042**		**-14**
	(0.023)	(0.021)	**[0.029]**	**0.154**	
GE(1), Theil's T (Total Population)	0.140	0.097	**-0.044*** **		**-31**
	(0.014)	(0.009)	**[0.016]**	**0.008**	
GE(1), Theil's T (All non-Nargis)	0.100	0.088	**-0.013**		**-13**
	(0.006)	(0.007)	**[0.009]**	**0.163**	
GE(1), Theil's T (non-Nargis HIlls)	0.117	0.076	**-0.041*** **		**-35**
	(0.009)	(0.004)	**[0.010]**	**0.000**	
GE(1), Theil's T (non-Nargis Dry Zone)	0.103	0.093	**-0.010**		**-10**
	(0.009)	(0.012)	**[0.014]**	**0.479**	
GE(1), Theil's T (non-Nargis Coastal)	0.081	0.084	**0.002**		**3**
	(0.007)	(0.014)	**[0.015]**	**0.871**	
GE(1), Theil's T (Nargis)	0.205	0.118	**-0.087***		**-42**
	(0.046)	(0.009)	**[0.046]**	**0.058**	
GE(0), Theil's L (Mean Log Deviation) (Total Population)	0.111	0.081	**-0.029*** **		**-27**
	(0.008)	(0.006)	**[0.010]**	**0.002**	
GE(0), Theil's L (All non-Nargis) (Mean Log Deviation)	0.088	0.073	**-0.015*** **		**-17**
	(0.003)	(0.003)	**[0.004]**	**0.000**	
GE(0), Theil's L (non-Nargis HIlls)	0.106	0.071	**-0.035*** **		**-33**
	(0.005)	(0.003)	**[0.006]**	**0.000**	
GE(0), Theil's L (non-Nargis Dry Zone)	0.088	0.074	**-0.014****		**-16**
	(0.004)	(0.005)	**[0.006]**	**0.023**	
GE(0), Theil's L (non-Nargis Coastal)	0.076	0.074	**-0.002**		**-3**
	(0.004)	(0.007)	**[0.008]**	**0.806**	
GE(0), Theil's L (Nargis) (Mean Log Deviation)	0.145	0.102	**-0.044*** **		**-30**
	(0.016)	(0.005)	**[0.017]**	**0.008**	
GE(2) (Total Population)	0.395	0.174	**-0.221**		**-56**
	(0.173)	(0.035)	**[0.174]**	**0.202**	
GE(2) (All non-Nargis)	0.147	0.171	**0.023**		**16**
	(0.022)	(0.044)	**[0.048]**	**0.622**	
GE(2) (non-Nargis Hills)	0.171	0.097	**-0.074****		**-43**
	[0.034]	[0.011]	**[0.035]**	**0.032**	
GE(2) (non-Nargis Dry Zone)	0.159	0.213	**0.054**		**34**
	[0.035]	[0.071]	**[0.077]**	**0.485**	
GE(2) (non-Nargis Coastal)	0.102	0.120	**0.017**		**17**
	[0.018]	[0.039]	**[0.042]**	**0.675**	
GE(2) (Nargis)	0.794	0.174	**-0.620**		**-78**
	(0.483)	(0.031)	**[0.480]**	**0.197**	
No. of Sample HHs ((Total Population))	**18,634**	**18,609**			
No. of Sample HHs (All Nargis)	**2,673**	**2,660**			
No. of Sample HHs (non-Nargis)	**15,961**	**15,949**			
No. of Sample HHs (non-Nargis Hills)	**4,027**	**4,020**			
No. of Sample HHs (non-Nargis Dry Zone)	**8,419**	**8,426**			
No. of Sample HHs (non-Nargis Coastal)	**2,735**	**2,730**			

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).

2) Linearized Standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses. Standard errors for the Gini coefficients are based on the Stata code of Jenkins (2008), which uses the method of Kovacevic and Binder (1997). Standard errors for GE indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).
3) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 3.18 Inequality measurement in Nargis- and non-Nargis-affected areas in Myanmar between 2004/05 and 2009/10 (2)

Measure of Inequality	'04-'05	'09-'10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Atkinson (ε= *0.5*) (Total Population)	0.059	0.043	**-0.016*** **		**-27**
	(0.005)	(0.003)	**[0.006]**	**0.003**	
Atkinson (ε= *0.5*) (All non-Nargis)	0.046	0.039	**-0.007** **		**-15**
	(0.002)	(0.002)	**[0.003]**	**0.011**	
Atkinson (ε= *0.5*) (non-Nargis HIlls)	0.054	0.036	**-0.018*** **		**-33**
	(0.003)	(0.002)	**[0.003]**	**0.000**	
Atkinson (ε= *0.5*) (non-Nargis Dry Zone)	0.046	0.039	**-0.007**		**-14**
	(0.003)	(0.003)	**[0.004]**	**0.125**	
Atkinson (ε= *0.5*) (non-Nargis Coastal)	0.038	0.038	**0.000**		**0**
	(0.003)	(0.005)	**[0.005]**	**0.980**	
Atkinson (ε= *0.5*) (Nargis)	0.079	0.053	**-0.026** **		**-33**
	(0.011)	(0.003)	**[0.012]**	**0.022**	
Atkinson (ε= *1.0*) (Total Population)	0.105	0.078	**-0.027*** **		**-25**
	(0.007)	(0.005)	**[0.009]**	**0.002**	
Atkinson (ε= *1.0*) (All non-Nargis)	0.085	0.071	**-0.014*** **		**-16**
	(0.003)	(0.003)	**[0.004]**	**0.000**	
Atkinson (ε= *1.0*) (non-Nargis HIlls)	0.101	0.068	**-0.032*** **		**-32**
	(0.005)	(0.003)	**[0.005]**	**0.000**	
Atkinson (ε= *1.0*) (non-Nargis Dry Zone)	0.084	0.071	**-0.013** **		**-16**
	(0.004)	(0.004)	**[0.006]**	**0.023**	
Atkinson (ε= *1.0*) (non-Nargis Coastal)	0.073	0.071	**-0.002**		**-2**
	(0.004)	(0.007)	**[0.007]**	**0.806**	
Atkinson (ε= *1.0*) (Nargis)	0.135	0.097	**-0.039*** **		**-29**
	(0.014)	(0.005)	**[0.014]**	**0.007**	
Atkinson (ε= *2.0*) (Total Population)	0.179	0.137	**-0.042*** **		**-23**
	(0.011)	(0.008)	**[0.013]**	**0.001**	
Atkinson (ε= *2.0*) (All non-Nargis)	0.151	0.126	**-0.025*** **		**-16**
	(0.003)	(0.003)	**[0.005]**	**0.000**	
Atkinson (ε= *2.0*) (non-Nargis HIlls)	0.183	0.126	**-0.057*** **		**-31**
	(0.006)	(0.004)	**[0.007]**	**0.000**	
Atkinson (ε= *2.0*) (non-Nargis Dry Zone)	0.148	0.125	**-0.023*** **		**-16**
	(0.005)	(0.005)	**[0.007]**	**0.001**	
Atkinson (ε= *2.0*) (non-Nargis Coastal)	0.135	0.128	**-0.007*** **		**-5**
	(0.006)	(0.008)	**[0.009]**	**0.470**	
Atkinson (ε= *2.0*) (Nargis)	0.222	0.166	**-0.055*** **		**-25**
	(0.015)	(0.007)	**[0.016]**	**0.000**	
No. of Sample HHs ((Total Population))	**18,634**	**18,609**			
No. of Sample HHs (All Nargis)	**2,673**	**2,660**			
No. of Sample HHs (non-Nargis)	**15,961**	**15,949**			
No. of Sample HHs (non-Nargis Hills)	**4,027**	**4,020**			
No. of Sample HHs (non-Nargis Dry Zone)	**8,419**	**8,426**			
No. of Sample HHs (non-Nargis Coastal)	**2,735**	**2,730**			

Source: Author's estimations

Notes:

1) See notes to Table 3.17 on the meaning of weights, round and square parentheses, z-statistics, and ***, ** and*.
2) Standard errors for Atkinson inequality indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).

Of course, the reduction in consumption expenditure inequality in the Nargis-affected area is not a socially desirable outcome if welfare levels decreased (or poverty increased) as a result of the cyclone. Based on the largest historical database (the World Top Income Database), Piketty (2014) claims that the reduction of inequality has only happened after big shocks such as world wars. Piketty (2014) concludes that "the history of the distribution of wealth has always been deeply political, and it cannot be reduced to purely economic mechanisms. In particular, the reduction of inequality that took place in most developed countries between 1910 and 1950 was above all a consequence of war and of policies adopted to cope with the shocks of war" (p.20). Similarly, the economic shock of Cyclone Nargis, a large scale natural disaster that destroyed a great deal of the wealth of rich people, producing a reduction in spending at the top of the distribution in the Nargis-affect area. Thus, Piketty's observation appears true for the case of Myanmar. On the other hand, the poverty incidences in the Ayeyarwady and Yangon regions, in the Nargis-affected areas, increased from 29.3 and 15.1 to 32.2 and 16.1, respectively, while poverty incidence declined substantially in other parts of Myanmar, in the non-Nargis-affected areas, according to the poverty profile reported by IDEA and IHLCA (2007a). Therefore, the decline in consumption expenditure inequality in the Nargis-affected area is not a socially desirable outcome since poverty increased in the Nargis-affected area as a result of the cyclone.

3.4 Conclusions

This chapter has provided some basic information on expenditure inequality for Myanmar as a whole, as well as rural and urban areas, over the period 2004/05 and 2009/10. It provides a baseline for critical changes that may occur after installation of a new civilian government in 2011. The study of expenditure inequality confirms that inequality measured by the consumption expenditure per adult equivalent, using a number of methods, declined between 2004/05 and 2009/10. The nationwide Gini coefficient for expenditure per adult equivalent decreased from 0.256 to 0.220 over time. Nationally, the declines in the Gini coefficient, the Theil index, the MLD, and Atkinson indices, were each statistically significant. The same trend was found for urban and rural areas, but the changes in the Gini coefficient were more prominent in rural areas. The GE and the Atkinson indices for Myanmar reveal that changes mainly occurred at the bottom part of the expenditure distribution.

Moreover, the Lorenz curves for real expenditures of the two surveys do not cross; thus the distributions are unambiguously ranked. Interestingly, it is found that the curves of the Pen's parades, a welfare indicator, cross for all households and panel households near the top end. This finding highlights the fact that the decline in real expenditure per adult equivalent at the top part of expenditure distribution in 2009/10 led to a decrease in expenditure inequality at the union level.

In addition, for a comparison of inequality indices over the study years, the standard errors (SEs) of differences are calculated both with and without taking into account covariance terms when calculating inequality indices, by using consumption aggregates of all households in 2004/05 and 2009/10 surveys. This study finds that the SEs reported based on the standard normal test statistic without consideration of covariance terms are slightly higher than the SEs reported by taking account of covariance parts. However, statistical significances are similar for almost all inequality indices reported in 2004/05 and 2009/10 surveys, as well as the SEs of the differences of two values of inequality indices, calculated both with and without taking into account covariance terms.

Furthermore, the findings of this research are robust, as a comparison of the asymptotic and bootstrap standard errors of each year for panel households indicates that they give similar Gini coefficients, GE indices and Atkinson indices, in line with the study of Clarke and Roy (2012). However, the bootstrapping of the differences of inequality indices between 2004/05 and 2009/10 show stronger significant results, compared with the results reported by asymptotic SEs based on the standard normal test statistic. The reason could be due to the resampling procedure of bootstrapping, which automatically takes into account the covariance structure (Biewen, 2002), even though the linearization approach based on the standard normal test statistic for dependent samples also removes the correlation between panel households. Horowitz (2001) argues that bootstrapping asymptotic pivotal statistics provides a powerful test (the 'bootstrap t method'). However, this approach is not further employed in this research due to the complexity of the IHLCA survey design. This issue may be investigated further in my future research.

The analyses using the growth incidence curve show that the percentage changes in real expenditures per adult equivalent declined for those in the top part of the expenditure distribution, while expenditure rose for those who were poor, for all households inclusively, rural and urban households between 2004/05 and 2009/10. The absolute

changes in real expenditures per adult equivalent of union of all households, as well as rural and urban households separately, between 2004/05 and 2009/10 also show that the larger drops of real expenditures per adult equivalent are found among higher centile groups, from the 91 to 100 centiles. In terms of relative and absolute inequality shown by the growth incidence curves, the impact of Cyclone Nargis was that expenditure inequality declined, especially in the top part of the expenditure distribution in the Nargis-affected region, compared with the smaller reduction that would have occurred anyway, as in the non-Nargis-regions.

The Gini coefficient, the GE indices and the Atkinson indices also confirm that Cyclone Nargis lowered expenditure inequality in the affected region, compared with the smaller reduction that would have occurred anyway. In terms of percentage changes, the larger changes are found in the GE (1), the GE(2), and the Atkinson ($\boldsymbol{\varepsilon}$= 0.5) indices of Nargis-affected area, indicating that the reduction in expenditure inequality among higher income groups was more intense. Therefore, Cyclone Nargis contributed to the decline in real expenditures per adult equivalent that occurred in the Nargis-affected area between 2004/05 and 2009/10, and also contributed to the observed decline in national inequality. Of course, the reduction in consumption expenditure inequality in the Nargis-affected area is not a socially desirable outcome as the poverty incidences in Ayeyarwady and Yangon regions increased while at the same time the poverty incidence declined substantially in those other parts of Myanmar which were non-Nargis-affected areas.

This chapter only focuses on expenditure inequality, because this is the only data available. The analysis supplements and extends the earlier study of consumption expenditures used by the IHLCA team. Inequality research in Myanmar could be further improved by jointly analysing income and expenditure, to better assess the welfare of households or individuals (for example, Attanasio, Battistin & Padula, 2010; Stiglitz et al., 2010; Fisher et al., 2012) when income data is available. In addition, according to the revised study of the World Bank (2014) based on the IHLCA 2009/10 survey, when the total consumption expenditures of each household are adjusted by the spatial cost of living, measured inequality increases inequality. Unfortunately, the methodology was not applied in the IHLCA 2004/05 survey.

Chapter 4

Decomposition of inequality analyses by rural and urban areas, states and regions, and population groups, 2004/05 and 2009/10

4.1 Introduction

Income (expenditure) of households varies substantially from urban to rural areas, and from one location to another. Several studies conducted in developing countries and/or transitional economies show that regional and spatial inequality of consumption, income and ownership of business and home assets, and other social indicators have increased (Kanbur & Venables, 2003; McKay & Aryeetey, 2007; World Bank, 2009). With regard to Myanmar, very few studies measure the relative contribution of rural and urban areas, inter-state/regional and intra-state/regional inequalities to overall inequalities[44]. Intra-state/regional disparities (within-group inequality) refer to an expression of heterogeneity that already exists in rural and urban areas, and in different states and regions. Inter-state/regional inequalities (between-group inequality) measure the differences in mean incomes (expenditures) across rural and urban areas, and in different states and regions. Disparities between rural and urban areas, and between states and regions have recently attracted much attention since the new civilian government came into power. This is due to a consistent demand for a democratic and federal union especially from ethnic armed groups, because of "alleged discrimination towards ethnic community and disempowerment of ethnic states" (Smith, 2007, p.189).

Decades of conflicts between armed groups and the government of Myanmar have occurred based around the control of natural resources, which are abundant in most states, especially in rural areas (South, 2012). There is a persistent argument, especially from people residing in resource-rich states, that they do not receive equal redistributions of their country's resources. It is likely that the distribution of income (expenditure) between rural and urban areas, and between states and regions will be of interest to people when

[44] OECD (2013b) reports the decomposition of Gini coefficient for the 2009/10 data set of IHCLA.

the new Myanmar civilian government is fully functioning. However, there is limited knowledge on even the magnitude of inequality across states and regions as well as rural and urban areas. Therefore, it is important to study the contributions to national inequality of the level of, and changes in, inequality of rural and urban areas, as well as in different states and regions, to identify where and what to focus on, in order to reduce the disparities. In addition, as described in Chapter 3, Cyclone Nargis in 2008 badly damaged the Delta regions. Thus, it is also crucial to learn how natural disasters affect the contributions of between-group and within-group inequalities of Nargis- and non-Nargis-affected areas to national inequality, for a robustness check of previous analyses.

Knowledge of the pattern of spatial inequalities in expenditures is valuable for geographic targeting, to control for the likely occurrence of huge gaps in expenditures of people living in different regions. Therefore, this chapter also focuses on the spatial aspects of expenditure inequality in Myanmar in the sense that we analyse the levels of, and changes in, rural and urban, intra-state/regional, and inter-state/regional inequalities in 2004/05 and 2009/10, using the IHLCA surveys. Furthermore, this study examines whether the impacts of Cyclone Nargis in 2008 contributed to (or even caused) the decline in measured inequality between 2004/05 and 2009/10. The 2-year data sets, collected for 2004/05 and 2009/10 by the Ministry of National Planning and Economic Development and UNDP Myanmar, also enable us to investigate the changes in consumption expenditure inequality over the period. In addition, this study also reports the statistical precision of differences of inequality indices in states/regions over the study years, following the basic theory of estimation for repeated surveys used in the previous chapter.

Shorrocks (1982) states that "it has also become increasingly common to decompose aggregate inequality value into the relevant component contributions" (p.193). Thus, this kind of analysis has been applied based on the interests of researchers, for example, the influence of population groups, such as those defined by ethnic groups, employment, occupation, industries and land ownership. Shorrocks (1982) also argues that "disaggregating inequality by population groups raises questions concerning the appropriate decomposition rule and the constraints placed on the choice of inequality measures" (p.193). For this study, the Generalized Entropy (GE) class of inequality measures is used, which can be additively decomposed into between-group and within-group components. The Generalized Entropy with different aversion parameters is employed to capture the disparities in different parts of the expenditure distributions, and

to check for the robustness of the estimates of various measures in the decomposition exercise. Following Bourguignon (1979) and Mookherjee and Shorrocks (1982), this research investigates the contributions of between-group and within-group expenditure inequalities to total inequality. Several empirical studies on the classic inequality decomposition find little evidence of significant between-group differences. However, Elbers, Lanjouw, Mistiaen, Özler and Simler (2005) argue that a high contribution of within-group inequality to total inequality does not definitely imply that there are no disparities in between-group differences at all or that all communities in a given country are as unequal as the country as a whole. Thus, the approach of Elbers, Lanjouw, Mistiaen, and Özler (2008)—hereafter referred to as ELMO (2008)—is also applied to explore the maximum plausible levels of, and changes in, between-group inequalities.

This research highlights expenditure differences among certain population groups by conducting a geographic decomposition of consumption expenditure by rural and urban areas, states and regions, and Nargis- and non-Nargis-affected areas. The goal is to determine the pattern of spatial disparity in inequality for the geographic targeting of resources with the following research questions:

- What is the level of inequality within and between rural and urban areas, different states and regions, Nargis- and non-Nargis-affected areas, and different population groups?
- How did the contribution of within-group and between-group expenditure inequalities to the total expenditure inequality change between 2004/05 and 2009/10?

This chapter aims at making three contributions. One is to decompose Myanmar's national inequalities along various dimensions. In terms of level of inequality, the contribution of within-group inequality of rural and urban areas to total inequality in Myanmar is much larger compared with the contribution of between-group inequality of rural and urban areas to total inequality in all GE indices. The contribution of between-group inequality of rural and urban areas to total inequality in Myanmar decreased over the study years, while that of within-group inequality to total inequality correspondingly increased. A similar trend is found for the between-group inequality and within-group inequality of states and regions. In addition, this study explores the 'maximum possible' between-group contributions of rural and urban areas, and states and regions to the total

expenditure inequality. The results indicate that there is very little overlap among individuals in states and regions, but some overlap in the distribution of per adult equivalent household expenditures in rural and urban areas. Therefore, the results confirm that a substantial part of expenditure inequality in Myanmar is not spatial.

The findings of this research also show that there are significant differences in household expenditures among the population groups. However, despite these differences, the between-group inequality accounts only for a small component of the overall inequality in all groups. In addition, the results of the analyses of 'maximum possible' between-group contributions of population groups reveal similar findings as for states and regions. The highest expenditure inequalities of household heads were found in those who were employers in 2004/05 and 2009/10, even though the population shares of own account workers were highest among other employment types, both with or without the inclusion of household heads who did not participate in the labour force. In addition, household heads who were working in electricity, gas, water supply, transport, storage and communications in 2004/05, and those who were employers working in private sector in 2009/10, had the highest expenditure inequalities. The results also show that all GE indices of white collar jobs (such as legislators, senior officials and managers) were highest while the GE indices of low-skilled occupations (for example, sales and services elementary occupations, agricultural and fishery and related labourers) were the lowest among the main types of occupations in both surveyed periods. Overall, the agriculture, hunting and forestry industry is by far the biggest employer, accounting for half of total employment, and the relative size of agriculture has remained unchanged since 2004/05. However, expenditure inequalities do not vary between land owners and landless in all GE indices, even though percentages of landless people were about 31% in 2004/05 and 24% in 2009/10. For ethnicity differences, household heads who spoke the Chinese language (among 12 main languages) had the highest GE indices in both study years, despite their share of the population being only 1%.

Additionally, on the empirical side, this study conducts hypothesis tests for $D=0$[45] for the differences in GE measures (that is the Theil's entropy) of inequality between the two surveyed years. The main finding of this research is that in terms of changes over the period 2004/05 and 2009/10, both between-group inequality and within-group inequality

[45] See Efron and Tibshirani (1993) for this approach.

of rural and urban areas have decreased significantly, and the same trend applies for states and regions. The changes of the contribution of within-group inequality to total expenditure inequality of rural and urban areas, to differences of total inequality over the study periods, are higher compared with those of between-group inequality. Regarding between-group inequality and within-group inequality of Nargis- and non-Nargis-affected areas, the decline in expenditure inequality of the between-group inequality of Nargis- and non-Nargis-affected areas is significantly greater compared to that of the within-group inequality between the two surveyed years. The results confirm that the decline in national expenditure inequality was affected by Cyclone Nargis, and the changes in within-group inequality were faster in the top part of expenditure distributions, though not significant.

The final contribution of this chapter is finding the magnitude of inequality indices to explain the existing expenditure disparities among households in different states and regions. An alternative indicator of expenditure inequality, the Gini coefficient, suggests that Mon, Rakhine, Bago (West) and Kayin had the lowest inequality indices in consumption expenditures, while the consumption inequality was high in Chin, Yangon and Taninthayi in 2004/05. The lowest Gini coefficients in consumption expenditures were found in Kayah, Sagaing, Kayin, and Chin, while the highest Gini coefficients reported were in Yangon, Mandalay, and Taninthayi in 2009/10. However, the analyses of P90/P10 ratios reveal that Yangon and Taninthayi had the highest inequality in consumption expenditures in both surveyed years. Kayin state was consistently lowest in the ranking of inequality over the period 2004/05 and 2009/10 in terms of the Gini coefficients and the P90/P10 ratios. Furthermore, 16 out of the 17 states and regions (except in Bago (West)) experienced a decrease in consumption inequality measured by the Gini coefficient over the survey periods.

The chapter is presented as follows. Section 2 documents the literature on decomposition analysis and maximum between-group inequalities. Section 3 lays out the methods used for standard inequality decomposition and the ELMO (2008) approach. Section 4 contains the empirical findings, and discusses the results (based on decompositions by rural and urban areas, different states and regions, Nargis- and non-Nargis-affected areas, and population groups), as well as the Gini coefficients per adult equivalent household expenditures for all households by different states and regions. The concluding section 5 provides a summary of the findings and suggests future research possibilities. The Gini

coefficients in rural and urban areas of different states and regions for all households and for panel households, and expenditure inequality indices (GE and Atkinson indices) of different states and regions, are reported in Appendix: 4-A.

4.2 Literature review on inequality decomposition

Inequality decomposition is attractive as an analytical approach and as a tool for providing a policy framework. Investigating the contributions of inequality within- and between-groups/sub-groups of the population to overall inequality is of interest to researchers and policy analysts—it provides insights that can be used for redistributing of resources as equally as possible. For instance, the groups/sub-groups can be within- and between-population groups of rural and urban areas, or within- and between-workers in industrial and agricultural sectors. The structure and dynamics of the groups can be explained by decompositions of inequality measures. This research field was pioneered by Bourguignon (1979), Cowell (1980, 2000), Toyoda (1980), Cowell and Kuga (1981), Blackorby, Donaldson, and Auersperg (1981), Das and Parikh (1982) and Shorrocks (1980, 1982, 1983a, 1983b, 1984). Fields (1980) presents summaries of application for developing countries. Deaton (1997) and Jenkins (1995) provide the methodologies in detail.

Little evidence of noticeable between-group disparities has been found in empirical analyses of inequality decomposition. Lanjouw and Rao (2011) argue that "by comparing group-average income inequality against total inequality, the procedure in effect compares observed group differences against the extreme benchmark where each individual in the data is treated as a separate group. As a result, the proportion of between-group inequality is always rather low, in comparison with the benchmark" (p.174). For example, Anand (1983) and Fishlow (1972) use the class of GE measures extensively when decomposing of overall inequality by population subgroups. The share for Brazil between-region to total inequality is substantially higher, as it goes beyond 50% of overall inequality in 1960 (Fishlow, 1972). However, the share of between-state differences in income inequality for Malaysia is only about 8% and the share of between ethnic groups disparities in Malaysia constitutes 15% of total inequality in 1970 (Anand, 1983).

A number of studies on spatial aspects of income inequality in China during the transition period in the second half of the 1980s, such as the study conducted by Kai-yuen (1998),

use survey data of net income and equivalent consumption of rural households in Guangdong and Sichuan (1985–1990) to decompose overall inequality into its between-region and within-region inequalities. The results reveal that inter-province inequality accounts for 6–12% of rural inequality. However, some studies of earlier time period found significant between-group inequality. Kanbur and Zhang (1999) investigate the decomposition of consumption inequality between rural and urban areas by using the GE class of inequality measures, and conclude that rural-urban inequality contributed to total inequality trended downward from 78% in 1983 to 71% in 1995. The study conducted by Gustafsson and Shi (2002) finds spatial income inequality in rural China in 1995 using household survey data in 18 provinces in 1988 and 1995. The GE(0) (MLD) index (64%) and the Theil index (52%) of the total rural inequality between 1988 and 1995 were attributed to increase inter-county inequality.

In Southeast Asia, Dollar and Glewwe (1998) studied between-group inequality in Vietnam for 1992/93 by using the Theil's T index for rural and urban areas, regions, ethnic groups and occupations, education level, and sex of household heads. The results reveal that the disparity between rural and urban areas accounts for 22%, while the disparity between regions is about 14%. A similar study for Vietnam in 1997/98 by Glewwe, Gragnolati, and Zaman (2002) also highlights the fact that between-group inequality accounts for rural and urban areas about 31%, and for regions, it is about 22% of the total inequality. Kanbur and Zhuang (2012) again study inter-country and intra-country inequality by using the GE(0) (MLD) index in Asia. They confirm that the contribution of inter-country inequality to Asia-wide inequality expands more quickly. The contribution was about 22.6% in the mid-1990s, while in the late 2000s, the contribution increased to 29.6%. The contribution of intra-country inequality to Asia-wide inequality, declined from 77.4% to 70.4% between the mid-1990s and late 2000s.

Elbers, Lanjouw, Mistiaen, Özler, and Simler (2004) also report that the highest share of inequality contributed to mean expenditure differences between communities measured as the GE(0) (MLD) index is discovered in Ecuador at about 41%, followed by Madagascar about 25% and Mozambique at 22%. The within-community inequality mostly contributes to overall inequality in all three countries when the 'community' stands for the administrative unit of the lowest level of central government. The decomposition of Annim, Mariwah and Sebu (2012) for the Theil's T index of inequality shows that the share of between-group inequality for the rural/urban locations, ecological

zones, districts, and regions is in the range between 11% and 38% in Ghana in 1991/92, 1998/99 and 2005/06.

On standard decomposition[46] analysis[47], Kanbur (2006) argues that spatial units may grow their own identities. The development of spatial units may not be based on ethnicity, race or religion. In addition, Kanbur (2006) contends that the contribution of the between-group inequality is hardly over 15%, and often less than this, according to a number of empirical decomposition analyses. One reason could be that the within-group inequality reported by a standard approach is overestimated while the between-group inequality recorded might be more than the 10-15% figure. Kanbur (2006) suggests that if the contribution of between-group inequality of regions or races to total inequality is small, the policy implementation for the reduction of inequality would be given lower priority to equalizing group means across regional or racial units than the within-group disparities. However, this should not be implemented without a thorough investigation of the structures of inequality, and the impacts and costs of the policy instruments.

Furthermore, Lanjouw and Rao (2011) claim that "standard measures have the mathematical property that between-group inequality will increase (or more precisely—never decrease) with a greater number of groups" (p.174). As a remedy, the ELMO (2008) statistic suggests to replace total inequality in the denominator of the standard formula with the maximum between-group inequality. They decompose total South African income inequality by racial groups (classified as 'white/non-white') by using the standard decomposition technique. They find that between-racial group inequality contributes only about 27% to total inequality. However, between-racial group inequality contributes about 80% when using their ELMO statistic. Lanjouw and Rao (2011) also use the ELMO (2008) statistic to compare this with the conventional inequality decomposition measures to explore the differences of caste inequality in two Indian villages over several decades. They find that "the ELMO statistic is better able to capture persistent inequalities where

[46] The standard decomposition of between-group inequality is the ratio of between-group inequality to total inequality, and the effect of the number of groups and relative sizes of the groups are not considered (ELMO, 2008).

[47] The terms: standard decomposition analysis, the conventional between-group inequality measure, the classic between-group inequality measure, and the classic inequality decomposition approach are used interchangeably in this research and they refer to the standard calculation of the between-group inequality.

they are more 'salient'[48] than standard measures, but is no different from standard measures when group-based inequality is not 'salient'" (Lanjouw & Rao, 2011, p.175).

The ELMO (2008) statistic is replicated in various empirical studies including the decomposition of spatial inequality between rural versus urban areas, and among provinces. For example, ADB (2007) states that the share of maximum between-group inequality is as high as 63.5%, 53.2% and 22.6% (for GE(0), GE(1) and GE(2) respectively) for rural/urban locations in India. Epprecht, Minot, Dewina, Messerli, and Heinimann (2008) calculate the maximum attainable between-group inequality following the approach of Elbers, Lanjouw, Mistiaen, Özler and Simler (2005). The study confirms that the alternative between-group measure is always larger than the standard between-group measure for the various sub-populations of rural and urban areas or lowland, midland and highland Lao ethnic groups. The share of maximum possible between-group inequality of the rural-urban decomposition is pronounced at 57%, while the share of between-group inequality of the conventional assessment is at 19%, provided that the number of sub-groups is only two. Epprecht et al. (2008) argue that the results are not surprising, because of the noticeable disparity between high inequalities among the smaller urban population when compared with low inequalities among the larger rural population. However, the alternative benchmark, termed 'maximum between-group inequality', among 17 provinces accounts for 22% while the between-component of inequality of the standard approach only amounts to 11% in Laos. Epprecht et al. (2008) contend that "this is possibly due to the smaller relative differences in mean per capita expenditure, to the relative difference in sub-group sizes, and the inverse relationship between the size of the sub-groups and the respective inequality levels" (p.43).

In addition, Agostini, Brown, and Roman (2010) apply Pyatt's (1976) Gini decomposition method and use the ELMO (2008) statistic to compare the maximum between-group inequality with the between-group inequality of the classic decomposition approach using household incomes in 2003 census data among ethnic groups in Chile. Given the relative sizes of the ethnic groups, the level of maximum between-group inequality accounts for 41% between indigenous and non-indigenous groups. The authors report that when all indigenous groups are decomposed separately, the between-group inequality explains a larger share of total inequality. Their result highlights the existence of substantial

[48] The term used in the ELMO (2008). The *salient* points or facts of a situation are the most important ones. (http://www.collinsdictionary.com/dictionary/english)

inequality among Chile's ethnic groups. Bibi and Lahga (2011) also study the decomposition of inequality using the ELMO (2008) alternative measure based on total household expenditure per capita for six Arab countries. They find that between-group inequality could attain (for some breakdowns) more than 50% of the 'maximum possible' between-group inequality. In addition, rural disparity is an important contributor to the 'maximum possible' between-group inequality in Tunisia and Morocco, but not in Yemen, Syria and Jordan. The more recently available surveys in Tunisia and Morocco show that the ratio of between-group inequality to its 'maximum possible' is significantly higher. They argue that this result may be explained by the concentration of the poor in rural areas, and by their lower living standard with regard to their urban counterparts.

Furthermore, Levine and Roberts (2013) decompose the generalised entropy indices between rural and urban zones, and among administrative regions, by using the two waves of the official Namibia Household Income and Expenditure Survey in 1993/1994 and 2003/2004. The share of maximum between-group expenditure inequality measured by the ELMO (2008) is more than one third higher than the share of between-group inequality calculated by the standard between-group measure. However, there has been no notable change in inequality among regions between the two measures in Namibia.

For Myanmar, OECD (2013b) reports studies of between-group inequality and within-group inequality in rural and urban areas based on the decomposition of the Gini coefficient. They find that 28% of total inequality is explained by between-group inequality, while about half of the total inequality is explained by within-group inequality of households in rural and urban areas. The levels of inequality are different among states and regions, ranging from 0.3 in Mon to 0.51 in Chin (as measured by the Gini coefficient). However, those results surprisingly ignore the inequality in business cities such as Yangon.

4.3 Methods

4.3.1 Decomposition of inequality

Haughton and Khandker (2009) highlight the fact that the inequality can be decomposed, —that is by various subgroups and characteristics of the population, by employment sectors, and by regions. For example, mean consumption expenditures (or incomes) may be different across groups, and it is crucial to examine the extent to which overall

inequality is attributable to inequality 'between-group'. In addition, consumption expenditures (or incomes) vary inside each group, and it is essential to understand the extent to which it is attributable to the inequality 'within-group'. The generalized entropy (GE) class of inequality measures, including the Theil indexes, can be additively decomposed across these partitions, but the Gini index cannot (Cowell, 1980; Champernowne & Cowell, 1998). Bourguignon (1979) proves that "the only zero-homogeneous 'income-weighted' decomposable measure is Theil's coefficient (T) and that the only zero-homogeneous 'population-weighted' decomposable measure is the logarithm of the arithmetic mean over the geometric mean (L)" (p.901). Shorrocks (1980) also demonstrates that the GE class with weighting parameters 0 and 1 (the mean log deviation and the Theil'sT index of Theil's measures of inequality) of inequality measures is an additively decomposable inequality measure.

A number of scholars attempt to decompose the Gini index, but Litchfield (1999) points out that the component terms of total inequality are not always intuitively meaningful or mathematically attractive (for example, Fei, Ranis & Kuo, 1978). Lerman and Yitzhaki (1985) show that decomposing the Gini index by sources yields three components: the product of the source's own Gini, its share of total income, and its correlation with the rank of total income. However, Sastre and Trannoy (2002) claim that although some interesting interpretations of the nature of inequality among population subgroups have been proposed it is not certain whether they provide a definite answer to the problem of decomposing inequality by sources. Yitzhaki and Lerman (1991) also attempt a decomposition of the Gini with a more intuitive residual term.

For the decomposition of Atkinson inequality indices, Das and Parikh (1981) suggest two procedures. They are the disaggregation of inequality by different income components and population sub-groups derived by the Atkinson-Sen-Kolm index. Instead of using subgroup means for calculating between-group inequality as in the conventional decomposition, Blackorby et al. (1981) suggest to use "subgroup equally-distributed-equivalent incomes as primitives rather than subgroup means" (p.684) for the decomposition of Atkinson and the Kolm-Pollak indices based on a welfare theory approach. The authors applied their approach to measure wage and salary inequality between males and females in Canada and its provinces. They argue the advantages of their approach as "first, it treats pairs of individuals in the same way, whether or not they belong to the same subgroup. Second, it measures the economic performance of each

subgroup in a way which is consistent with the social-evaluation function for that subgroup" (p.684). They also claim that their procedure correctly measures the contribution of between-group inequality to total inequality.

Decomposition of the Generalized Entropy class of inequality indices

The decomposition of inequality measures was introduced by Bourguignon (1979), Cowell (1980), and Shorrocks (1980, 1982, 1983b, 1984). The GE class of inequality measures can be additively decomposed into between-group and within-group components as follows (Bourguignon, 1979; Mookherjee & Shorrocks, 1982):

$$GE(\alpha) = GE_W(\alpha) + GE_B(\alpha)\ , \tag{4.1}$$

$$I_c = \sum_j v_j\,(\lambda_j)^c I_c^j + \frac{1}{c(c-1)}\sum_j v_j[(\lambda_j)^c - 1] \quad c \neq 0, 1 \quad , \tag{4.2}$$

$$I_0 = \sum_j v_j\, I_0^j + \sum_j v_j \log\left(\frac{1}{\lambda_j}\right) \quad , \tag{4.3}$$

$$I_1 = \sum_j v_j\, \lambda_j\, I_1^j + \sum_j v_j\, \lambda_j\, \log \lambda_j \ . \tag{4.4}$$

Mookherjee and Shorrocks (1982) define these decompositions as follows: "the first term in these equations (the 'within-group component') is a simple weighted sum of the subgroups' inequality values. The second term is the 'between-group component', reflecting the inequality contribution due solely to differences in the subgroup means" (pp.889-890).

In Equations (4.2-4.4), I_c is a GE inequality index for the general formula, and I_0 is GE(0) and I_1 is GE(1). $v_j = N_j/N$ is the number of individuals in subgroup j divided by the total number of individuals or households in the sample (the population share of group j), and λ_j is group j's mean income (expenditure) relative to the population mean income (expenditure) (the income (expenditure) share of group j). Jenkins (2008) explains that "the $GE_j(\alpha)$ inequality for subgroup j, is calculated as if the subgroup were a separate population, and $GE_B(\alpha)$) is derived assuming every person within a given subgroup j received j's mean income, m_j".

However, Bellù and Liberati (2006b) stress that "even though members of the GE class with $\alpha>1$ are perfectly decomposable, weights do not sum up to 1. The best candidates

for decomposability are the Theil Index and the mean logarithmic deviation, obtained by setting α=1 and α=0, respectively. They combine perfect decomposability with a nice structure of weights" (p. 16).

4.3.2 Maximum between-group inequality

The standard method decomposes overall income (expenditure) inequality into its components by employing measures that can divide inequality into between-group (differences in average income (expenditure) across population subgroups), and within-group (differences within those subgroups). However, several empirical studies on classic inequality decomposition find little documentation of noticeable between-group differences. For example, Anand (1983) concludes that between-group inequality among ethnic people in Malaysia contributed only 15% to total inequality in the early 1970s.

ELMO (2008) argues that the level of "between-group inequality depends on three factors: differences among groups in mean incomes, the number of the groups considered and their relative sizes" (p. 232). Various empirical studies confirm that when the number of sub-groups increases, the between-group inequality becomes larger (Cheng, 1996; Elbers, Lanjouw, Mistiaen, & Özler, 2005; Shorrocks & Wan, 2005). In addition, Lanjouw and Rao (2011) contend that "between-group inequality in the ELMO measure does not necessarily increase with an increase in the number of groups" (p.175). ELMO (2008) also argues that "between-group inequality would equal total inequality under only two unlikely scenarios: (i) if each household itself constituted a group, or (ii) if there were fewer groups than households, but somehow all the households within each of these groups happened to have identical per capita incomes" (p.235).

In addition, ELMO (2008) indicates that the proportion of between-group inequality in conventional decomposition procedures is measured by the ratio of observed between-group inequality to total inequality. For the standard inequality measure *I*, between-group inequality can be summarized as follows:

$$R_B(\Pi) = \frac{I_B\,(\Pi)}{I} \quad . \tag{4.5}$$

ELMO (2008) defines R_B (Π) as "the share of inequality explained by between-group differences[49]. For any characteristics *x* and *y*, $R_B(\Pi_x \& y) \geq R_B(\Pi_x)$ and $R_B(\Pi_x \& y) \geq RB(\Pi_y)$. This means that moving from any partition (Π) to a finer sub-partition, the share of between-group inequality cannot decrease" (p.235).

ELMO (2008) also contends that the conventional decomposition procedure is entirely silent on "whether the richest person of the poorer group is poorer than the poorest person in the richer group" (p.175). They also ask whether conventional decomposition partitions the income distribution into non-overlapping intervals. To overcome this limit, they suggest the adaptation of a minor change in the standard procedure, to provide an alternative statistic of the between components (that is the ELMO (2008) statistic). ELMO (2008) argues that "such a modification can provide a complementary perspective on the question of whether a particular population breakdown is salient to an assessment of inequality in a country" (p. 244).

ELMO (2008) proposes "to compare actual observed between-group inequality against a counterfactual between-group inequality constructed from the same data, using the same number of groups and relative sizes, but where households in the income distribution are reassigned to the population groups in such a manner so as to maximize between-group inequality" (p.235). The index that they propose is given by

$$\hat{R}_B(\Pi) = \frac{I_B(\Pi)}{Max\{I_B|\Pi(j(\mathrm{n}),J)\}} = RB(\Pi)\frac{I_B(\Pi)}{Max\{I_B|\Pi(j(\mathrm{n}),J)\}} \ , \qquad (4.6)$$

"where the denominator is the maximum between-group inequality that could be obtained by reassigning individuals across the *J* sub-groups in partition (Π) of size *j(n)*. Since the counterfactual maximum between-group inequality can never exceed total inequality, it follows that $\hat{R}_B(\Pi)$ cannot be smaller than $R_B(\Pi)$. However, unlike the traditional between-group inequality measure, the alternative measure, does not necessarily increase when a finer partitioning is obtained from the original one" (pp. 235-236). The method of calculating this new measure is relatively simple, and involves replacing total inequality in the denominator of the standard formula with the counterfactual maximum between-group inequality.

[49] This research follows the notation in ELMO (2008).

Calculating maximum between-group inequality

ELMO (2008) points out that incomes of sub-groups should take up non-overlapping intervals. Also, "a necessary condition for between-group inequality to be at its maximum: if $\{y\}$ is an income distribution for which inequality between sub-groups g and h is maximized, then either all incomes in g are higher than all incomes in h, or vice versa. In the case of J sub-groups in a particular partition, the following approach can be followed: take a particular permutation of sub-groups $\{g(1), \ldots, g(J)\}$, allocate the lowest incomes to $g(1)$, then to $g(2)$, etc., and calculate the corresponding between-group inequality. Repeat this for all possible $J!$ permutations of sub-groups. The highest resulting between-group inequality is the maximum sought" (ELMO, 2008, p.236). The ELMO (2008) procedure is explained step by step as follows: Suppose there are two population groups; in rural and urban areas:

1) Calculate the standard between-group inequality term, obtained by the conventional decompositions of the GE indices.
2) All individuals are reclassified in ascending order of per adult household expenditure into groups that are non-overlapping, and preserve the ranking of the original groups.
3) Starting from the bottom of the expenditure distribution, all expenditures are allocated to an artificial 'rural group' based on the size of original rural group, and the remainder are allocated to an artificial 'urban' group based on the size of original urban group.
4) This gives a first estimate of between-group inequality.
5) Starting from the bottom of the expenditure distribution, all expenditures are now allocated to an artificial 'urban' group based on the size of the urban group, and the remainder are allocated to an artificial 'rural group' based on the size of the rural group.
6) This results in a second estimate of between-group inequality.
7) The larger one of the two between-group inequality components is the maximum, and this is then replaced as the denominator in the index proposed above. If instead of two groups there had been 3, a total of six (3!) between-group calculations would have been necessary to decide which is the maximum. In real-life distributions, members of different groups often overlap in their expenditures. Using this index, between-group inequality would be 1 whenever groups did not overlap and would be 0 when they were coincident.

8) The maximum between-group inequality is defined as the highest between-component obtained among all possible *J*! permutations of subgroups.

The authors introduce more structure to the approach proposed and restrict attention to sub-group permutations. Lanjouw and Rao (2011) argue that "in addition to fixing the number of sub-groups and their relative sizes, the sub-groups are arrayed according to their observed mean incomes. The authors called them with preserving their 'pecking order'. The approach is both intuitively appealing and less computationally intensive, involving only a single calculation rather than *J!* calculations" (p. 186). The procedure is as follows:

1) The groups sorted by mean per adult equivalent expenditure are reallocated by the households based on the per adult equivalent household expenditure values in such a way that
    a. all the lowest per adult equivalent household expenditures are assigned to the households of the sub-group with the lowest mean per adult equivalent expenditure,
    b. the next lowest per adult equivalent household expenditures are assigned to the households of the sub-group with the second lowest mean per adult equivalent expenditure, and so forth.
2) then, the highest per adult equivalent household expenditures are assigned to the households of the sub-group with the highest mean per adult equivalent expenditure. The size, the number and the relative ranking of mean expenditure of the population sub-groups, along with the overall expenditure distribution, stays the same. The main intention is to redistribute the expenditures of the total population among the sub-groups as unequal as possible.
3) Using this data set with the redistributed household per adult equivalent household expenditure, the maximum between-group inequality is calculated. It is obtained given the current overall expenditure distribution, the numbers and relative sizes of the groups, and the original 'pecking order'.

ELMO (2008) affirms that their approaches are not an alternative to the standard approach, but a complement. The maximum between-group inequality possible is always less than (or equal to) that over *J!* permutations when the 'pecking order' of groups is kept fixed. Consequently, the value of maximum between-group inequality can be

different under these two methods: (1) repeating for all possible *J!* permutations of sub-groups given the current income distribution and (2) "fixing the number of sub-groups and their relative sizes, the sub-groups are arranged according to their observed mean incomes—preserving their 'pecking order'" (p.237).

4.4 Results and Discussions

The findings of between-group and within-group inequalities of rural and urban areas, states and regions, and Nargis-affected and non-Nargis-affected areas, are reported below in detail. As explained above, between-group inequality is based on the analysis of differences in the subgroup means of consumption expenditures of rural and urban areas, states and regions, and Nargis-affected area and non-Nargis-affected areas. Within-group inequality is a calculation on the weighted sum of the inequality values of the subgroups.

4.4.1 Between-group and within-group inequalities of rural and urban areas

The decomposition of inequality by geographic subgroups allows a useful illustration of patterns that can be a first step in identifying the proximate reasons of inequality. Table 4.1 can be seen the importance of between-group and within-group components of total inequality in terms of the Generalized Entropy indices, with sensitivities 0, 1 and 2. In terms of changes between 2004/05 and 2009/10, between-group inequality of rural and urban areas decreased about one-third, and the decrease is statistically significant at the 1% level for all GE inequality indices. Within-group inequality of rural and urban areas declined between 2004/05 and 2009/10, by about 26%, 31% and 57% as measured by the MLD GE(0), the Theil index GE(1) and GE(2), respectively, and the changes are statistically significant at the 5% level in GE(1) and GE(0) indices.

In terms of level of inequality, as shown in Table 4.2, between-group inequality of rural and urban areas stood at 12% and 10% and 4% of total inequality, as measured by the MLD, the Theil index and the GE(2) respectively, in the year 2004/05. However, the corresponding contribution to total inequality slightly decreased to 11% for the MLD, and remained the same for the Theil Index, but increased to 6 % for the GE(2) in 2009/10. Within-group inequality of rural and urban areas stayed at 88% and 90% and 96% of total inequality, measured by the MLD, the Theil index and the GE(2) respectively, in the year 2004/05. The corresponding contribution to total inequality slightly increased to 89% for

the MLD and remained the same for the Theil Index, but decreased to 94 % for the GE(2) in 2009/10.

Table 4.1 Between-group and within-group inequalities of rural and urban areas

Measure of Inequality	2004-2005	2009-2010	Difference	P- value	% Δ (2004/05 vs. 2009/10)
Total Inequality					
GE(1), Theil's T	0.140 (0.014)	0.097 (0.009)	**-0.044*** [0.016]**	**0.008**	-31
GE(0), Theil's L (Mean Log Deviation)	0.111 (0.008)	0.081 (0.006)	**-0.029*** [0.010]**	**0.002**	-27
GE(2)	0.395 (0.173)	0.174 (0.035)	**-0.221 [0.174]**	**0.202**	-56
Between-group					
GE(1), Theil's T	0.014 (0.001)	0.009 (0.000)	**-0.005*** (0.001)**	**0.000**	-34
GE(0), Theil's L (Mean Log Deviation)	0.013 (0.001)	0.009 (0.000)	**-0.004*** (0.001)**	**0.000**	-33
GE(2)	0.015 (0.001)	0.010 (0.000)	**-0.005*** (0.001)**	**0.000**	-34
Within-group					
GE(1), Theil's T	0.126 (0.015)	0.087 (0.009)	**-0.039** (0.016)**	**0.019**	-31
GE(0), Theil's L (Mean Log Deviation)	0.097 (0.008)	0.072 (0.006)	**-0.025** (0.010)**	**0.011**	-26
GE(2)	0.380 (0.173)	0.164 (0.035)	**-0.216 (0.174)**	**0.213**	-57

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction.[50] Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses. Standard errors for GE inequality indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).
3) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed t-test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

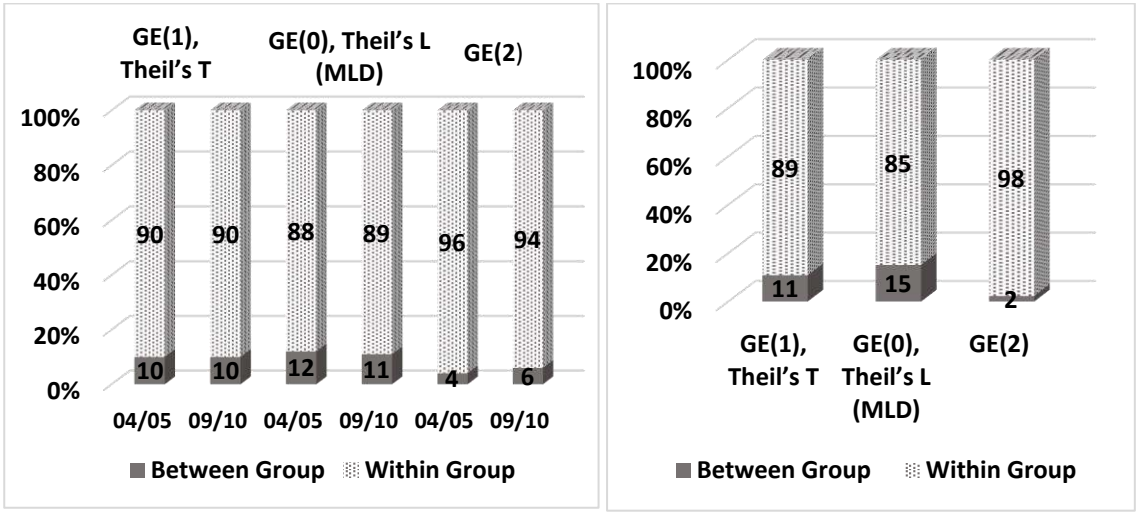
Table 4.2 Total inequality and its decomposition of rural and urban areas in Myanmar, 2004/05 and 2009/10

Measure of Inequality	2004-2005			2009-2010		
	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)
GE(1), Theil's T	0.140 **(100)**	0.126 **(90)**	0.014 **(10)**	0.097 **(100)**	0.087 **(90)**	0.009 **(10)**
GE(0), Theil's L (Mean Log Deviation)	0.111 **(100)**	0.097 **(88)**	0.013 **(12)**	0.081 **(100)**	0.072 **(89)**	0.009 **(11)**
GE(2)	0.395 **(100)**	0.380 **(96)**	0.015 **(4)**	0.174 **(100)**	0.164 **(94)**	0.010 **(6)**

Source: Author's estimations

[50] For example, if you have a population of 100 and you select 3 into your sample, your sampling fraction would be 3/10 and your p-weight would be 10/3 = 3.33.
(http://www.ats.ucla.edu/stat/stata/faq/weights.htm)

The contributions of between-group and within-group inequalities of rural and urban areas to the levels of, and changes in, total inequality between 2004/05 and 2009/10 are also illustrated in Figure 4.1. In inequality level, within-group inequality contributed to total inequality is very high and GE indices with all parameters show more than 88 % in both years. Similarly, the differences of within-group inequality over the study periods contributed highly to changes in total inequality, at 85%, 89% and 98%, for the indices of the MLD, the Theil Index and the GE(2) respectively, as shown in Figure 4.1 and Table 4.3. This reveals that a substantial part of expenditure inequality in Myanmar is therefore not spatial.



Level Changes between 2004/05 and 2009/10

Figure 4.1 Contributions of between-group and within-group inequalities of rural and urban areas

Table 4.3 Total inequality and its decomposition of rural and urban areas in Myanmar, changes between 2004/05 and 2009/10

Measure of Inequality	Changes between 2004/05 and 2009/10		
	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)
GE(1), Theil's T	-0.044 **(100)**	-0.039 **(89)**	-0.005 **(11)**
GE(0), Theil's L (Mean Log Deviation)	-0.029 **(100)**	-0.025 **(85)**	-0.004 **(15)**
GE(2)	-0.221 **(100)**	-0.216 **(98)**	-0.005 **(2)**

Source: Author's estimations

4.4.2 Inequality by state/region

An alternative indicator of expenditure inequality, the Gini coefficient, suggests similar rankings for states and regions (Table 4.4). The Gini coefficients of all states and regions ranged from 0.180 in Kayin to 0.322 in Yangon and 0.323 in Chin in 2004/05, and from 0.160 in Chin to 0.258 in Yangon. Mon, Rakhine, Bago (West) and Kayin had the lowest inequality indices in consumption expenditures, while inequality was high in Chin, Yangon and Taninthayi in 2004/05. The lowest Gini coefficients in consumption expenditures in 2009/10 were found in Kayah, Sagaing, Kayin and Chin while the highest Gini coefficients reported were in Yangon, Mandalay and Taninthayi. In addition, inequality declined in almost all states and regions except in Bago (West), and the decreases of inequality were greater in Chin (51%), Shan State (from 14% to 22%), Yangon (20%) and Kachin (19%) over the survey periods. In terms of the standard normal test statistic, using the Equation (2.18) of this research, the differences between Gini coefficients in Chin and Kachin are highly statistically significant—at the 1% level—and Shan (North) and Bago (Eest) are statistically significant at the 5% level between 2004/05 and 2009/10, when taking into account the correlation between the two expenditure distributions as reported in Table 4.4.

The Gini coefficients of 2004/05 and 2009/10 for all households are also checked without Chin state, to investigate whether the decline in the Gini coefficient in Chin state affects the changes in overall inequality. The results confirm that the significant drop of the Gini coefficient in Chin in 2009/10 did not matter to the changes in overall inequality at national level.

In terms of households residing in rural and urban areas, the increases in inequality of urban households are observed in Bago (West) at 63% and Mon at 38%, and the greater declines in inequality of urban households are reported in Kayah (33%), Kachin (20%) and Shan States (23% each) as shown in Table 4.20 in Appendix: 4-A. The changes of the Gini coefficients are statistically significant at the 1% level in Bago (East), Magwe and Shan (North) for urban households. The rises in inequality of rural households are reported in Kayah at 3% and Yangon at 1%, and the larger drops in inequality of rural households are found in Chin (61%) and Shan (East) at 33% as presented in Table 4.21 in Appendix: 4-A. The changes of the Gini coefficients are highly significant at the 1% level in Kachin, Chin, Sagaing, and Shan (East) for rural households.

Table 4.4 Gini coefficients by state/region

States / Regions	No. of HHs		2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
	04/05	09/10					
Kachin	672	672	0.256	0.207	**-0.049*** **		-19
			(0.016)	(0.012)	**[0.019]**	**0.009**	
					[0.020]	**0.014**	
Kayah	156	156	0.213	0.186	**-0.027**		-13
			(0.004)	(0.020)	**[0.020]**	**0.185**	
					[0.021]	**0.190**	
Kayin	719	715	0.180	0.170	**-0.011**		-6
			(0.006)	(0.016)	**[0.016]**	**0.509**	
					[0.017]	**0.524**	
Chin	324	323	0.323	0.160	**-0.164*** **		-51
			(0.035)	(0.016)	**[0.039]**	**0.000**	
					[0.039]	**0.000**	
Sagaing	2,207	2,217	0.213	0.182	**-0.031***		-15
			(0.013)	(0.013)	**[0.017]**	**0.072**	
					[0.018]	**0.085**	
Taninthayi	720	715	0.266	0.238	**-0.028**		-11
			(0.019)	(0.010)	**[0.020]**	**0.163**	
					[0.021]	**0.187**	
Bago (East)	936	935	0.225	0.191	**-0.034****		-15
			(0.005)	(0.016)	**[0.016]**	**0.038**	
					[0.017]	**0.043**	
Bago (West)	840	840	0.188	0.198	**0.010**		5
			(0.005)	(0.024)	**[0.024]**	**0.691**	
					[0.025]	**0.692**	
Magwe	1,749	1,751	0.216	0.191	**-0.025**		-12
			(0.014)	(0.011)	**[0.017]**	**0.133**	
					[0.018]	**0.148**	
Mandalay	2,687	2,683	0.259	0.240	**-0.019**		-7
			(0.025)	(0.020)	**[0.031]**	**0.543**	
					[0.032]	**0.556**	
Mon	768	767	0.199	0.197	**-0.002**		-1
			(0.015)	(0.025)	**[0.028]**	**0.935**	
					[0.029]	**0.938**	
Rakhine	1,247	1,248	0.192	0.187	**-0.004**		-2
			(0.008)	(0.007)	**[0.010]**	**0.669**	
					[0.011]	**0.683**	
Yangon	1,223	1,212	0.322	0.258	**-0.064**		-20
			(0.036)	(0.026)	**[0.041]**	**0.121**	
					[0.045]	**0.153**	
Shan (South)	624	622	0.242	0.208	**-0.034**		-14
			(0.026)	(0.008)	**[0.027]**	**0.197**	
					[0.027]	**0.209**	
Shan (North)	932	934	0.263	0.220	**-0.043****		-16
			(0.019)	(0.011)	**[0.021]**	**0.038**	
					-0.043*		
					[0.022]	**0.051**	
Shan (East)	600	598	0.258	0.201	**-0.057**		-22
			(0.029)	(0.036)	**[0.045]**	**0.203**	
					[0.046]	**0.217**	
Ayeyawaddy	2,230	2,221	0.236	0.211	**-0.024**		-10
			(0.011)	(0.021)	**[0.023]**	**0.285**	
					[0.023]	**0.298**	

Source: Author's estimations

Notes:

1) See notes to Table 4.1 on the meaning of weights, round and square parentheses, P-values, and ***, ** and *.
2) Standard errors for the Gini coefficients are based on the Stata code of Jenkins (2008), which uses the method of Kovacevic and Binder (1997).
3) Z-statistics of the first line are calculated by taking into account correlation, following Steel and McLaren (2009) and Zheng and Cushing (2001).
4) Z-statistics of the second line are calculated without taking into account correlation, using the standard normal test statistic (Barrett & Pendakur, 1995; Davidson & Duclos, 2000).
5) For a two tailed t-test of 2004-05=2009/10, the 5% critical value for the z-statistic is 1.96.

4.4.2.1 Gini coefficients by state/region (panel households): A comparison of the asymptotic and bootstrap standard errors for panel households

Table 4.5 presents a comparison of the asymptotic and bootstrap standard errors of the Gini coefficients for panel households in Myanmar states and regions. Inequality declined in almost all states and regions except in Kayah, Bago (West) and Rakhine, and the highest percentages of decreases in inequality are similar to the trend in the results of all households. The increases of inequality are faster in Kayah (10%) and Bago (West) (17%). The changes in the Gini coefficients in Shan (South) are highly significant at the 1% level for panel households, while these changes are not significant for all households.

The increases in inequality of urban panel households are discovered in Bago (West), and the greater declines in inequality of urban panel households are presented in Taninthayi (28%) and Shan (South) at 26% and Shan (North) at 25% as shown in Table 4.22 in Appendix: 4-A. The changes of the Gini coefficients are statistically significant at the 1% level in Bago (East), Bago (West) and Shan (North) for urban panel households. The rises in inequality of rural panel households are seen in Kayah at 19% and Taninthayi at 5%, and the larger drops in inequality of rural panel households are observed in Chin (69%) and Shan States (from 18% to 25%), as illustrated in Table 4.23 in Appendix 4-A. The changes of the Gini coefficients are highly significant at the 1% level in Kachin, Chin, Shan (South) and Shan (East) for rural panel households.

In general, the increase in the Gini coefficient is mainly found in Bago (West), though it is only significant at the 10% level in urban households. The declines in the Gini coefficients are obvious in Chin, based on the results of the Gini coefficients for all households, rural households, panel households and panel households in rural areas, and followed by Shan States based on the results of the Gini coefficients for panel households and panel households in rural areas.

Table 4.5 Gini coefficients by state/region (panel households): A comparison of the asymptotic and bootstrap standard errors for panel households

States / Regions	Number of Sample HHs	2004/05	2009/10	Difference	P- value	% Δ (2004/05 vs. 2009/10)
Kachin	336	0.245	0.206	**-0.039*** **		-16
ASE		(0.012)	(0.014)	**[0.014]**	**0.005**	
		0.245	0.206	**-0.039*** **		
BSE		(0.009)	(0.009)	**[0.012]**	**0.001**	
Kayah	78	0.159	0.176	**0.017**		10
ASE		(0.008)	(0.013)	**[0.014]**	**0.226**	
		0.159	0.176	**0.017**		
BSE		(0.007)	(0.007)	**[0.014]**	**0.231**	
Kayin	357	0.186	0.163	**-0.023**		-12
ASE		(0.008)	(0.023)	**[0.021]**	**0.273**	
		0.186	0.163	**-0.023**		
BSE		(0.006)	(0.013)	**[0.019]**	**0.219**	
Chin	161	0.392	0.160	**-0.232*** **		-59
ASE		(0.060)	(0.015)	**[0.062]**	**0.000**	
		0.392	0.160	**-0.232*** **		
BSE		(0.044)	(0.011)	**[0.057]**	**0.000**	
Sagaing	1,083	0.202	0.181	**-0.020**		-10
ASE		(0.013)	(0.011)	**[0.014]**	**0.139**	
		0.202	0.181	**-0.020** **		
BSE		(0.010)	(0.008)	**[0.010]**	**0.040**	
Taninthayi	351	0.263	0.241	**-0.022**		-8
ASE		(0.017)	(0.015)	**[0.016]**	**0.164**	
		0.263	0.241	**-0.022**		
BSE		(0.013)	(0.011)	**[0.014]**	**0.107**	
Bago (East)	465	0.227	0.195	**-0.032** **		-14
ASE		(0.012)	(0.010)	**[0.013]**	**0.011**	
		0.227	0.195	**-0.032**		
BSE		(0.009)	(0.007)	**[0.016]***	**0.053**	
Bago (West)	409	0.178	0.208	**0.030**		17
ASE		(0.004)	(0.036)	**[0.036]**	**0.401**	
		0.178	0.208	**0.030**		
BSE		(0.003)	(0.024)	**[0.026]**	**0.252**	
Magwe	875	0.210	0.185	**-0.024**		-12
ASE		(0.014)	(0.014)	**[0.016]**	**0.134**	
		0.210	0.185	**-0.024** **		
BSE		(0.010)	(0.010)	**[0.012]**	**0.038**	
Mandalay	1,320	0.265	0.237	**-0.028**		-11
ASE		(0.027)	(0.020)	**[0.029]**	**0.329**	
		0.265	0.237	**-0.028** **		
BSE		(0.019)	(0.013)	**[0.014]**	**0.037**	
Mon	372	0.195	0.186	**-0.008**		-4
ASE		(0.014)	(0.005)	**[0.013]**	**0.502**	
		0.195	0.186	**-0.008**		
BSE		(0.010)	(0.003)	**[0.007]**	**0.203**	
Rakhine	614	0.188	0.193	**0.004**		2
ASE		(0.011)	(0.009)	**[0.011]**	**0.700**	
		0.188	0.193	**0.004**		
BSE		(0.008)	(0.007)	**[0.006]**	**0.479**	
Yangon	586	0.283	0.264	**-0.019**		-7
ASE		(0.038)	(0.030)	**[0.029]**	**0.506**	
		0.283	0.264	**-0.019**		
BSE		(0.032)	(0.026)	**[0.015]**	**0.206**	
Shan (South)	310	0.245	0.200	**-0.045*** **		-18
ASE		(0.014)	(0.005)	**[0.013]**	**0.000**	
		0.245	0.200	**-0.045*** **		
BSE		(0.007)	(0.010)	**[0.009]**	**0.000**	
Shan (North)	456	0.264	0.215	**-0.049*** **		-18
ASE		(0.018)	(0.016)	**[0.017]**	**0.004**	
		0.264	0.215	**-0.049*** **		
BSE		(0.014)	(0.012)	**[0.010]**	**0.000**	
Shan (East)	290	0.240	0.199	**-0.041**		-17
ASE		(0.022)	(0.024)	**[0.028]**	**0.137**	
		0.240	0.199	**-0.041***		
BSE		(0.022)	(0.020)	**[0.022]**	**0.058**	
Ayeyawaddy	1,039	0.233	0.219	**-0.015**		-6
ASE		(0.011)	(0.022)	**[0.021]**	**0.493**	
		0.233	0.219	**-0.015**		
BSE		(0.008)	(0.016)	**[0.015]**	**0.326**	

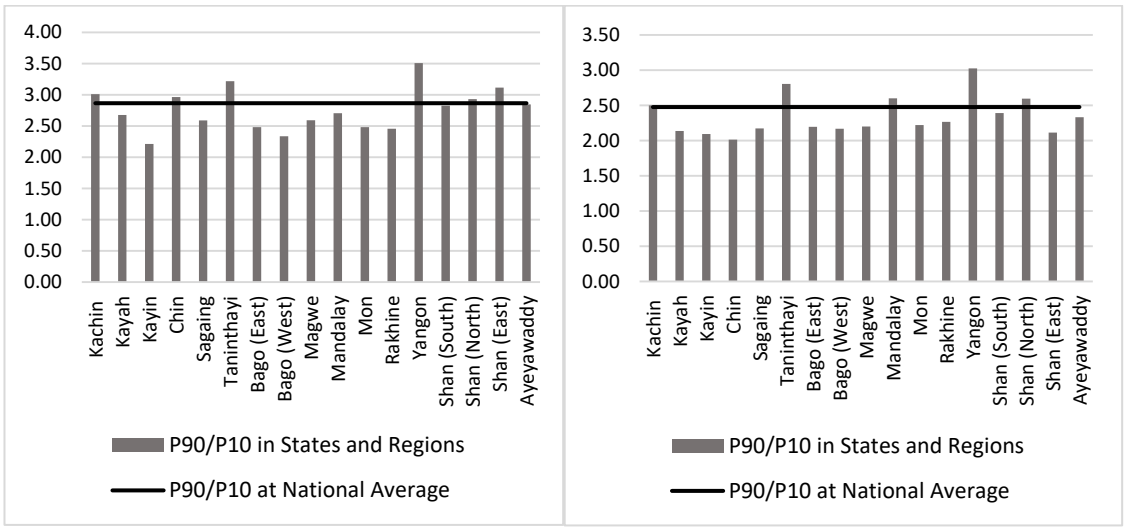
Source: Author's estimations

Notes:

1) See notes to Table 4.1 on the meaning of weights, round and square parentheses, P-values, and ***, ** and *.

2) Standard errors for the Gini coefficients are based on the Stata code of Jenkins (2008), which uses the method of Kovacevic and Binder (1997).
3) SEs of the differences of the first and second lines are asymptotic and bootstrap SEs respectively.
4) Z-statistics are calculated by taking into account correlation, following Steel and McLaren (2009) for the asymptotic SEs.
5) For a two tailed t-test of 2004/05=2009/10, the 5% critical value for the z-statistic is 1.96.

4.4.2.2 Inequality (P90/P10) by state and region and national average in Myanmar



2004-2005 2009-2010

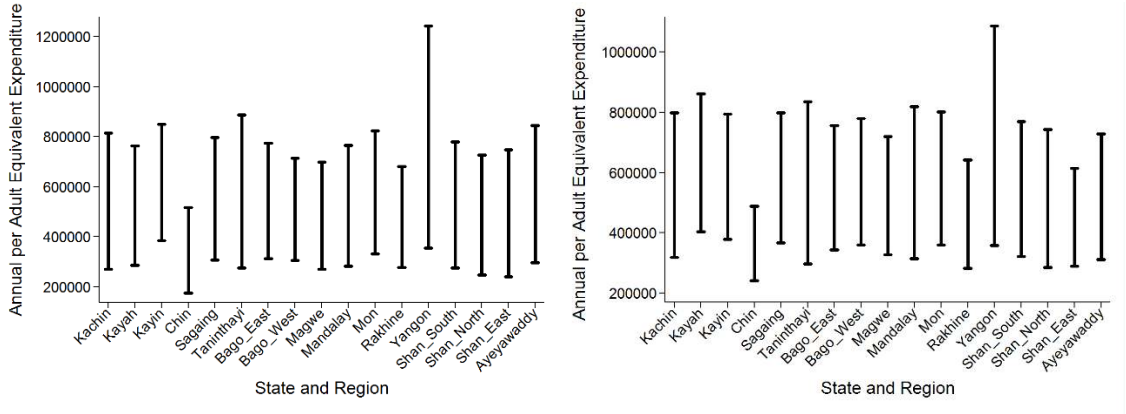
Figure 4.2 Inequality (P90/P10) by state and region and national average in Myanmar

OECD (2014) defines "P90/P10 as the ratio of the upper bound value of the ninth decile (that is the 10% of people with highest income) to that of the first decile" (p.64). A lower P90/P10 ratio is good, as it indicates that the gap between the poor and rich is not significant. The P90/P10 ratios for all states and regions in 2004/05 and 2009/10 are shown in Figure 4.2. It can be seen that Yangon and Taninthayi had the highest rates of inequality: the ratio between the top and the bottom is 3.51 and 3.22 respectively, while the P90/P10 ratio at national level was 2.86 in 2004/05. A ratio of 3.51 in Yangon in 2004/05 means that the consumption expenditures of the richest 10% of the population are about 3.5 times higher (on average) than the expenditures of the poorest 10% of the population. The highest P90/P10 ratios for the two regions went down to 3.03 and 2.81 in 2009/10, while the ratio at national level was 2.48 in 2009/10.

4.4.2.3 Top (P90) and bottom (P10) consumption expenditures by state and region (in December, 2009 Kyat)

Figure 4.3 shows the P90 and P10 consumption expenditures for each state and region in December 2009 Kyat. It can be seen that there was not much variation in the bottom 10%

of consumption expenditure, apart from Chin state at 174,374 Kyats in 2004/05 and 242,285 Kyats in 2009/10; but there was variation in the top 10% of consumption expenditure (the P90). Yangon had the highest P90 expenditures at 1,241,918 Kyats, and Kayin had the highest P10 expenditures at 384,442 in 2004/05, and they fell to 1,085,097 Kyats and 379,328 Kyats in 2009/10.



2004-2005 2009-2010

Figure 4.3 Top (P90) and bottom (P10) consumption expenditures by state and region (December, 2009 Kyat)

As shown in Table 4.24 (Appendix: 4-A), there is a considerable variation in expenditure inequality in different states and regions across Myanmar in terms of the GE and Atkinson measures at different sensitivities. Growth has been uneven across subnational locations (that is, across regions, and states). Apart from Bago (West), the expenditure inequality indices of the GE class and Atkinson class declined in all states and regions.

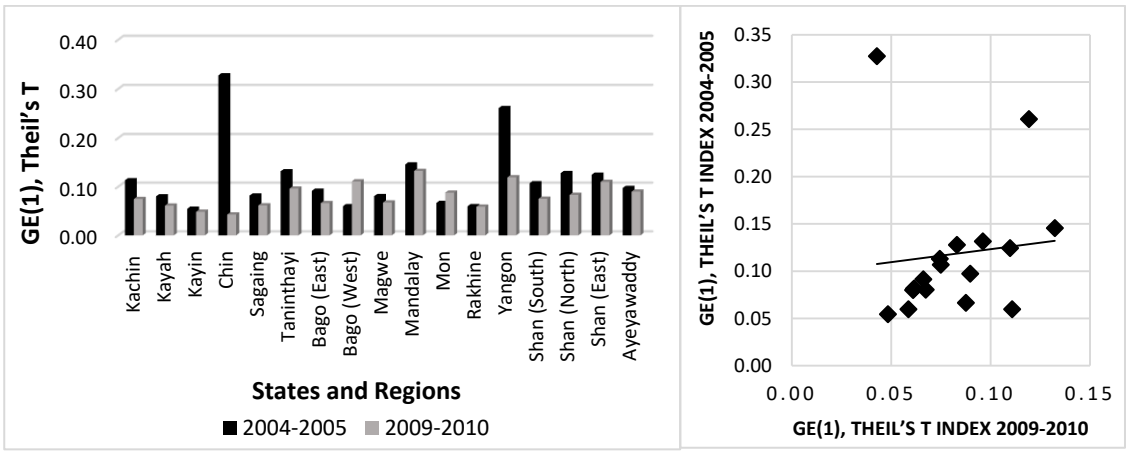


Figure 4.4 Inequality GE(1), Theil's T Indices by state and region

The GE(1) Theil's T index of different states and regions illustrated in Figure 4.4 reveals that, between 2004/05 and 2009/10, inequality rose in Bago (West) and Mon, and the increase was strongest in Bago (West), where the Theil index increased from 0.060 to 0.111. The decreases were steepest in Chin and Yangon, where the Theil index decreased from 0.327 to 0.043 and from 0.261 to 0.119 respectively. The scatter chart of Figure 4.4 also demonstrates the same pattern over the study years.

4.4.3 Between-group and within-group inequalities of states and regions

In Table 4.6, this study reports the importance of between-group and within-group components of total inequality for states and regions in terms of GE indices with sensitivities 0, 1 and 2. In terms of changes between 2004/05 and 2009/10, between-group inequality of states and regions decreased more than 50% and the decrease is statistically significant at the 1% level for all GE inequality indices. In other words, the proportion of inter-state and region inequality contributed to total inequality in Myanmar decreased more than half.

Table 4.6 Between-group and within-group inequalities of states and regions

Measure of Inequality	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Total Inequality					
GE(1), Theil's T	0.140 (0.014)	0.097 (0.009)	**-0.044*** [0.016]**	**0.008**	-31
GE(0), Theil's L (Mean Log Deviation)	0.111 (0.008)	0.081 (0.006)	**-0.029*** [0.010]**	**0.002**	-27
GE(2)	0.395 (0.173)	0.174 (0.035)	**-0.221 [0.174]**	**0.202**	-56
Between-group					
GE(1), Theil's T	0.013 (0.001)	0.005 (0.000)	**-0.007*** [0.001]**	**0.000**	-57
GE(0), Theil's L (Mean Log Deviation)	0.012 (0.001)	0.005 (0.000)	**-0.006*** [0.001]**	**0.000**	-54
GE(2)	0.014 (0.001)	0.005 (0.000)	**-0.008*** [0.001]**	**0.000**	-60
Within-group					
GE(1), Theil's T	0.128 (0.015)	0.091 (0.009)	**-0.036** [0.017]**	**0.029**	-28
GE(0), Theil's L (Mean Log Deviation)	0.099 (0.009)	0.076 (0.006)	**-0.023** [0.010]**	**0.021**	-23
GE(2)	0.382 (0.173)	0.168 (0.035)	**-0.213 [0.174]**	**0.219**	-56

Source: Author's estimations

Notes:

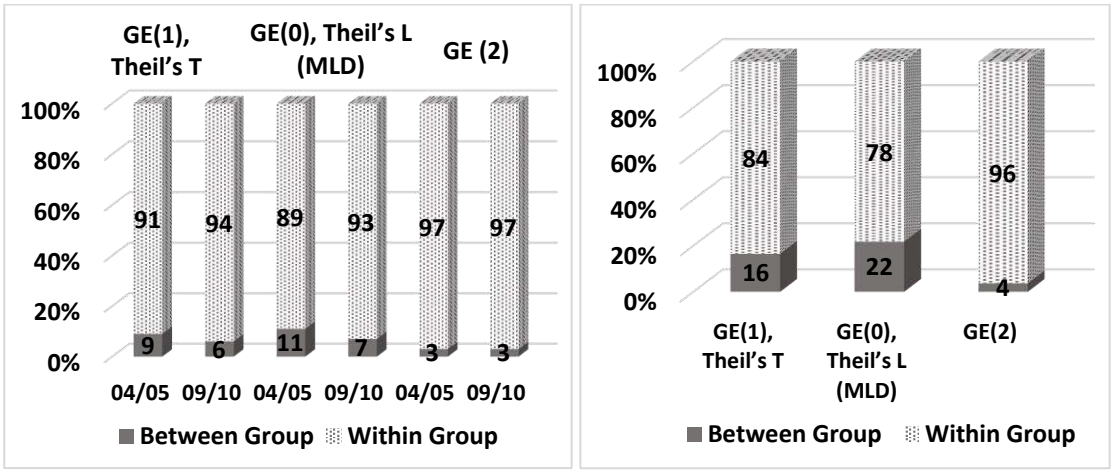
1) See notes to Table 4.1 on the meaning of weights, round and square parentheses, z-statistics, and ***, ** and * .
2) Standard errors for GE indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).

Within-group inequality of states and regions declined about 23%, 28% and 56% from 2004/05 to 2009/10, as measured by the MLD GE(0), the Theil index GE(1), and the GE(2), respectively, and the changes are statistically significant at the 5% level in the GE(1) and GE(0) indices.

Table 4.7 Total inequality and its decomposition of states and regions in Myanmar, 2004/05 and 2009/10

Measure of Inequality	2004-2005			2009-2010		
	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)
GE(1), Theil's T	0.140 **(100)**	0.128 **(91)**	0.013 **(9)**	0.097 **(100)**	0.091 **(94)**	0.005 **(6)**
GE(0), Theil's L (Mean Log Deviation)	0.111 **(100)**	0.099 **(89)**	0.012 **(11)**	0.081 **(100)**	0.076 **(93)**	0.005 **(7)**
GE(2)	0.395 **(100)**	0.382 **(97)**	0.014 **(3)**	0.174 **(100)**	0.168 **(97)**	0.005 **(3)**

Source: Author's estimations



Level Changes between 2004/05 and 2009/10

Figure 4.5 Contributions of between-group and within-group inequalities of states and regions

In terms of level of inequality, as demonstrated in Table 4.7, between-group inequality of states and regions stood at 11% and 9% and 3% of total inequality in 2004/05, as measured by the MLD, the Theil index, and the GE(2), respectively. However, the corresponding contribution to the total inequality in 2009/2010 decreased to 7%, 6% and 3% for the MLD, the Theil Index and the GE(2). Within-group inequality of states and regions was responsible for 89% and 91% and 97% of total inequality in 2004/05, as measured by the MLD, the Theil index, and the GE(2), respectively. Nevertheless, the corresponding contribution to the total inequality slightly increased to 93% and 94% for

the MLD and the Theil Index, though the GE(2) remained the same in 2009/10, as presented in Table 4.7.

As reported in Table 4.7, the chart of inequality level in Figure 4.5 shows higher contribution of within-group inequality to total inequality in all GE indices in 2004/05 and 2009/10. In addition, as illustrated in Figure 4.5 and reported in Table 4.8, changes in the contribution of within-group inequality of states and regions to differences in total inequality over the study periods are greater, at 78%, 84% and 96% as measured by the MLD, the Theil index, and the GE(2) respectively, compared with changes in the contribution of between-group inequality of all GE measures. This confirms that a substantial part of expenditure inequality in Myanmar is not spatial.

Table 4.8 Total inequality and its decomposition of states and regions in Myanmar, changes between 2004/05 and 2009/10

Measure of Inequality	Changes between 2004/05 and 2009/10		
	Total Inequality (%)	**Within-group Inequality (%)**	**Between-group Inequality (%)**
GE(1), Theil's T	-0.044 **(100)**	-0.036 **(84)**	-0.007 **(16)**
GE(0), Theil's L (Mean Log Deviation)	-0.029 **(100)**	-0.023 **(78)**	-0.006 **(22)**
GE(2)	-0.221 **(100)**	-0.213 **(96)**	-0.008 **(4)**

Source: Author's estimations

However, it is important to interpret the results with caution at the state/region level for those states/regions where townships were excluded due to inaccessibility, (for example in Kachin, Kayah, Kayin, Shan (North) and Yangon). However, the problem was fixed "by adjusting the weights of the remaining households of the strata to which they belonged for both rounds in 2004/05 and 2009/10".[51]

4.4.4 Maximum between-group inequalities of rural and urban areas, and states and regions

In terms of inequality level, as shown in Table 4.9 and Figure 4.6, by repeating for all possible *J!* permutations of sub-groups, the observed 'maximum possible' between-component of rural and urban areas of GE(0), GE(1), and GE(2) rose over the standard approach, to 21%, 20% and 19% in 2004/05 and 19%, 18% and 17% in 2009/10 respectively. The inequality levels of GE(0), GE(1) and GE(2) in the maximum between-

[51] IHLCA (2011b, p.8, p. 22)

group inequality were about 5 times higher respectively, compared with those of the classic calculation in 2004/05. However, the indices of GE(0), GE(1) and GE(2) in the maximum between-group inequality were 5-6 fold higher in 2009/10, compared with those indices in the classic approach. This highlights the fact that there are some overlaps in the lower part of the distribution, and more overlapping in the top part of distribution of per adult equivalent household expenditures, between rural and urban areas.

Table 4.9 Comparison of between-group inequalities in Myanmar, 2004/05 and 2009/10

Measure of Inequality	2004-2005			2009-2010		
	'Classic' between-group Inequalities (%)[a]	ELMO between-group inequalities with the original 'pecking order' (%)[b]	ELMO maximum between-group inequality (%)[c]	'Classic' between-group Inequalities (%)[a]	ELMO between-group inequalities with the original 'pecking order' (%)[b]	ELMO maximum between-group inequality (%)[c]
Rural/Urban						
GE(1), Theil's T	0.014 **(10)**	0.070 **(20)**	0.070 **(20)**	0.009 **(10)**	0.051 **(18)**	0.051 **(18)**
GE(0), Theil's L (Mean Log Deviation)	0.013 **(12)**	0.065 **(21)**	0.065 **(21)**	0.009 **(11)**	0.048 **(19)**	0.048 **(19)**
GE(2)	0.015 **(4)**	0.078 **(19)**	0.078 **(19)**	0.010 **(6)**	0.057 **(17)**	0.057 **(17)**
State/Region						
GE(1), Theil's T	0.013 **(9)**	0.112 **(11)**		0.005 **(6)**	0.083 **(7)**	
GE(0), Theil's L (Mean Log Deviation)	0.012 **(11)**	0.104 **(11)**		0.005 **(7)**	0.077 **(7)**	
GE(2)	0.014 **(3)**	0.134 **(10)**		0.005 **(3)**	0.096 **(6)**	

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [bc] Between-group inequality as a percentage of the ELMO maximum potential between-group inequality, or the ELMO maximum attainable between-group inequality with the original 'pecking order'

By preserving their 'pecking order', in addition to fixing the number of sub-groups and their relative sizes, the contributions of maximum between-group inequality of rural and urban areas of the MLD, the Theil index, and the GE(2) indices did not vary compared with the contributions of between-group inequality of the GE indices calculated using the conventional approach in both years 2004/05 and 2009/10—apart from the GE(2) which quintupled in 2004/05 and tripled in 2009/10 between the two approaches. This indicates

that there is very little overlap in the distribution of per adult equivalent expenditures between rural and urban sectors in Myanmar.

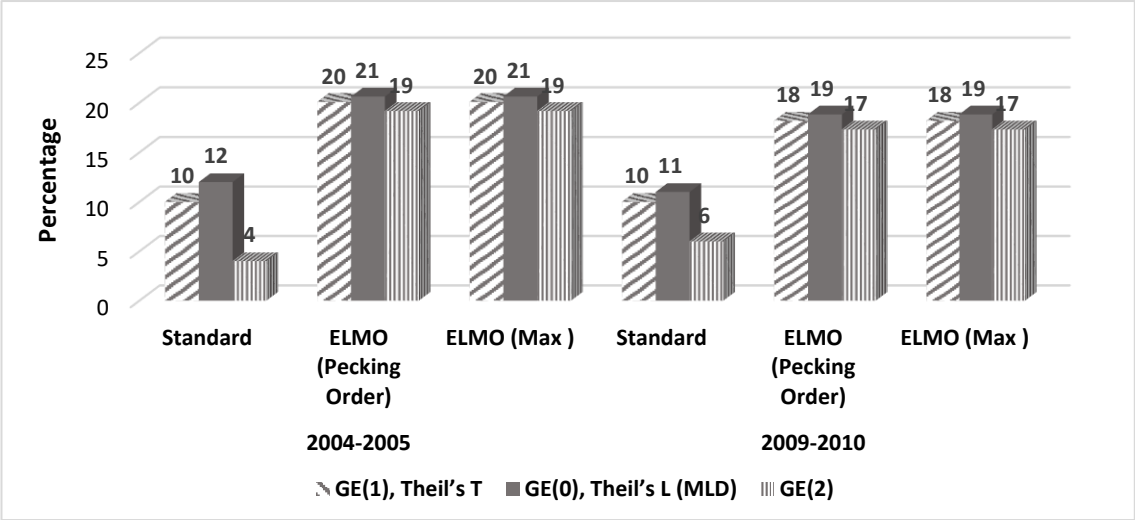


Figure 4.6 Comparison of between-group inequalities of rural and urban areas among standard approach, ELMO approaches with pecking order and maximum between-group inequality

ELMO (2008) stresses that when repeating for all possible *J!* permutations of sub-groups, this approach requires the number of groups, *J*, to be relatively small. Therefore, this research cannot be repeated for all possible permutations of the 17 states and regions using Stata application. As reported in Table 4.9, the share of between-group inequality of states and regions slightly increased, given its current income distribution, the number of groups, their sizes, and their ranking in terms of maintaining average income of original groups, compared with that of states and regions using the conventional measure in 2004/05 and 2009/10 study years. The results indicate that there is almost no overlap in the distribution of per adult equivalent household expenditures among states and regions in Myanmar.

4.4.5 Between-group and within-group inequalities of Nargis- and non-Nargis-affected areas

In Chapter 3, the plausible significant effects of Cyclone Nargis on consumption expenditure distributions in the cyclone affected area were discussed. The declines in inequality measured by the GE(1) and the GE(0) are significant, but the decline in the GE(2) is not significant for all population. However, in the non-Nargis-affected area, there was a small increase in inequality in the case of GE(2), though it is not statistically significant. In fact, the consumption expenditure distribution of the Nargis-affected area

is more internally unequal than that of the non-Nargis-affected area. Over the study periods, the GE indices of the Nargis-affected area declined more than those of the non-Nargis-affected area.

As shown in the earlier part of this research, inequality also went down in the non-Nargis-affected area significantly in the GE(0), but not significantly in the GE(1) and GE(2), thus the observed decline in overall inequality was not solely due to Nargis. However something must have caused this decline, as it occurred in all non-Nargis areas. Inequality went up slightly in terms of GE(1) and GE(2), and there was a small decline in GE(0) in the non-Nargis-affected Coastal area, but these are not significant. The Nargis-affected area would seem to be most similar to the non-Nargis-affected Coastal area as discussed in Chapter 3, the latter provides the best check against what would have happened in the Nargis-affected area. Based on these findings, it is possible that if it had not been for Cyclone Nargis, the Nargis-affected area as well as the whole country would have followed the trends in this coastal area. Therefore, Cyclone Nargis is likely a big part of the explanation for why inequality went down in Myanmar.

The findings of Chapter 3 show that Cyclone Nargis affected the richest households, as inequality went down in GE(2), which is sensitive to the upper part of distribution—but this is not significant. Cyclone Nargis also affects the poorest people, as its repercussions are stronger in the case of GE(0) and GE(1), and inequality goes down significantly in the Nargis-affected area. There would have been some declines in inequality as measured by the GE indices for all population at the national level without Cyclone Nargis, but not large ones. Therefore, the effect of Cyclone Nargis contributed to the reduction in total inequality. In this section, the between-group and within-group inequalities of Nargis- and non-Nargis-affected areas are further investigated to confirm and verify the robustness of the previous findings.

Table 4.10 reports the between-group and within-group components of total inequality of Nargis- and non-Nargis-affected areas in terms of the GE indices with sensitivities 0, 1 and 2. In terms of percentage changes of the GE indices between 2004/05 and 2009/10, the between-group inequality of Nargis- and non-Nargis affected areas decreased by more than 80%, and the decreases of all GE indices are highly statistically significant at the 1% level. The decreases are also greater compared to the declines in all GE indices of within-group inequality. These findings again confirm that the reduction in expenditure

inequality between the two surveyed years was affected by Cyclone Nargis. All GE indices of within-group inequality of Nargis- and non-Nargis-affected areas also declined from 2004/05 to 2009/10, and the decrease was faster in the GE(2) index at about 55% implying that changes were greater in the top part of expenditure distributions, however this is not statistically significant.

Table 4.10 Between-group and within-group inequalities of Nargis- and non-Nargis-affected areas

Measure of Inequality	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Total Inequality					
GE(1), Theil's T	0.140 (0.014)	0.097 (0.009)	**-0.044*** [0.016]**	**0.008**	-31
GE(0), Theil's L (Mean Log Deviation)	0.111 (0.008)	0.081 (0.006)	**-0.029*** [0.010]**	**0.002**	-27
GE(2)	0.395 (0.173)	0.174 (0.035)	**-0.221 [0.174]**	**0.202**	-56
Between-group					
GE(1), Theil's T	0.010 (0.001)	0.001 (0.000)	**-0.009*** (0.001)**	**0.000**	**-87**
GE(0), Theil's L (Mean Log Deviation)	0.009 (0.001)	0.001 (0.000)	**-0.008*** (0.001)**	**0.000**	**-86**
GE(2)	0.011 (0.001)	0.001 (0.000)	**-0.009*** (0.001)**	**0.000**	**-87**
Within-group					
GE(1), Theil's T	0.130 (0.016)	0.095 (0.008)	**-0.035** (0.017)**	**0.043**	-27
GE(0), Theil's L (Mean Log Deviation)	0.101 (0.009)	0.080 (0.005)	**-0.021** (0.010)**	**0.034**	-21
GE(2)	0.385 (0.176)	0.172 (0.034)	**-0.212 (0.177)**	**0.229**	-55

Source: Author's estimations

Notes:

1) See notes to Table 4.1 on the meaning of weights, round and square parentheses, z-statistics, and ***, ** and *.
2) Standard errors for GE indices are based on the Stata command of Biewen and Jenkins (2006), which uses the method of Woodruff (1971).

The contributions of between-group and within-group inequalities of Nargis- and non-Nargis-affected areas to the total inequality of Nargis- and non-Nargis-affected areas are also illustrated in Figure 4.7 for the level of, and changes in, inequality between 2004/05 and 2009/10. In terms of inequality level, as shown in Table 4.11, between-group inequality of Nargis- and non-Nargis affected areas stood at 9% and 7% and 3% of total inequality, as measured by the MLD, the Theil index and the GE(2) respectively, in the year 2004/05. However, the corresponding contribution to the total inequality decreased to 1% each for the Theil Index and the GE(2), and 2% for the MLD in 2009/10. In

inequality level, within-group inequality contributed to total inequality was high and the GE indices with all parameters showed more than 90 % in both years.

Table 4.11 Total inequality and its decomposition of Nargis- and non-Nargis-affected areas in Myanmar, 2004/05 and 2009/10

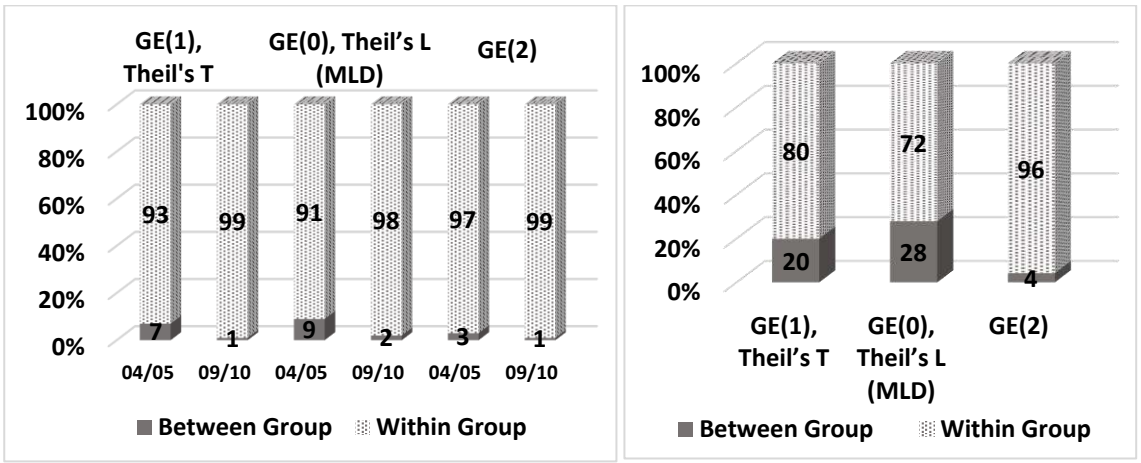
Measure of Inequality	2004-2005			2009-2010		
	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)
GE(1), Theil's T	0.140 **(100)**	0.1302 **(93)**	0.0100 **(7)**	0.097 **(100)**	0.0954 **(99)**	0.0013 **(1)**
GE(0), Theil's L (Mean Log Deviation)	0.111 **(100)**	0.1011 **(91)**	0.0095 **(9)**	0.081 **(100)**	0.0799 **(98)**	0.0013 **(2)**
GE(2)	0.395 **(100)**	0.3846 **(97)**	0.0105 **(3)**	0.174 **(100)**	0.1723 **(99)**	0.0013 **(1)**

Source: Author's estimations

Table 4.12 Total inequality and its decomposition of Nargis- and non-Nargis-affected areas in Myanmar, changes between 2004/05 and 2009/10

Measure of Inequality	Changes between 2004/05 and 2009/10		
	Total Inequality (%)	Within-group Inequality (%)	Between-group Inequality (%)
GE(1), Theil's T	-0.044 **(100)**	-0.035 **(80)**	-0.009 **(20)**
GE(0), Theil's L (Mean Log Deviation)	-0.029 **(100)**	-0.021 **(72)**	-0.008 **(28)**
GE(2)	-0.221 **(100)**	-0.212 **(96)**	-0.009 **(4)**

Source: Author's estimations



Level Changes between 2004/05 and 2009/10

Figure 4.7 Contributions of between-group and within-group inequalities of Nargis- and non-Nargis-affected areas to total inequality

Similarly, differences of within-group inequality over the study periods contributed to changes of total inequality were at 72%, 80% and 96% for the indices of the MLD, the Theil Index and the GE(2) sequentially as shown in Figure 4.7 and Table 4.12. The changes of between-group inequality were at 28%, 20% and 4% for the indices of the MLD, the Theil Index, and the GE(2) respectively between 2004/05 and 2009/10. Noticeably, the contributions of changes of GE indices of between-group inequality of Nargis- and non-Nargis-affected areas to total inequality were also higher compared with levels of between-group inequality of Nargis- and non-Nargis-affected areas contributed to total inequality in 2004/05 and 2009/10 as shown in the Figure 4.7, Tables 4.11 and 4.12. Thus, this study again confirms that Cyclone Nargis was a major cause of the reduction in inequality.

4.4.6 Maximum between-group inequality of Nargis- and non-Nargis-affected areas in Myanmar, 2004/05 and 2009/10

The ELMO partitioning index turns out to be different from the standard between-group statistic in the 2004/05 survey year, when the population groups are defined in terms of Nargis- and non-Nargis-affected areas. As reported in Table 4.13 and Figure 4.8, observed inequality between Nargis- and non-Nargis-affected areas accounted for 16%, 14% and 12% of the 'maximum possible' between-group inequality for the indices of the MLD, the Theil Index, and the GE(2) respectively, though the conventional between-group contribution was well below 10% for the GE indices in 2004/05 surveyed year. The reported 'maximum possible' between-group inequality indices are measured by preserving their ranking in terms of average income in addition to fixing the number of sub-groups and their relative sizes. The results indicate that there were some overlaps in the distribution of per adult equivalent household expenditures between Nargis- and non-Nargis-affected areas in 2004/05.

The ELMO maximum possible between-group inequality, calculated from the highest between-component obtained among all possible *J!* permutations of subgroups (Nargis- and non-Nargis-affected areas), also yielded 16%, 14% and 12% for the indices of the MLD, the Theil Index, and the GE(2), in this order, in 2004/05. A similar trend was also perceived between the conventional between-group contributions and the ELMO partitioning statistic in 2009/10 surveyed year. However, there is very little overlap in the distribution of per adult equivalent expenditures between Nargis- and non-Nargis-

affected areas in 2009/10, as a small degree of partitioning was observed in the ELMO statistics at 3%, 3% and 2% for the indices of the MLD, the Theil Index and the GE(2) respectively.

Table 4.13 Comparison of between-group inequalities of Nargis- and non-Nargis-affected areas in Myanmar, 2004/05 and 2009/10

Measure of Inequality	2004-2005			2009-2010		
	'Classic' between-group Inequalities (%)[a]	ELMO between-group inequalities with the original 'pecking order' (%)[b]	ELMO maximum between-group inequality [b] (%)[c]	'Classic' between-group Inequalities (%)[a]	ELMO between-group inequalities with the original 'pecking order' (%)[b]	ELMO maximum between-group inequality (%)[c]
GE(1), Theil's T	0.010 **(7)**	0.070 **(14)**	0.070 **(14)**	0.001 **(1)**	0.050 **(3)**	0.050 **(3)**
GE(0), Theil's L (Mean Log Deviation)	0.009 **(9)**	0.059 **(16)**	0.059 **(16)**	0.001 **(2)**	0.042 **(3)**	0.042 **(3)**
GE(2)	0.011 **(3)**	0.088 **(12)**	0.088 **(12)**	0.001 **(1)**	0.061 **(2)**	0.061 **(2)**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of the total inequality (the standard method)
3) [bc] Between-group inequality as a percentage of the ELMO maximum potential between-group inequality or the ELMO maximum attainable between-group inequality with the original 'pecking order'

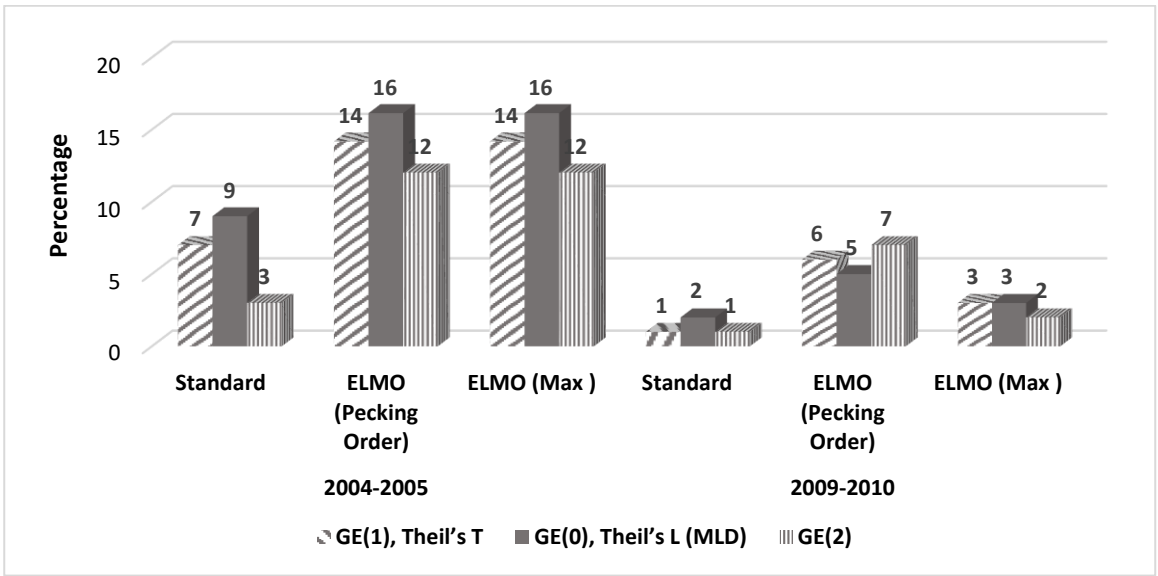


Figure 4.8 Comparison of between-group inequalities of Nargis- and non-Nargis-affected areas between the standard approach, and the ELMO approaches, with original pecking order and maximum between-group inequality

The percentages of the ELMO 'maximum possible' between-group inequalities measured by all GE indices (with the original 'pecking order' and without in 2004/05) were substantially larger than that of the ones in 2009/10. Thus, the significant drop in the percentage of ELMO 'maximum possible' between-group inequalities in 2009/10 can be partly because of the effect of Cyclone Nargis.

4.4.7 Decomposition of consumption expenditure inequality by employment status of household head

The employment status of a household head turns out to have a notable effect on household expenditure. In this decomposition, this research divides individuals into the following groups according to the employment status of household heads: 1) employer, 2) own account worker, 3) employee, 4) member of producer's cooperative, 5) contributing family worker, 6) casual labourer and 7) workers not classifiable as defined in IDEA and IHLCA (2007a) and IHLCA (2011a). Employment status is defined as household heads who are working or available for work. Thus, only household heads who are economically active are considered in this study, and household heads who do not participate in the labour force are excluded. In each surveyed year, two rounds of data collection are conducted in December/January and May to cover seasonal variations in employment. The data collected on labour force participation in the last 7 days of May 2005 and May 2010 are used for this study, as there are only small differences between the two rounds.

Table 4.14 presents the data on the main employment status of household heads for the economically active population. In terms of level of inequality, the population share of the own account worker was highest in 2004/05 and 2009/10 among different categories of the employment status of household heads. These data also indicate the changing nature of employment in Myanmar. There was a corresponding increase in the contribution of the own account workers from 48% in 2004/05 to 58% in 2009/10. The proportion of employers declined from 16% in 2004/05 to 9% in 2009/10. Employees and casual labourers stayed flat between the two years. However, the percentage of casual labourers went up from 16% to 18% between the surveys collected in December/January 2005 and 2010, though the results are not presented in the table. In terms of level of inequality, the highest expenditure inequalities of household heads in 2004/05 were found in those who were employers, at 0.212, 0.142 and 1.130 in GE(1), GE(0) and GE(2)

respectively. However, in 2009/10 the same results were observed only in GE(1) and GE(0)—not GE(2).

Table 4.14 also reports the importance of between- and within-components of total inequality, and the ELMO maximum between-group inequality with the original 'pecking order' in terms of GE indices with sensitivities 0, 1, and 2. Expenditure inequalities were highest in the employer group at all GE indices in both surveyed years, as expected. Even though the lowest inequality is found in members of producer's cooperative, their participation rate in labour force is negligible. In fact, the levels of inequality were lowest among the casual labourers in both study years. However, expenditure inequalities in all GE indices declined between the two years, in all employment types.

Table 4.14 Decomposition of consumption expenditure inequality by employment status of household head (1)

Household Group	2004-2005				2009-2010			
	Pop Share (%)	**GE(1)**	**GE(0)**	**GE(2)**	**Pop Share (%)**	**GE(1)**	**GE(0)**	**GE(2)**
Employer	**16**	**0.212**	**0.142**	**1.130**	**9**	**0.128**	**0.112**	**0.181**
Own account worker	48	0.106	0.092	0.173	58	0.098	0.077	0.228
Employee	13	0.098	0.091	0.127	14	0.078	0.072	0.093
Member of producer's cooperative	0.15	0.040	0.037	0.047	0.02	0.004	0.004	0.004
Contributing family worker	4	0.141	0.120	0.207	2	0.047	0.045	0.053
Casual labourer	15	0.053	0.052	0.058	14	0.043	0.043	0.046
Workers not classifiable	4	0.085	0.081	0.098	2	0.068	0.064	0.082
Total Inequality (%)		**0.134 (100)**	**0.106 (100)**	**0.441 (100)**		**0.099 (100)**	**0.082 (100)**	**0.192 (100)**
Within-group Inequality (%)		**0.123 (92)**	**0.095 (90)**	**0.430 (97)**		**0.091 (91)**	**0.074 (90)**	**0.183 (95)**
Between-group[a] Inequality (%)		**0.011 (8)**	**0.011 (10)**	**0.011 (3)**		**0.008 (9)**	**0.008 (10)**	**0.009 (5)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.092 (12)**	**0.088 (12)**	**0.102 (11)**		**0.079 (11)**	**0.068 (12)**	**0.150 (6)**
No. of observations				**12,419**				**12,911**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

The contribution of within-group inequality to total inequality of all GE indices is more than 90%, while the shares of between-group inequalities to total inequality of all GE indices calculated by the standard method are small. In terms of changes between 2004/05

and 2009/10, the contributions of differences of all GE indices of within-group inequalities to changes of total inequality over the study periods were high though the results are not presented in the table.

Between-group inequalities as percentages of the ELMO maximum attainable between-group inequalities with the original 'pecking order' were at around 10% in both years. They are not different from that of the standard method, especially in GE(0) and GE(1), indicating that there is very little overlap in the distribution of per adult equivalent expenditures among the different employment status of household heads. The ELMO maximum between-group inequalities were more than three times higher in 2004/05, for GE(2) index, compared with the contribution of between-group inequalities calculated by the conventional approach.

Table 4.15 Decomposition of consumption expenditure inequality by employment status of household head (2)

Household Group	2004-2005				2009-2010			
	Pop Share (%)	**GE(1)**	**GE(0)**	**GE(2)**	**Pop Share (%)**	**GE(1)**	**GE(0)**	**GE(2)**
Employer	**11**	**0.212**	**0.142**	**1.130**	**6**	**0.128**	**0.112**	**0.181**
Own account worker	32	0.106	0.092	0.173	40	0.098	0.077	0.228
Employee	9	0.098	0.091	0.127	10	0.078	0.072	0.093
Member of producer's cooperative	0.10	0.040	0.037	0.047	0.02	0.004	0.004	0.004
Contributing family worker	3	0.141	0.120	0.207	1	0.047	0.045	0.053
Casual labourer	10	0.053	0.052	0.058	10	0.043	0.043	0.046
Workers not classifiable	2	0.085	0.081	0.098	2	0.068	0.064	0.082
No participation in labour force	33	0.153	0.120	0.307	31	0.091	0.080	0.133
Total Inequality (%)		**0.140 (100)**	**0.111 (100)**	**0.395 (100)**		**0.097 (100)**	**0.081 (100)**	**0.174 (100)**
Within-group Inequality (%)		**0.133 (95)**	**0.103 (93)**	**0.388 (98)**		**0.091 (94)**	**0.075 (93)**	**0.168 (97)**
Between-group[a] Inequality (%)		**0.007 (5)**	**0.007 (7)**	**0.007 (2)**		**0.006 (6)**	**0.006 (7)**	**0.006 (3)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.100 (7)**	**0.095 (8)**	**0.114 (6)**		**0.083 (7)**	**0.072 (8)**	**0.129 (5)**
No. of observations				**18,634**				**18,609**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

In Table 4.15, household heads who did not participate in the labour force are also included. Their shares were about 30% in both surveyed years. The data collected on the labour force participation in the last 7 days of May 2005 and May 2010 were used for this study, as the data only slightly varied between the rounds. Household heads who did not participate in the labour force included "the following population groups: those unable to work for health reasons; those doing unpaid domestic work fulltime; full-time religious personnel; those who are physically or developmentally delayed and unable to work; those living on a pension or retired and others who are not seeking employment" (IHLCA, 2011, p.51). There were no unemployed household heads who looked for and could not find work in May 2005 and May 2010.

The same trend is found for the population shares and expenditure inequalities of these household heads as in the results without non-labour-force participant household heads. Also, similar percentages of the contributions of between-group and within-group to total inequality, and ELMO maximum between-group inequality with the original 'pecking order', were observed in inequality both its level and changes (though the results are not presented in the table for changes). However, the percentage of household heads who did not participate in the labour force went up from 29% to 31% between the surveys collected in December/January 2004 and 2009, though the results are not presented in the table.

4.4.8 Decomposition of consumption expenditure inequality by industry status of household head

The data collected on labour force participation in the last 7 days of May 2005 and May 2010 were used for this study as the data only slightly varied between the rounds, as in the study on employment. Table 4.16 shows data on industry status, based on the main economic activity of household heads. Overall, the agriculture, hunting and forestry industry is by far the biggest employer, accounting for half of total employment. The relative size of agriculture has remained unchanged since 2004/05. The relative size of manufacturing was small, employing around 5% of the economically active household heads in both years. These data imply that the structural transformation of the economy remains unchanged, and most people still are engaged in the agriculture sector.

The shares of household heads in the different industry status did not differ between the two years, apart from two categories. Those working in wholesale and retail trade, including repair, and hotels and restaurants, declined by about half, while those working in financial intermediation, real estate, renting and business activity increased by about half between the two surveyed years.

Table 4.16 Decomposition of consumption expenditure inequality by industry status of household head

Household Group (During the past 7 days)	2004-2005				2009-2010			
	Pop Share (%)	GE(1)	GE(0)	GE(2)	Pop Share (%)	GE(1)	GE(0)	GE(2)
Agriculture, hunting and forestry	51	0.071	0.068	0.090	52	0.065	0.057	0.114
Fishing	4	0.084	0.076	0.105	3	0.051	0.048	0.060
Mining and quarrying	1	0.144	0.140	0.178	1	0.092	0.071	0.170
Manufacturing	5	0.158	0.138	0.218	5	0.115	0.104	0.146
Electricity, gas and water supply, transport	**5**	**0.434**	**0.219**	**3.646**	6	0.114	0.089	0.311
Construction	4	0.074	0.069	0.088	5	0.065	0.059	0.079
Wholesale and retail trade incl. repair, and Hotels and restaurants	11	0.128	0.120	0.156	6	0.186	0.126	**0.579**
Financial intermediation, Real estate, renting and business activity	5	0.145	0.132	0.192	10	0.134	0.118	0.182
Public administration, education, health and social work, other community, social and personal services, and Extra-territorial org	11	0.119	0.108	0.153	10	0.090	0.084	0.107
Activities of private households as employers	2	0.327	0.204	0.971	**1**	**0.221**	**0.150**	0.460
Total Inequality (%)		**0.134 (100)**	**0.106 (100)**	**0.441 (100)**		**0.099 (100)**	**0.082 (100)**	**0.192 (100)**
Within-group Inequality (%)		**0.123 (92)**	**0.095 (90)**	**0.430 (97)**		**0.092 (92)**	**0.074 (91)**	**0.184 (96)**
Between-group[a] Inequality (%)		**0.011 (8)**	**0.011 (10)**	**0.011 (3)**		**0.008 (8)**	**0.007 (9)**	**0.008 (4)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.094 (12)**	**0.084 (13)**	**0.111 (10)**		**0.079 (10)**	**0.071 (11)**	**0.095 (9)**
No. of observations				**12,419**				**12,911**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

However, the changes in the industry status of household heads were opposite to the results of the 1st round survey collected in December/January 2004 and 2009, though the results are not presented in the table. In terms of level of inequality, the highest

expenditure inequalities of household heads in 2004/05 were found in those working in electricity, gas, water supply, transport, storage and communications at 0.434, 0.219 and 3.646 in GE(1), GE(0) and GE(2) respectively. However, the highest expenditure inequalities of household heads in 2009/10 were observed in those who were employers working in the private sector, seen in GE(1) and GE(0) but not GE(2).

In inequality levels, the contributions of within-group inequalities to total inequality of all GE indices are more than 90%, while the shares of between-group inequalities of all GE indices calculated by the standard method are near to or less than 10%. In inequality changes between 2004/05 and 2009/10, the differences of within-group inequality contributions to total inequality were much higher, compared with the contributions of changes in between-group inequalities, though the results are not shown in the table. The ELMO maximum between-group inequalities of GE(1) and GE(0) were at around 10% in both years, and they were not different from those of the conventional approach, indicating that there was very little overlap in the distribution of per adult equivalent expenditures among the different types of jobs of household heads. However, the maximum between-group inequalities were more than three times and two times higher in 2004/05 and 2009/10 respectively, for GE(2) index, compared with the contribution of between-group inequalities calculated by the conventional approach.

4.4.9 Decomposition of consumption expenditure inequality by occupation status of household head

The data collected on the labour force participation in the last 7 days of May 2005 and May 2010 were used for this study, as there were few differences between the rounds, as in the study on employment. Table 4.17 reports the composition of occupations in the labour market. The share of skilled agricultural and fishery workers was the highest among the different occupations of household heads in both surveyed years (42% in 2005 and 44% in 2010). The results show that all GE indices of white collar jobs—such as those working as legislators, senior officials and managers—were the highest, while the GE indices of low-skilled occupations (for example, sales and services elementary occupations, agricultural and fishery and related labourers), were the lowest among the main types of occupations in both surveyed years. The proportion of the household heads working as service workers, shop and market sales workers rose from 6% in 2004/05 and 9% to 2009/10.

Table 4.17 Decomposition of consumption expenditure inequality by occupation status of household head

Household Group (During the past 7 days)	2004-2005				2009-2010			
	Pop Share (%)	GE(1)	GE(0)	GE(2)	Pop Share (%)	GE(1)	GE(0)	GE(2)
Legislators, senior official and managers	**6**	**0.338**	**0.206**	**1.813**	**4**	**0.213**	**0.155**	**0.552**
Professionals	2	0.162	0.143	0.214	2	0.084	0.080	0.096
Technicians and associate professionals	3	0.114	0.104	0.145	3	0.127	0.111	0.177
Clerks	2	0.074	0.073	0.083	2	0.088	0.081	0.107
Services workers, shop and market sales	6	0.112	0.107	0.132	9	0.106	0.097	0.132
Skill agricultural and fishery workers	**42**	**0.069**	**0.066**	**0.087**	**44**	**0.063**	**0.055**	**0.118**
Craft, construction and related workers	10	0.096	0.088	0.118	10	0.098	0.079	0.159
Plant and machine operators and assemblers	4	0.141	0.128	0.192	3	0.134	0.102	0.408
Elementary occupations	25	0.069	0.066	0.079	22	0.055	0.052	0.062
Total Inequality (%)		**0.134 (100)**	**0.106 (100)**	**0.441 (100)**		**0.099 (100)**	**0.082 (100)**	**0.192 (100)**
Within-group Inequality (%)		**0.110 (82)**	**0.084 (80)**	**0.415 (94)**		**0.086 (87)**	**0.069 (85)**	**0.178 (93)**
Between-group[a] Inequality (%)		**0.024 (18)**	**0.022 (20)**	**0.026 (6)**		**0.013 (13)**	**0.013 (15)**	**0.014 (7)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.103 (23)**	**0.093 (23)**	**0.124 (21)**		**0.081 (16)**	**0.073 (17)**	**0.097 (14)**
No. of observations				**12,419**				**12,911**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

In terms of level of inequality, the within-group inequality contributions of the occupations of household heads to total inequality were at 82%, 80% and 94% of GE(1), GE(0) and GE(2) in 2004/05, and the proportions of the within-group inequalities slightly increased for GE(1) and GE(0) indices in 2009/10, but it remained almost unchanged for GE(2). In terms of inequality changes between 2004/05 and 2009/10, the GE(1) and GE(0) percentage contributions of differences of within-group inequality to changes of total inequality over the study periods were two times higher, compared with the GE(1) and GE(0) percentage contributions of differences of between-group inequalities to changes of total inequality, though the results are not presented in the table.

The ELMO maximum between-group inequalities measured by preserving their 'pecking order', in addition to fixing the number of sub-groups and their relative sizes, were 23%

each for GE(1) and GE(0) indices in 2004/05, and 16% and 17% for GE(1) and GE(0) indices in 2009/10. The ELMO maximum between-group inequalities were more than three times (21%) and two times (14%) higher in 2004/05 and 2009/10 respectively, for GE(2) index, compared with the contributions of between-group inequalities calculated by the standard approach.

4.4.10 Decomposition of consumption expenditure inequality by ethnicity of household head

This research uses the ethnicity data of household heads, broken into 12 categories, based on the language spoken: Kachin, Kayah, Kayin, Chin, Mon, Myanmar, Rakhine, Shan, other indigenous language, Chinese, Hindi /other Indian language, and other foreign languages. Household heads who were Myanmar made up a clear majority (72%) in 2004/05, and their share of the population remained the same at 71% in 2009/10. The next largest shares of the population at 7 % each in 2004/05 and 2009/10 were household heads who spoke the Shan language.

Household heads who spoke the Chinese language had the highest GE indices in both study years, despite their share of the population being only 1%. In addition, the contributions of within-group expenditure inequalities to the level of inequality were very high, and varied from 96% to 99% for different GE indices in both surveyed years. In changes between 2004/05 and 2009/10, the differences of total inequality of all GE indices were mainly due to the differences of within-group inequalities, though the results are not presented in Table 4.18. It turns out that for the groups as defined in terms of different ethnicity of household heads, there is no striking difference between the classic between-group contributions and the ELMO partitioning statistic.

Table 4.18 Decomposition of consumption expenditure inequality by ethnicity of household head

Household Group	2004-2005				2009-2010			
	Pop Share (%)	GE(1)	GE(0)	GE(2)	Pop Share (%)	GE(1)	GE(0)	GE(2)
Kachin	2	0.099	0.098	0.109	1	0.090	0.082	0.109
Kayah	0	0.067	0.064	0.074	0	0.059	0.054	0.073
Kayin	3	0.061	0.062	0.065	3	0.054	0.053	0.060
Chin	2	0.228	0.156	0.729	2	0.087	0.074	0.114
Mon	2	0.062	0.060	0.068	2	0.117	0.086	0.227
Myanmar	72	0.130	0.109	0.218	71	0.094	0.080	0.155
Rakine	4	0.054	0.053	0.058	4	0.055	0.055	0.059
Shan	7	0.189	0.130	0.485	7	0.089	0.077	0.132
Other indigenous language	4	0.123	0.110	0.162	5	0.077	0.072	0.092
Chinese	**1**	**1.611**	**0.735**	**12.922**	**1**	**0.720**	**0.381**	**2.869**
Hindi/other Indian language	2	0.120	0.108	0.153	1	0.117	0.110	0.149
Other foreign language	1	0.051	0.049	0.057	2	0.056	0.051	0.066
Total Inequality (%)		**0.140 (100)**	**0.111 (100)**	**0.395 (100)**		**0.097 (100)**	**0.081 (100)**	**0.174 (100)**
Within-group Inequality (%)		**0.137 (98)**	**0.107 (97)**	**0.392 (99)**		**0.094 (97)**	**0.078 (96)**	**0.171 (98)**
Between-group[a] Inequality (%)		**0.003 (2)**	**0.003 (3)**	**0.003 (1)**		**0.003 (3)**	**0.003 (4)**	**0.003 (2)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.081 (4)**	**0.072 (5)**	**0.120 (3)**		**0.068 (4)**	**0.060 (5)**	**0.092 (3)**
No. of observations				**18,634**				**18,609**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

4.4.11 Decomposition of consumption expenditure inequality by land ownership of household head

The data collected from households who had the rights to use land for agriculture, livestock, forestry and fishery activities (held by any member of the household) in May 2005 and May 2010 were used for this study. As shown in Table 4.19, 69% of households owned land in 2004/05 while the ownership increased to 76% in 2009/10. However, expenditure inequalities did not vary between the two groups for all GE indices in both surveyed years. The expenditure inequalities mainly occur within the groups, rather than between the groups, based on the calculations using the standard approach at the level of, and changes in, inequality (not shown in the table).

In inequality level, the ELMO maximum between-group inequalities were about two times higher for the GE(1) and the GE(0) indices compared with the contributions of between-group inequalities calculated by the standard approach in both study years. However, in the 2009/10 study period, the percentage of maximum between-group inequality of the GE(2) index—given its current income distribution, the number of groups, their sizes, and their ranking in terms of maintaining average income of original groups—was five times bigger than the percentage of standard between-group inequality of the GE(2) index.

Table 4.19 Decomposition of consumption expenditure inequality by land ownership of household head

Household Group	2004-2005				2009-2010			
	Pop Share (%)	GE(1)	GE(0)	GE(2)	Pop Share (%)	GE(1)	GE(0)	GE(2)
Land Owners	69	0.078	0.073	0.094	76	0.065	0.058	0.105
Landless	31	0.079	0.070	0.119	24	0.069	0.058	0.111
Total Inequality (%)		**0.080 (100)**	**0.075 (100)**	**0.102 (100)**		**0.068 (100)**	**0.060 (100)**	**0.109 (100)**
Within-group Inequality (%)		**0.078 (97)**	**0.073 (97)**	**0.100 (98)**		**0.066 (96)**	**0.058 (96)**	**0.107 (98)**
Between-group[a] Inequality (%)		**0.002 (3)**	**0.002 (3)**	**0.002 (2)**		**0.003 (4)**	**0.003 (4)**	**0.002 (2)**
ELMO maximum between-group inequality with the original 'pecking order' (%)[b]		**0.034 (6)**	**0.038 (6)**	**0.031 (7)**		**0.024 (10)**	**0.027 (9)**	**0.022 (11)**
No. of observation				**11,047**				**11,113**

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) [a] Between-group inequality as a percentage of total inequality (the standard method)
3) [b] Between-group inequality as a percentage of the ELMO maximum attainable between-group inequality with the original 'pecking order'

4.5 Conclusions

This chapter has examined how expenditure inequality varies within and across rural and urban areas, states and regions, Nargis- and non-Nargis-affected areas, and population groups by using the IHLCA data sets of 2004/05 and 2009/10. The decomposition exercises allow us to pin down the levels of aggregation at which a substantial amount of disparity is observed. It is crucial to know the extent of the contributions of between-group and within-group inequalities to overall inequality from a policy perspective. Thus, expenditure inequality was decomposed into between-group and within-group constituent

parts, to analyse cross-section data in individual years in the conventional way, and also to study changes of the components over the years. In addition, this study explores the 'maximum possible' between-group contributions of rural and urban areas, states and regions, and among the population groups, to total inequality, to check whether there are significant between-group differences compared with those of the conventional approach.

The decompositions employ breakdowns by urban and rural areas, states and regions, and Nargis- and non-Nargis-affected areas, by ethnicity, occupation, industry, employment and land ownership. The empirical results show that expenditure inequality varies significantly between rural and urban areas, states and regions, Nargis- and non-Nargis-affected areas, and among different population subgroups. The contribution of within-group inequality of rural and urban areas to total inequality in both levels and changes is higher than that of between-group inequality. Over the period 2004/05 and 2009/10, the changes in both between-group and within-group inequalities of rural and urban areas decreased significantly. The contribution of between-group inequality of rural and urban areas to total inequality in Myanmar decreased over the study period, while that of within-group inequality to total inequality correspondingly increased. A similar trend is found for the level of, and changes in, contributions of states and regions to total inequality as in the case of urban and rural areas. Therefore, the results confirm that a substantial part of expenditure inequality in Myanmar is not spatial.

The analysis of state and regional level inequalities indicates that almost all states and regions recorded reductions over the period 2004/05 and 2009/10, and 16 out of the 17 states and regions experienced a decrease in consumption inequality, except in Bago (West), over the survey periods. The Gini coefficients of all states and regions ranged from 0.180 in Kayin to 0.322 in Yangon and 0.323 in Chin in 2004/05, and from 0.160 in Chin to 0.258 in Yangon in 2009/10. However, the analyses of P90/P10 ratios reveal that Yangon and Taninthayi had the highest inequality in consumption expenditures in both surveyed years. Kayin state was consistently lowest in the ranking of inequality over the period 2004/05 and 2009/10.

In terms of employment, the highest expenditure inequalities of household heads were found in those who were employers, based on the results of all GE indices in 2004/05. However, the highest expenditure inequalities of household heads in 2009/10 were observed in those who were employers only at GE(1) and GE(0) indices, not GE(2). The

population shares of own-account workers were the highest in 2004/05 and 2009/10 among different employment status of household heads, both with or without inclusion of household heads who did not participate in the labour force. In terms of industry, the highest expenditure inequalities of household heads in 2004/05 were observed in those who were working in electricity, gas and water supply, and transport, storage and communications, at 0.434, 0.219 and 3.646 in GE(1), GE(0) and GE(2) respectively. However, the highest expenditure inequalities of household heads in 2009/10 were identified in those who were employers working in the private sector, in GE(1) and GE(0), but not GE(2).

The research also discovers that all GE indices of white collar jobs, such as legislators, senior officials and managers, were the highest, while the GE indices of low-skilled occupations (for instance, sales and services elementary occupations, agricultural and fishery and related labourers), were the lowest among the main types of occupations in both surveyed years. Overall, the agriculture, hunting and forestry industry was by far the biggest employer, accounting for half of total employment, and the relative size of agriculture remained unchanged since 2004/05. However, expenditure inequalities did not vary between land owners and landless in all GE indices, even though percentages of landless people were about 31% in 2004/05 and 24% in 2009/10. Household heads who spoke the Chinese language had the highest GE indices among 12 main languages in both study years, despite their share of the population being only 1%. In line with results from earlier studies, this research finds greater contributions of within-group inequality to total inequality in all groups compared with that of between-group inequality in each year, and also that contributions of within-group inequality slightly increased over the study periods.

In addition, the between-group inequality of Nargis- and non-Nargis-affected areas decreased by more than 80%, and the decreases of all GE indices are highly statistically significant. The decreases of the between-group inequality are also greater compared to that of the within-group inequality. All GE indices of within-group inequality of Nargis- and non-Nargis-affected areas also declined, and the decrease was larger in the GE(2) index, implying that the change was greater in the top part of expenditure distributions, however this is not statistically significant. Thus, the decomposition results provide interesting information for practical implementations. They help to identify the target level of aggregation to execute the appropriate policy. In general, the policy intervention

should aim to reduce within-group inequality in Myanmar, based on the differences in patterns and trends of the between and within components of national inequality.

Kanbur (2006) argues that decomposition analyses alone cannot decide the most appropriate policy instruments. Kanbur (2006) suggests considering 1) a thorough study of the proposed policy instruments, 2) its costs, and 3) its specific impacts on the inequalities of between-group and within-group. Nevertheless, this research provides valuable information of how between-group and within-group components of expenditure inequality vary based on the target aggregation levels. Therefore, decomposition of consumption expenditure inequality should be conducted according to the interested target level of aggregation in Myanmar when designing a suitable policy framework to balance the inequality between- and within- population groups. This decomposition exercise can be extended to other population groups, such as those defined by age, sex, or education, which are the individual characteristics found to be associated with the distribution of income (expenditure), as further research for Myanmar.

Chapter 5

Regression-based analysis of the factors contributing to consumption inequality in Myanmar: 2004/05 and 2009/10

5.1 Introduction

This chapter examines the influencing factors on the level of, and changes in, consumption expenditure inequality in Myanmar. As documented in Chapter 3, the estimation results indicate that the nationwide Gini coefficient for expenditure per adult equivalent decreased from 0.256 to 0.220 over the period 2004/05 to 2009/10. The downward trend is statistically significant and robust to the choice of inequality indicator. The question remains as to what caused this change. This research is important in that Myanmar's political landscape has been changing since 2011 when a nominally civilian government took over from the previous military government, under the road map of what was called 'Discipline-flourishing democracy'. Subsequently, the opposition party, the National League for Democracy, won a landslide victory in the November 2015 election. Thus, the Myanmar people expect to see profound social and economic reforms, and these reforms are likely to increase income disparities among households. Examining the influencing factors on the levels of expenditure inequality and its changes should provide analytical information for a comprehensive policy framework to plan ahead in order to ensure inequality is kept at a low level, and to address potential inequality-increasing elements.

With this aim, a regression-based inequality decomposition technique is adopted, after analysing the static inequality decompositions in Chapter 4. Knowing what factors determine the level of, and changes in, expenditure inequality over time "would highlight whether existing inequalities are due to intrinsic unchangeable characteristics, such as location or ethnicity, or due to variables whose distribution can be changed through policy, for instance, through broadening access to education services" (Naschold, 2009, p.747). However, Azevedo, Inchauste, and Sanfelice (2013) stress that "one way to

answer these questions would be to use multi-year panel data that could track the life and labor histories of households over time and therefore explore the sources of inequality reductions" (pp.2-3). As reported in Chapter 2, there are no data available for long periods in Myanmar and only two one-year data sets (2004/05 and 2009/10) are available. However, the nationally representative surveys (Integrated Household Living Conditions Assessment (IHLCA) conducted by UNDP Myanmar and the Ministry of National Planning and Economic Development in 2004/05 and 2009/10) do exist and the IHLCA survey in 2009/10 contains a panel of 50% from the IHLCA 2004/05 sample of households.

This study uses these data and applies the Fields (2003) regression-based methodology using Shorrocks' (1982) inequality decomposition techniques, based not on wages and other sources of income, but on the results of micro-econometric estimation of the determinants of expenditures. The regression-based approach, in which an expenditure function is regressed on economically meaningful variables such as the level of education, occupations of household members and geographic dummies, is in line with standard human capital and production theory, along with other theoretical concepts and past empirical findings. The estimates of the expenditure equations are subsequently used to calculate the so-called 'relative factor inequality weights'. This allows the expenditure function to be decomposed into its exogenous causal factors. This decomposition technique is exact (adds to one), independent of choice of inequality index and allows analytical interpretations. Thus, the Gini coefficient and Generalized Entropy indices are employed in this study to assess how much geographical characteristics or the levels of education of household members contributed to total expenditure inequality in 2004/05 and 2009/10, and changes in total expenditure inequality over time, while controlling for other factors such as the characteristics and endowments of the individuals and their households.

The diversity of experience in determining the driving forces behind rising or declining income (expenditure) inequality across countries in the 2000s implies that there is no single satisfactory explanation for these trends. Wan (2007) identifies that location and location-related factors are the key contributors to total regional inequality, but the percentage contribution has declined over time. Molini and Wan (2008) report that the major determinants of the inequality are location, education, and infrastructure. Between 1993 and 1998, the contributions of land, credit access, and ethnicity to total inequality

decreased while those of education, physical capital, labour and community infrastructure rose. Using panel data from rural Pakistan, Naschold (2009) also finds that "land ownership is key to explaining the level of inequality, but not its changes. In contrast, higher education drives changes, but not the level of inequality. Household location affects both, reflecting growing differences in market access across regions" (p.746). In a study on regression-based inequality decomposition using Atkinson's index in India, Bigotta, Krishnakumar and Rani (2015) conclude that education, household size, employment status and regional differences are the largest contributing factors to income inequality in both rural and urban areas.

This research builds on, and contributes to work in expenditure inequality research. Although numerous studies have identified the magnitude of classic inequality indices, less analytical attention has been paid to the reasons that inequality increased or decreased over time. Although several researchers have undertaken this type of research for a number of countries, there has not been a similar study in Myanmar, due to the difficult access to nationally representative data. Myanmar has long experienced civil wars related to distributional issues, but an empirical study of the determinants of the level of, and changes in, consumption inequality is lacking. Therefore, the broad aim of the study is to decompose total expenditure inequality by using the Fields' regression-based approach for Myanmar. The study aims to answer the following questions relating to the 2004/05 and 2009/10 data:

1) What are the factors contributing to the level of consumption expenditure inequality in Myanmar?
2) What are the factors that contributed to the change in consumption expenditure inequality between 2004/05 and 2009/10 in Myanmar?

This research contributes to new knowledge about Myanmar as this is the first study to explore the factors influencing the level of, and changes in, expenditure inequality for Myanmar. In addition, this is the first research to report the flaws of the Yun (2006) approach. This research identifies and quantifies the major determinants of the level of, and changes in, consumption expenditure inequality over the study periods. The likely expenditure disparities during the times of liberalizing reforms can be controlled, based on the findings of this research. Molini and Wan (2008) affirm that "a quantitative analysis on inequality determinants might be used in deciding the tools and the targets for

redistributive policies. For example, government can better justify infrastructure investments in poor regions if location is found to be dis-equalising and contributing for a significant amount to total inequality" (p.76).

The findings of the study show that location and regional effects, occupation, and levels of education of household members are all key to explaining both the levels of, and changes in, inequality for all households and panel households, and for rural and urban households. Region specific variables are the main contributors to the narrowing of expenditure inequality and they explain about 35%, 43%, 23% and 19% of the changes in the Gini coefficients for all, and for panel, households, and for rural and urban households, respectively. The shares of household members with different types of occupation contributes about 22%, 16%, 32% and 11% of the reduction in expenditure inequality for all, and for panel, households, and for rural and urban households (in order). The analysis also indicates that the favourable change in the level of education of working-age adults has an impact on decreasing inequality by about 14%, 18%, 18% and 10% for all, and for panel, households, for rural and urban households (in sequence). This finding is in line with those of other studies; for example, the study of Heltberg (2002) in Vietnam, which also finds that the regional effect is a prominent factor in the reduction of inequality. Though the analysis using the Fields (2003) approach explains only about one-third of the expenditure inequality of Myanmar, as in other studies (Guanatilaka and Chotikapanich, 2009, for example), the decomposition results are reliable.

The contributing factors are further investigated as to whether they are effects of coefficients or characteristics on the change in the inequality measures by using Yun's (2006) decomposition approach. Yun (2006) unifies the approaches of Juhn et al. (1993) and Fields (2003) to decompose the changes in income inequality between two time periods and his approach is limited and only to apply for the variance of log expenditures: there is an apparent defect in the decomposition approach of Yun when the method is examined using an alternative way of specifying the auxiliary expenditure equation.

This chapter is organized as follows. Section 2 provides a literature review, and then Section 3 introduces the regression-based inequality decomposition methodologies to identify the causes of inequality. Section 4 presents the descriptive statistics and discusses the regression results, and explains the determinants of the level of, and changes in, consumption expenditure inequality by using the Fields (2003) decomposition. Section 5

draws conclusions on the policy implications based on the findings of this study. Appendix: 5-A shows the maps of Gini coefficients by Myanmar's state and region, and rural and urban areas. Appendix: 5-B discusses the regression results for all households and panel households, and for rural and urban households.

5.2 Literature review

5.2.1 Traditional approaches to inequality decomposition

The literature on the decomposition of inequality measures is widely recorded. Conventional inequality decomposition commonly follows Shorrocks (1980, 1982, 1984) and Bourguignon (1979). Two inequality decomposition techniques are mainly used in the literature. They are (1) the inequality decomposition by income sources following Fei et al. (1978), Pyatt, Chen and Fei (1980) and Shorrocks (1982) and (2) inequality decomposition by population sub-groups in the form of Blinder (1973), Oaxaca (1973) and Shorrocks (1984). The first approach calculates the contribution of individual income components to total inequality, and the second approach estimates the contributions of within-group and between-group of the population to the observed inequality.

There are also studies on the relationship between economic growth and the family distribution of income. For example, Fei et al. (1978) study the underlying causal relationships between economic growth and the family income distribution. Shorrocks (1982) separates the income of individuals or households into its components, such as labour income, investment income, and transfer income, and estimates the contributions of these components to total income inequality. Shorrocks (1984) examines "the implications of imposing a weak aggregation condition on inequality indices, so that the overall inequality value can be computed from information concerning the size, mean, and inequality value of each population subgroup" (p.1369). Fields (1998) argues that "decomposition by income sources is also problematic. While the results from the decomposition indicate the contribution to income inequality of income components, such as wages, property income and transfer income, it cannot quantify the effect on income inequality of contributing factors such as gender, education and experience" (as cited in Deng & Shi, 2009, p.603). Thus, Kanbur (2000) contends that there are "two key areas where our understanding of inequality is weak. These are the causes of inequalities at country level, and the causes of inequalities at different levels of aggregation between

broadly defined groups, for example by household demographics, education, region, or ethnic group" (as cited in Naschold, 2009, p.749).

In the decomposition of population subgroups, researchers are able to identify the 'between-group' attribute that is due to differences in mean incomes across subgroups, for instance, population subgroups in rural and urban areas. In addition, the 'within-group' attribute can be identified as inequality within the population subgroups in rural and urban areas. However, the conventional approaches cannot control for other factors when identifying and measuring the contribution of a particular variable. In addition, for the decomposition by population groups, Morduch and Sicular (2002) state that the sample can be grouped into discrete categories, for example, gender, region or individuals with different levels of education to quantify how gender, education, etc., effect inequality. In addition, Morduch and Sicular (2002) stress that "the decomposition can only be carried out over discrete categories even though some factors like age are more appropriately considered as continuous variables" (p.93). Deng and Shi (2009) again point out that "although artificial disaggregation based on continuous variables enables decomposition by groups, the threshold for each category lacks economic justification" (p.603). Thus, the decomposition by subgroups only answers the question of how income is different for 'between' and 'within' components, but it does not explain why it varies. Both are typically descriptive methods rather than analytical (Cowell & Fiorio, 2011). Therefore, Morduch and Sicular (2002) remark that even though it is a useful application for policy-makers, it has limitations.

5.2.2 Alternative approaches: quantile regression and semi- and non-parametric techniques

The conventional approach to the topic has been based on the mathematical properties of inequality indices and it allows inequality accounting but not a causal analysis. Conditional and unconditional quantile regressions are the other techniques in inequality decomposition. Koenker and Bassett (1978) and Koenker (2005) introduce the conditional approach by using characteristics of the conditional distribution (median, upper, and lower quartiles, or different percentiles). Firpo, Fortin, and Lemieux (2009) propose the unconditional quantile regressions which "consists of running a regression of the (re-entered) influence function (RIF) of the unconditional quantile on the explanatory variables" (p.953). DiNardo, Fortin and Lemieux (1996) propose the semi-parametric

technique and Deaton (1997) introduces the non-parametric technique. The whole distribution of income is modelled and compared in terms of density functions in these techniques.

5.2.3 Regression-based approaches

Unlike the traditional methods of inequality decomposition, researchers are able to include plausible explanatory variables including both discrete and continuous ones based on the social, demographic and economic theories in the regression-based decomposition. The main attractiveness of this method is 1) the contribution of fundamental variables to total inequality, which can be estimated with several control variables, 2) the endogeneity problems such as reverse causality can be addressed. Therefore, Wan (2002) contends that "it enables identification as well as quantification of root causes or determinants of inequality. The number of determinants can be arbitrary and even their proxies could be used. Owing to its vast flexibility and accommodating characteristics, the regression-based approach is expected to attract much attention and gain popularity" (p.1).

5.2.3.1 The method of Juhn, Murphy and Pierce (JMP, 1993)

Several economists have developed the regression-based approach to inequality decomposition. Oaxaca (1973) and Blinder (1973) are pioneers in examining discrimination in the labour market "to estimate the average extent of discrimination against female workers in the United States and to provide a quantitative assessment of the sources of male-female wage differentials" (Oaxaca, 1973, p. 693). They answer the questions of "how much of the white-black wage differential is attributable to the superior education of the whites? How much of the male-female differential is due to the fact that men have easier access to the high-paying occupations? It is questions such as these which this paper seeks to answer" (Blinder, 1973, p.437). The Oaxaca and Blinder methods both decompose differences in means between groups. However, their approach has been criticized for taking into account only the 'differences in mean outcomes', but the distributions may differ for other significant features such as dispersion (Wan 2002; Jenkins & Van Kerm 2009). Juhn et al. (1993) relax the application of Oaxaca and Blinder using only the mean income by allowing for the differences of the decomposition of the between-group in full distribution. The method of Juhn et al. (1993) is similar to the decomposition exercise of Oaxaca type for wage differentials. They show that "the differences in earnings inequality may be decomposed into a part explained by the

differences in the coefficients of earnings equations (coefficients or price effect), partly explained by the differences in observable quantities (characteristics or quantity effect), and partly explained by the differences in distribution of unobservables (residuals effect)" (as cited in Yun, 2006, p.128). The requirement to work on a linear income-generating function is also relaxed by the more sophisticated ones based on micro econometric modelling with endogenous behaviour as proposed by Bourguignon, Fournier and Gurgand (2001). Bourguignon et al. (2011) also advocate a comparative static approach based on the Blinder–Oaxaca decomposition to decompose differences in income distribution into three categories: price effects, participation effects, and population effects. Obviously, these efforts were only devoted to aggregate contributions to total inequality.

5.2.3.2 The method of Morduch and Sicular (2002)

For decomposing an inequality measure, Morduch and Sicular (2002) apply the formula used by Theorem 1 of Shorrocks (1982). In their study, they apply the regression-based approach to decompose the inequality of the average income of 259 farm households of 16 villages in Zouping County in Republic of China during 1990-1993 using a standard linear specification. Their study decomposes Theil-T, squared CV/variance, alternative CV, and the Gini coefficient to quantify the sources of the inequality based on the variables which are grouped into regional segmentations, human capital accumulation, and political variables. Their findings show that in all decompositions the contributions of spatial characteristics are large whereas the contribution of political variables is relatively small. De Hoyos (2007) notes that "Morduch and Sicular (2002) integrate inequality decomposition by factor components and population subgroups using a semi-parametric methodology" (p.13).

However, the approach of Morduch and Sicular (2002) varies both with the inequality indices used and the rule of factor decomposition used. Bigotta et al. (2015) contend that "the factor shares obtained by Morduch and Sicular (2002) vary with the inequality measure chosen" (p.1235). Also, their results (that is, the relative contribution of each factor) are sensitive to the inequality index employed. For instance, human capital and demographic variables strongly reduce inequality when using Theil's T index. However, these factors contribute moderately to measured inequality when using the Gini coefficients. Wan (2002) claims that only additively decomposable measures of

inequality, and more specifically Theil's T measure of inequality, are able to be used in Morduch and Sicular (2002)'s approach. The use of other measures is either troublesome or not possible (for example, coefficient of variation (CV)). Furthermore, under the framework of Morduch and Sicular (2002), the most popular inequality measure—the Gini coefficient—does not satisfy their property of uniform additions.

Wan (2004) points out that "the residual term and the constant term, which is a uniform addition to or deduction from income from all recipients, may or may not contribute to total inequality depending on the particular inequality measure used. This measure-dependent feature is a deficiency of the Morduch and Sicular (2002)'s framework" (p.350). Apart from using the linear functional form (or the inequality index adopted), a study which leaves 70% or 80% of inequality to the residual term, as in Morduch and Sicular (2002)'s approach, can be regarded as useless or, of very limited value (Wan, 2002). In contrast, the Fields (2003) decomposition approach constitutes the contribution of the regression error to total inequality, but this is sometimes likely to be large, and consequently the major part of inequality is unexplained (Gunatilaka & Chotikapanich, 2009).

Morduch and Sicular (2002), and Fields and Yoo (2000) adopt the approach of Shorrocks (1999) for the inequality decomposition based directly and entirely on the traditional regression equations. Fields and Yoo (2000) apply the Fields (1998) method to South Korea's labour market to assess the percentage contribution of each variable to wage inequality. The level of income equality is influenced by job tenure, gender, years of education, and occupation while the changes in income equality are explained by years of education, industry, occupation, and potential experience. Wan (2004) highlights some limitations of the Fields and Yoo (2000) method. The serious ones are: (i) the income generating function must be a semi-log linear function; (ii) inequality must be measured over the logarithm of income; and (iii) the constant term in the income-generating function does not contribute to inequality. Under this restriction, Fields (1998) uses the squared CV to decompose income inequality. Wan (2002) argues that "the CV measure is known to violate the crucial principle of transfer" (p.1). Morduch and Sicular (2002) also state that the variance of logs used in the Fields (1998) method does not satisfy the 'Principle of transfers' (Dalton, 1920; Pigou, 1912).

In addition, Wan (2002) contends that measuring inequality over the logarithm of income is not desirable because it distorts the whole distribution picture. However, "it could be argued that a semi-log or double-log income-generating function is better than the linear form in that the predicted values of income from logarithmic models are guaranteed to be non-negative" (Wan, 2002, p.9). Wan (2004) also argues that the scaling of variables may distort the results of inequality decomposition though it may not affect the rankings of income.

5.2.3.3 The method of Fields (2003)

Fields (2003) proposes a semi-parametric method with a simple regression-based decomposition to analyse labour earnings inequality in the United States for variables such as gender, race, experience, schooling, occupation, industry, and region. Fields indicates that exogenous variables in the regression function can be regarded the same as factors in the inequality literature. One advantage of the Fields method is that each factor (for example, education) in the regression specification can contribute to total inequality. This decomposition technique is exact (adds to one), and allows analytical interpretations. Thus, the Fields method provides an innovative method to connect the divide between statistical analysis of inequality and economic theories of its causes. The Fields (2003) approach uses Theorem 3 of Shorrocks (1982). The formula for factor shares for any inequality indices (Gini, variance, coefficient of variation, Theil's measure, etc.) satisfies Shorrocks' six assumptions. This method begins with a decomposition of income, (rather than inequality of income), into its components which are replaced by the estimates obtained from a regression. Therefore, the Fields method is different from that of Murdoch and Sicular (2002), as the authors decompose the inequality of household incomes even though they are both regression-based.

The Fields approach discussed below, decomposes total inequality. In addition, Fields (2003) mainly answers two questions with his proposed method: 1) "given an income-generating function estimated by a standard semi-log regression, how much income inequality is accounted for by each explanatory factor? 2) denoting the two countries, groups, or dates by 1 and 2 respectively, given estimates of comparable income-generating functions how much of the difference in income inequality between one country and another, between one group and another within a country, or between one

date and another is accounted for by education, by potential experience, and by the other explanatory factors?" (Fields, 2003, p.2).

5.2.3.4 The method of the Shapley value decomposition

The Shapley value approach advocated by Shorrocks (1999) decomposes inequality totally, thus accounting for all parts of the income-generating equation including the error term. This approach is based on the concept of cooperative game theory and it can be applied with any income-generating functional form of the inequality indices. The Shapley value decomposition "yields an exact additive decomposition of inequality index into all possible contributory factors. It offers a unified framework capable of handling any type of decomposition exercise." (Shorrocks, 1999, p.3).

The Shorrocks (1999) approach using the Shapley value decomposition methodology "is based on the marginal effects of the contributing factors on inequality, each of which measures the change in inequality after isolating a factor. Because there are many sequences of isolating factors, the marginal effect of a particular factor is not unique. Shorrocks (1999) suggests taking averages of all possible marginal effects to quantify the contribution of that factor to inequality" (as cited in Deng & Shi, 2009, p.604). Shorrocks (1999) and Sastre and Trannoy (2002) show that the Shapley value decomposition is symmetric in all variables and also it is sensitive to the inequality index applied. However, when Wan (2004) employs it for Chinese data, and Epo and Baye (2013) apply it for the 2007 Cameroon household consumption survey, by using a log-linear income generating function, they find that the sensitivity to the inequality index is not high.

In the context of the Shapley decomposition, two calculations are reasonable: 1) zero income inequality decomposition (that is, any equally distributed component of income makes no contribution to overall inequality (Shorrocks, 1999)), 2) equalized income inequality decomposition. Sastre and Trannoy (2002) suggest to "1) avoid the use of the zero income decomposition as it is highly volatile, and (2) apply the Nested Shapley rule" (p.75). However, Sastre and Trannoy (2002) argue that "these solutions might face some difficulty in finding a sensible economic interpretation and some empirical 'solutions' only circumvent the problem without solving it" (as cited in Cowell & Fiorio, 2011, p.511). Furthermore, Cowell and Fiorio (2011) contend that "despite its internal consistency and attractive interpretation, the Shapley value decomposition in empirical

applications raises some dilemmas that cannot be solved on purely theoretical grounds" (p.511). Charpentier and Mussard (2011) also find that "the results derived from the Shapley value are either different or identical to traditional decomposition techniques. They cannot be better. They are different for two things: either the Shapley value is modified in order to capture different contributions or the Shapley value is applied to inequality (poverty) measures that rely on different axiomatic shapes in order to capture different contributions" (p.531). However, Chantreuil and Trannoy (2013) propose the methods of decomposing inequality measures by income sources based on the Shapley value and extensions of the Shapley value of transferable utility cooperative games. The authors find that the Owen[52] value can be applied in their proposed procedure, "for instance, some income sources can be labelled as market incomes, while others can be considered as transfers. With the Owen decomposition rule, the contribution of, for example, labour income would be independent of the number of sources gathered under the label of transfers" (p.87). They also prove that "the axiomatization by the potential of Hart and Mas-Colell[53] remains valid in the presence of the domain restriction of inequality indices" (p.83).

5.2.3.5 The method of Wan (2004)

Wan (2002) contends that a possible deficiency of the Shapley value approach is attributing zero contributions to constant terms in regression models. Thus, Wan (2002, 2004) relaxes this limitation and the studies by Wan (2004), Wan and Zhou (2005), and Wan and Zhang (2008) combine the Shapley value framework of Shorrocks (1999) and the regression-based decomposition approach for China by using several inequality indices. Wan (2004) expands the Shapley approach, taking the constant and residual terms into account fully. Following the before-after principle of Cancian and Reed (1998), the residual contribution is simply equal to $I(Y) - I(\hat{Y})$, where $\hat{Y}$ is the predicted income value based on the estimated regression model, and I denotes any inequality measure when assuming $\hat{u} = 0$, where $\hat{u}$ is the residual term (Wan, 2004). After estimating semi-log income functions, Wan (2004) "transforms the predicted logarithmic income term to an income term in which the constant term is simply a multiplier of income that has no effect on inequality" (as cited in Deng and Shi, 2009, p.605).

[52] Owen (1977)
[53] Hart and Mas-Colell (1989)

However, Deng and Shi (2009) further contend that Wan (2002, 2004) "treats the constant and residual terms differently from the explanatory variables. The effects of the deterministic part on inequality are quantified by applying the Shapley decomposition, whereas the contributions of the constant and residual terms are computed simply by subtracting the contributions of the earnings determinants from total inequality" (p.605). Deng and Shi (2009) also assert that there are still issues to be dealt with in the application of dummy variables in the regression-based decomposition techniques. Specifically, the coefficients of the explanatory variables and the coefficient of the constant term are influenced by the choice of the reference groups for the dummy variables. To solve this problem, Ximing, Sicular, Shi and Gustafsson (2008) propose a standard transformation of the dummy variables. To do this, a single variable that aggregates all the dummy variables is constructed. It equals the sum of the estimated coefficients on the dummy variables multiplied by the values of the dummy variables for all observations in the sample. The next step is to "calculate the mean of this aggregate dummy variable, and then subtract from the aggregate dummy variable its mean. The constant is then adjusted to include the mean of the aggregate dummy variable" (p.116). The authors note that this reconstruction of the dummy variables in the regression equation makes the decomposition produce a consistent result, regardless of how the dummy variables were originally constructed. However, Ximing, Sicular, Shi and Gustafsson (2008) note that "the decomposition so carried out, however, can identify only the aggregate contribution of all dummy variables to inequality, and not the separate effects of individual dummy variables" (p.116).

5.2.3.6 The method of Yun (2006)

Yun (2006) integrates the approaches of Fields (2003) and Juhn et al. (1993). The Fields (2003) approach has the advantage of decomposing the contribution of a factor to the change in inequality. The approach of Juhn et al. (1993) has the advantage of decomposing the contribution into coefficients (price), characteristics (quantity) and non-observable effects (residuals) at the aggregate level by using an auxiliary equation. Yun (2006) shows a way to combine the methods of Juhn et al. (1993) and Fields (2003) based on the changes in earnings inequality in America, 1969-99. Yun (2006) notes that "the shortcoming of the unified method is that it is limited to the variance of log-earnings as the Inequality index. This method cannot be applied to percentile differences in log-

earnings, e.g. 90–10, 90–50, and 50–10, used in JMP (1993) or various other inequality indices used in Fields (2003)" (p.131).

5.2.4 Findings of empirical studies

Several applications of the regression-based income inequality decomposition are found in the literature. There are many studies concerned with inequality in rural China since the late 1970s economic reform specifically with its high economic growth and high inequality. Wan and Zhou (2005) combine both the Shapley value framework of Shorrocks (1999) and the regression-based decomposition proposed by Morduch and Sicular (2002) to examine the determinants and the changes of income inequality in rural China with household-level datasets for 1995–2002. They find that while geography has been the prominent factor, it is less important in contributing to total inequality. Capital input appears as a major factor of income inequality. Farming structure is the most significant factor, compared with labour and other inputs, in explaining income inequality across households. Arayama, Kim, and Kimhi (2006) discover that family size and its composition, as well as land ownership, are the main determinants of the inequality for Korean farm households. They also extended the regression-based decomposition method suggested by Morduch and Sicular (2002) to estimate regime-specific income-generating functions for Korean farm households using a micro dataset collected in 2003.

In a study of rural and urban areas in Nigeria, "urbanization, residence in the southwest zone, household size, house head's formal education, number of time[s] suffered from illness, engagement in paid job, involvement in non-farm business, formal credit and informal credit" (p.45) are core factors to increase income inequality in 2004 (Oyekale, Adeoti & Oyekale, 2007). Guanatilaka and Chotikapanich (2009) apply three regression-based approaches to decomposition—the Fields method, the Shapley value decomposition and the Yun approach—when exploring Sri Lanka's expenditure inequality. Their study finds that the rich enjoy a faster expenditure growth, resulting in increased inequality. The change in inequality is mainly because of differential access to infrastructure, education, and occupation status. However, demographic factors consisting of ethnicity and spatial factors contributed very little.

Cain, Hasan, Magsombol, and Tandon (2010) also use the regression-based decomposition (as proposed by Fields (2003)), on consumer expenditure surveys to

investigate the poverty and inequality of 17 major states of India in 1983, 1993, and 2004. The explanatory variables are age, gender, social group, production sector, occupation, level of education, and state of residence. Epo and Baye (2013) test potential endogeneity and unobserved heterogeneity of artificial variables for education and health, while controlling for other correlates of household consumption, (using the 2007 Cameroon household consumption survey). They find that education, health, urban residency, household size, the share of active household members working in the formal sector, and farmland ownership are the main determinants of household income inequality, in that order.

As a methodological contribution, Devicienti (2010) proposes a Shapley value-based methodology to solve the problem of path-dependency exhibited by existing approaches. Devicienti (2010) computes "the contributions due to (1) changes in sample observable characteristics, (2) changes in the return of characteristics, (3) changes in the distribution of unobservable characteristics" (p.35). His decomposition of changes in the Italian wage distribution shows that the ordering of factor elimination matters for the results. To do this he uses the Worker History Italian Panel data on employees in private firms for the years 1985–1999.

Using the data drawn from the Survey of Household Income and Wealth in Italy, Manna and Regoli (2012) also employ the Fields (2003) approach and the Shapley value method to estimate a panel data regression model by pooling the observations on a cross-section of individuals over several time periods with time invariant unobserved random effects (Wooldridge, 2010). They find that gender, and human capital, as well as non-human capital, are the major factors in explaining the observed income inequality in Italy between 1998 and 2008. On the other hand, the work status and the area of residence only influence income inequality in a marginal way.

In contrast, Bigotta et al. (2015) provide theoretical contributions to the regression-based decomposition by deriving "the asymptotic distribution of all share estimators for obtaining their standard errors necessary for drawing inference" (p.1233). They argue that the application of the Fields (2003) approach under the Shorrocks (1982) framework is not directly applicable to Atkinson's inequality index. Their findings show that the key significant factors contributing to income inequality in both rural and urban areas in India are education, household size, employment status and regional differences.

5.2.5 The method chosen for this research

As presented above, the regression-based decomposition approaches have advantages and disadvantages. Also, complete agreement on methodology does not exist in the literature as to the best way to measure exactly how factors contributes to inequality and what factors influence expenditure inequality. Most empirical researchers apply the regression-based decomposition proposed by Fields (2003) and the Shapley value decomposition. In the case of Myanmar, there is, so far, no study on regression-based decomposition approaches to inequality, though the regression-based inequality decomposition has attracted many research attempts to identify the factors explaining the level of, and changes in, income (expenditure) inequality. In light of the above review of the literature, the Fields approach is a fairly simple exercise and straightforward to program computationally; however, it is time consuming, given the number of variables to be considered for addition in the regression analyses. The Shapley decomposition approach is computationally intensive and the number of variables needs to be limited to be included in the regression analyses, as each variable has to have its marginal impacts computed. Therefore, in order to be able to include plausible variables in the regression model based on the human capital theory, along with other theoretical concepts and past empirical findings, this research investigates the factors contributing to level of, and changes in, consumption expenditure inequality over time by adopting the Fields (2003) regression-based inequality decomposition techniques and applying these to cross-sectional methods with the IHLCA data sets from Myanmar.

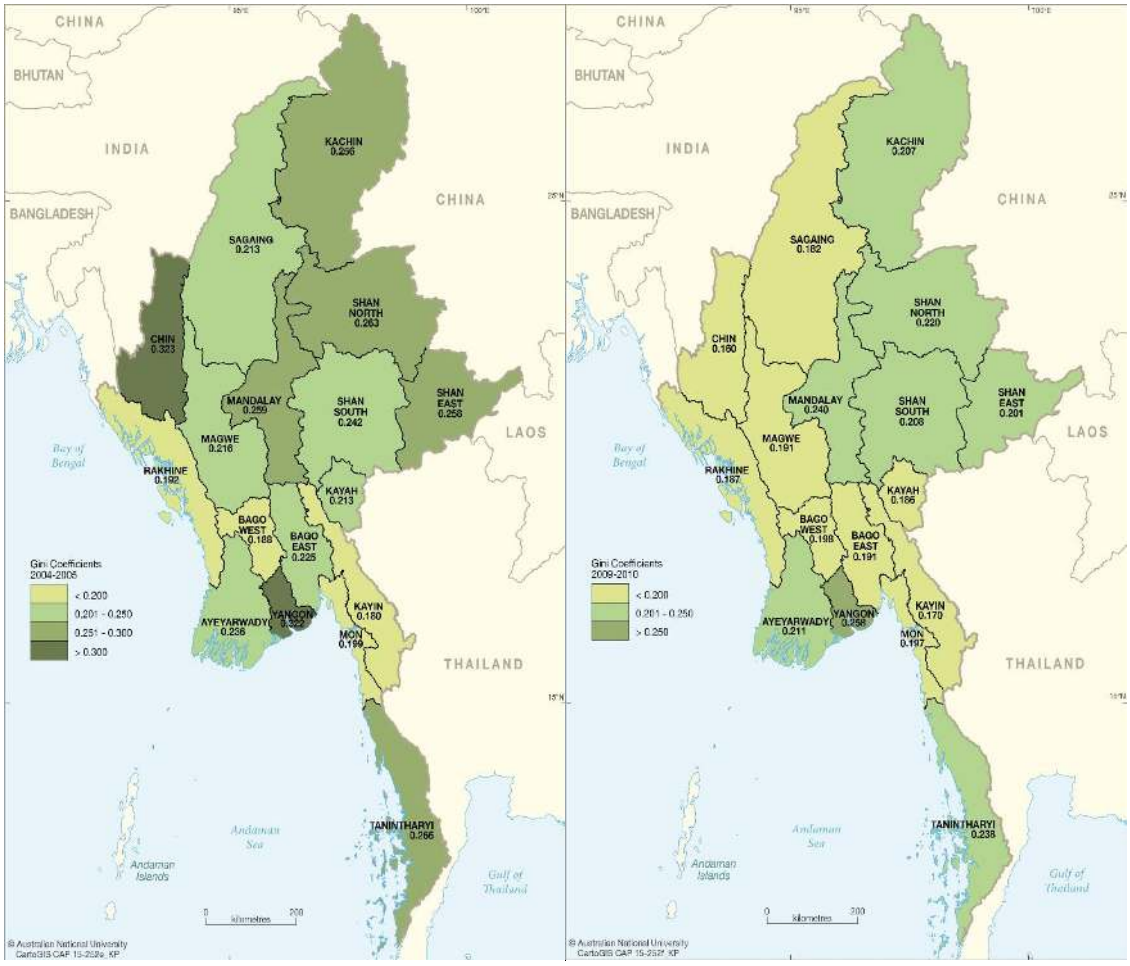
5.3 Methods

5.3.1 Data sources

The data from the 2004/05 and 2009/10 IHLCA surveys are used in this research. As reported in Chapter 2, the IHLCA survey in 2009/10 retains a panel of 50% from the IHLCA survey in 2004/05, and the survey designs and methodology used are broadly comparable. Household expenditure data are adjusted, based on the equivalence scales as reported in Chapter 2 of this study and in December 2009 Kyat.

The regression analyses of this research concentrate on the Gini coefficient and Generalized Entropy indices with different weights (0, 1 and 2) to assess the contributions of individual/grouped factors to both the level of, and the changes in, consumption

expenditure inequality. As reported in Chapter 3 of this thesis, the changes in the Gini coefficient and the Generalized Entropy indices are statistically significant and thus the changes confirm that inequality in Myanmar declined during the reference period. The decline in inequality in 2009/10 also coincided with much slower consumption growth, particularly for the top deciles, as well as faster consumption growth of the lowest deciles as reported in Chapter 3. The circumstances behind this were exceptional. Map 5.1 also shows the maps of Gini coefficients of different states and regions for all households in 2004/05 and 2009/10 in order to enable the reader to visualize the expenditure disparities in Myanmar. The maps of the Gini coefficients of different states and regions for rural and urban areas in 2004/05 and 2009/10 are presented in Appendix: 5-A.



2004/05 2009/10

Map 5.1. Gini coefficients by state and region, Myanmar 2004/05 and 2009/10

5.3.2 Regression-based inequality decomposition

The levels of, and changes in, expenditure inequality

A consumption expenditure model is required to estimate decomposing consumption expenditure inequality by using the regression-based approach. Molini and Wan (2008) consider that "since consumption expenditure is a function of income and wealth, it is justified to include wealth indicators and other income-generating factors as independent variables" (p.84).

Following the approach of Fields (2003), income generating functions estimated by a standard semi-logarithmic regression framework are adopted to decompose consumption expenditure inequality into the contributions of individual factors at a point in time, and in light of human capital and other theoretical concepts. After that, the method compares the changes in consumption expenditure inequality between 2004/05 and 2009/10 using the results of the levels of inequalities. Expenditures for 2004/05 December are deflated by 2009/10 December prices. The estimates of comparable consumption expenditure functions are given:

$$\boldsymbol{ln\ (E_{i1}) = f(X_{i1}, \beta_1, \varepsilon_1)} \quad (5.1)$$

$$\boldsymbol{ln\ (E_{i2}) = f(X_{i2}, \beta_2, \varepsilon_2)} \quad (5.2)$$

where ln E is the vector of the logarithm of household consumption expenditure per adult equivalent for the ith household E_i, and 1 and 2 denote years: 2004/05 and 2009/10. X is a matrix of observable household and community level characteristics, while ε is assumed to be a normally distributed error term with mean zero and constant variance, which is a set of unobservable parts. There is an argument raised by Wan (2004) about the Fields (2003) approach for using the dependent variable as a natural log of expenditure. In fact, the distributions of expenditure variables are found to be positively skewed and they do not follow a normal distribution. Therefore, these variables must be transformed, and thus Fields (2003) presumably chooses a log-transformation of expenditure variables.

Inequality shares

Fields (2003) adopts an approach commonly held in the literature to decompose inequality by additive factor components. Let us consider the total consumption expenditure E_i of an individual i ($i = 1, \ldots, N$) and let *I(E)* be as an inequality measure of the distribution of consumption expenditure of the total population satisfying Shorrocks' six assumptions. Fields (2003) uses Theorem 3 of Shorrocks (1982) which provides the most general formula for decomposing the inequality of total income (expenditure) into additive factor components. Theorem 3 of Shorrocks (1982, p.204) provides the natural decomposition of inequality *I(E)* into different contributing factors s_j *(*E^j*, E)* and gives the share of each factor s_j to total inequality as follows:

$$\frac{S(E_j,E)}{I(E)} \equiv s_j = \frac{cov(E_j,\ E)}{\sigma^2(E)} \quad \text{with } \sum_{j=1}^{J} S_j = 1 \quad , \tag{5.3}$$

where $cov(E^j, E)$ is the covariance between total consumption expenditure and contributing factors *j*, and $\sigma^2(E)$ is the variance of total expenditure. Fields (2003) refers to S_j as "relative factor inequality weight" (p. 6) for any inequality index. The concept of Shorrocks (1982), "*I (Y)* is continuous and symmetric; *I(Y)* = 0 if and only if $Y = \mu e$, where $e = (1, 1, \ldots, 1)$" (p. 196), can also apply for *I(E)*. Almost all inequality indices—the coefficient of variation, the Gini coefficient, the Generalized Entropy family and the Atkinson index—meet these criteria.

Fields (2003) directly applies Shorrocks's Theorem to account for income (expenditure) inequality using income (expenditure) generating functions. The standard expenditure-generating functional form of Equation (5.1) is rewritten in the form as follows:

$$ln(E) = \propto + \beta_j X_j + \varepsilon, \text{ define } E_j = \widehat{\beta_j} X_j \, . \tag{5.4}$$

Let an inequality index *I* (ln *E*) be defined on the vector of log-expenditures ln $E \equiv$ (ln E_1, . . ., ln E_N) (Fields, 2003, p.6). *E* is replaced with ln (*E*) and E_j is replaced with $\widehat{\beta_j} X_j$ in Equation (5.3) as follows:

$$s_j = \frac{cov[\ln(E),(\widehat{\beta_j} X_j)]}{\sigma^2[\ln(E)]} = \frac{\widehat{\beta_j}\, cov[\ln(E),\ X_j]}{\sigma^2[\ln(E)]} = \frac{\widehat{\beta_j}\, cor[\ln(E),\ X_j]\, \sigma[\ln(E)]\, \sigma(X_j)}{\sigma^2[\ln(E)]} ,$$

$$s_j = \frac{\widehat{\beta_j}\,\sigma(X_j)\,cor[\ln(E),\ X_j]}{\sigma[\ln(E)]}\ , \tag{5.5}$$

where $\widehat{\beta_j}$ is the return to characteristic *j* estimated from Equation (5.1), and $cor[ln(E)\,,\ X_j]$ is the correlation between the log of expenditure and factor *j*. Fields (2003) states that "the resultant inequality measure $I(\ln Y_1, \ldots, \ln Y_N)$ defined on the vector of log-incomes is also continuous and symmetric and satisfies the property $I(\mu,\mu, \ldots,\mu) = 0$, and therefore the factor inequality weights from Equation (5.5) can be applied to the standard inequality measures" (p.7). The error term of the consumption function (5.1), ε, shows the share of inequality unexplained by the included regressors in the regression and thus

$$s_\varepsilon = \frac{cov(\varepsilon,\ E)}{\sigma^2(E)} = 1 - R^2 \text{ and } \sum_{j=1}^{J} S_j = R^2\ . \tag{5.6}$$

The percentage contribution of "*p* weights", p_j, is given by

$$p_j = \frac{S_j}{R^2}, \tag{5.7}$$

and holds for *any* inequality index $I(\ln E_1, \ldots, \ln E_N)$ which is continuous and symmetric and for which $I(\mu,\mu, \ldots,\mu) = 0$ (Field, 2003, p.7).

A group of explanatory variables (for instance, a set of administrative regional dummies) is often considered in the contribution to overall inequality (Heltberg, 2002). Thus, "relative factor inequality weights for a subset of variables can be combined into a single group factor inequality weight, *Sg*, as follows:

$$S_g = \sum_{j\epsilon g} S_j \frac{cov[\sum_{j\epsilon g} \widehat{\beta_j} X_j, \ln(\mathrm{E})]}{\sigma^2[\ln(Y)]}\ . \tag{5.8}$$

This adding up of S_{js}, works for non-continuous *x* variables, such as dummies and categorical variables, regardless of variable units. …… Subgroups can be added to Equation (5.4) by including subgroup specific dummy variables" (Naschold, 2009, pp.766-767). Heltberg (2002) stresses that subgroups have to be exogenous.

Fields (2003) argues that the inclusion of interaction terms, (for example, gender) with other variables such as experience, education, and so forth, provides a problem as the factor inequality weights given by the model cannot decompose into gender, experience and education components neatly. Ssewanyana, Okidi, Angemi, and Barungi (2004) also contend that "the decomposition depends entirely on the regression specification and therefore, this regression-based inequality decomposition imposes very restrictive assumption on the functional form. For instance, inclusion of interaction terms in the models makes the interpretation difficult" (pp.7-8). However, Heltberg (2002) claims that "interaction terms in the income-explaining regression can likewise be included in relevant groups" (p.10) as explained above for constructing a single group factor inequality weight.

Following the approach of Fields (2003), for any given inequality measure *I*, the changes in inequality between two periods, say 1 and 2, can be written as

$$I_2 - I_1 = \sum_j [s_{j2} I_2 - s_{j1} I_1], \tag{5.9}$$

where $S_{j,1}$ and $S_{j,2}$ denote the factor inequality weights of factor *j* in period 1 and 2, respectively. The contribution of factor *j* to the change in inequality for any given inequality measure *I* can be defined as

$$\prod_j (I) = \frac{s_{j2} I_2 - s_{j1} I_1}{I_2 - I_1}, \quad \sum_j \prod_j (I) + \prod_\varepsilon (I) = 1. \tag{5.10}$$

As *I* is included in the Equation, the explanatory contribution of the *j*'th factor depends on the inequality measure used, and changes in X_j, *E*. Fields (2003) develops an approximation for the percentage change (%Δ) in the *j*'th explanatory factor's relative inequality weight as follows:

$$\%\Delta (s_j) \approx \%\Delta (\beta_j) + \%\Delta [\sigma (X_j)] + \%\Delta [\text{corr} (X_j, \ln E)] - \%\Delta [\sigma (X_j, \ln E)]. \tag{5.11}$$

This regression-based decomposition approach has a number of advantages as "first, it is not limited to predetermined income sources. Instead, inequality can be decomposed into any factor explained by an income regression. Second, it makes it easy to combine the relative factor inequality weights of a subset of variables into a single group factor, for example, merging wells, tractors and tools into a single 'agricultural assets' factor or

combining the age and age squared of the household head into a single 'age' factor. Third, we can combine subgroup and source inequality decomposition in one analysis. Fourth, the regression constant does not affect inequality as the constant's relative factor inequality weight is zero by definition. Fifth, the relative factor inequality weights are independent of the inequality measure being used" (Naschold, 2009, p.749-750).

Cross-sectional methods

This study uses cross-sectional methods to apply the Fields (2003) approach. The following is a discussion of the reasons why this study chooses the cross-sectional methods. Firstly, the IHLCA surveys are based on a stratified multi-stage sampling frame with 62 strata which are all districts in Myanmar. Sampling units are calculated in each survey year and they have different probabilities of being selected (IHLCA, 2011c). The sampling weights permit the samples as if simple random sampling was drawn from the total population. Thus, utilization of sampling weights is important in order to get the point estimates correct. Also, it is crucial to consider the weighting and stratification of the survey design in data analysis to get the standard errors correct. The Stata documentation notes that "omitting weights from the analysis results in estimates that may be biased, sometimes seriously so. Sampling weights also play a role in estimating standard errors" (StataCorp LP, 2015, p.3). Survey data analysis using sampling weights (probability weights) is available in the Stata application to fit a linear regression model for the survey data set.

There are some arguments over the use of sampling weights in regression analysis if the aim is to estimate causal effects (Solon, Haider & Wooldridge, 2015). However, the aim of this research is to estimate how much of the difference in consumption inequality between two survey periods is accounted for by several explanatory factors and/or groups of factors. On the other hand, even though the IHLCA survey in 2009/10 retains a 50% panel for the surveyed households in 2004/05, there is no ID for household members. Thus, the basic essential characteristics of household heads are not exactly the same between the panel households of the two survey periods. For instance, only about 90% of gender and 95% of mother tongue of household heads are exactly the same between the panel households of the two survey periods. If some households are dropped based on the different characteristics of household heads between the panel households of the two surveys for panel data methods, there can be attrition bias in econometric models

estimated and the attrition may not be random. Therefore, the thesis did not perform panel data analysis.

5.3.3 Variables

As the first step to estimate the empirical expenditure function for Myanmar, where more than 70% of the population are residing in rural areas according to the population and housing census 2014, consideration must be given to both human capital theory and production theory in combination with the indicators for household composition and geography. Presumably, rural people, especially farmers, must utilize land, labour and physical capital in generating their incomes, and spend for their consumption expenditures. Thus, standard production inputs are included in the regression model. In addition, in line with the human capital theory, education variables are also considered.

The natural log of household consumption expenditure per adult equivalent is the dependent variable in this Fields (2003) regression-based decomposition analysis. The independent (explanatory) variables which may influence the level of household consumption expenditures are explained as follows. The reference group for each of the categorical variables is also stated.

Description of definitions of variables

The literature identifies a variety of characteristics relevant for the determination of both household and household per capita income (expenditure) (Gustafsson & Shi, 1998, 2001; Knight & Song 1999; Miles 1997; Morduch & Sicular 2000). These include household demographic characteristics such as household size (if economies or diseconomies of scale in income generation exist), age structure of the households, the ethnic composition of household head, and the age of household head. In addition, the education and experience of household members may be crucial, as they influence the returns to labour and to some assets. Explanatory variables include characteristics that are likely to influence household per adult equivalent expenditure and are not themselves a function of expenditure, and so are endogenous in the short term. Following are the definitions of the variables included in this study.

Characteristics of household heads

These are age, sex, and ethnicity of the household head. The relationship between age and income (as proxy by expenditure) has an inverted-U shape, which is consistent with theories of life-cycle earnings and with empirical findings elsewhere (for example, Knight & Song 1999; Gustafsson & Shi 2001). Several empirical studies show that well-being is U-shaped for age (Blanchflower & Oswald, 2004, 2008). Thus the age of the household head and its square are included to capture the life cycle effects. The inequality of age and its squared term for the household head can be assessed to understand the disparities of consumption expenditures between households where the head is young or old. The household head can be a man or a woman.

Ethnic differences (the Bamar is a major ethnic group comprising about 84% of all Myanmar nationals) are another aspect that could create inequality. Its effect can be presumably large as most ethnic minorities live in rural and mountainous areas in Myanmar. Human capital theory (Schultz, 1963) indicates that income is a function of education and experience; however, years of work experience are not included in the IHLCA survey questionnaires. Thus, in this study, years of non-agricultural business in operation of household heads are included.

Characteristics of household members

These are household size, the share of household members with different age groups, occupation status, and industry sector. Household size is included, for example, a very large households (such as one with 28 members) may be larger than the most efficient size. Thus, a squared term of household size is also included as the relationship with expenditure. Age structure of the household members can also matter as expenditures per adult equivalent may vary in terms of size and composition, according to the stage of the life cycle. The age structure of the household is divided into six subgroups: the proportion of members below 6 years of age; between 6 and 10; 11 and 15; 16 and 65; and older than 65 years of age. The reference group is the proportion of household members above aged 65. The inequality among the different age subgroups is captured by the decomposition of this characteristic.

In addition, changes in labour across occupations and sectors can affect inequality. Therefore this research includes the proportion of household members who are working-

age adults (aged from 15 to 64[54]) with different occupations relative to the number of working-age persons in the household. Occupation is a categorical variable and the proportion of members with the main occupation in the last 7 days is divided into nine subgroups as follows:

1) legislators, senior officials and managers
2) professionals
3) technicians and associate professionals
4) clerks
5) service workers, and shop and market sales workers
6) skilled agricultural and fishery workers
7) craft and related trades workers
8) plant and machine operators and assemblers
9) elementary occupations, and the reference group in this categorical variable is household members who are clerks.

The proportion of working-age adults (aged from 15 to 64) in the household working in various sectors in the last six months is also a categorical variable and the sector is reclassified based on the primary, secondary and tertiary sectors of the economy[55]. The tertiary sector of the economy is also known as the service sector. These three sectors and the undifferentiated ones are as follows:

1) agriculture, forestry, fishing and mining sector
2) manufacturing and construction sector
3) services sector which is comprised of
    a. Electricity, gas and water supply, transport, storage and communications
    b. Construction
    c. Wholesale and trade; repair of vehicles and household goods; and hotels and restaurants
    d. Financial intermediation, real estate, renting and business, and public administration; community and social service activities
4) Undifferentiated production activities of private households (the reference group)

[54] "The working age population is defined as those aged 15 to 64. The basic indicator for employment is the proportion of the working age population aged 15-64 who are employed." (https://data.oecd.org/pop/working-age-population.htm)

[55] "The primary sector of the economy is the sector of an economy making direct use of natural resources. This includes agriculture, forestry, fishing and mining. In contrast, the secondary sector produces manufactured goods, and the tertiary sector produces services" (https://en.wikipedia.org/wiki/).

Among the household members, the working-age adults who did not work in the six months prior to the administration of the surveys, and looked for a job but could not get one, are included with those with open unemployment[56].

Education of household members

Following human capital theory (Schultz, 1963), human capital is captured by six variables: proportion of household members with tertiary education, upper secondary education, lower secondary education, primary education and illiterates (the reference group is unclassified level of education) since the whole household is likely to benefit from the education levels of individual household members.

Health Indicator

This is the variable for the proportion of household members who were sick in the last 30 days, constructed to control for ability to work, though the poor health condition of household members may be endogenous. However, it is relevant from a policy perspective and included in this study.

Land ownership and access along with the cultivation of crops

The level of expenditure inequality can be determined by physical assets, particularly land. Therefore, to investigate the impact of physical assets on inequality, this study includes the area of land owned, or access to irrigated and unirrigated land areas of households, as the access to and ownership of land and irrigated land is an important productive asset in rural areas in Myanmar. Major types of land are different in Myanmar and cultivated crops also vary, based on the land types. The dummies of cultivated crops are included in order to examine the effect of crop diversification on expenditure for six major categories:

1) cereal crops
2) pulses
3) oilseed crops
4) tuber/root crops, spices/medicinal plants and vegetables

[56] Open unemployment is explained in the poverty profile of the IHLCA (2011a), as the per cent of household members aged 15 and above, who did not work in the six months prior to the survey periods.

5) fruit crops
6) industrial crops.

Location and regional variables

Administratively, the Union of Myanmar is divided into 17 states/regions (divisions). Thus, the population is grouped according to the regions where households are living. The regional effect is important in the determination of consumption expenditures as it indicates a relationship with fixed natural resources, market access, and infrastructure. In addition, differences in endowment of natural resources (for example jade mines versus teak forest) could affect the relative distribution of expenditures of households. To account for geographic location and location related factors, regional dummy variables are created. To investigate how much the regional differences contribute to inequality in Myanmar, four regional dummies are grouped. They are Dry Zone, Delta, Coastal areas, and the Hills region (the reference group).

Nargis Dummy

A dummy for the 2008 Cyclone Nargis affected area is created for the 2009/10 data set, as parts of the Ayeyarwady and Yangon divisions were severely affected and these constitute about 14% of all households in Myanmar. Infrastructure, the agricultural sectors and business firms were all badly damaged in these areas. Also, the findings on the impact of Cyclone Nargis in Chapters 3 and 4 reveal that Nargis lowered expenditure inequality significantly in the affected regions, compared with the smaller reduction that would have occurred anyway, and the changes were greater in the top part of the expenditure distributions. Cyclone Nargis also affects the poorest people. Thus, a Nargis dummy is included in the 2009/10 regression analyses.

Community characteristics

The IHLCA surveys in 2004/05 and 2009/10 also collected information on community level characteristics. However, this research can only include village/ward infrastructure variables, as the steering committee of IHLCA surveys (which has members from MoNPED and UNDP Myanmar) allowed the author to access to the village/ward infrastructure module of the community data.

In addition to the regional variables described above, the types of topography of the village tract/ward where households lived are also included in the location and regional factors. At the community level, the types of topography in 1,555 village tracts and wards vary substantially, thus they are included as village tract/ward level dummy variables. Among the different types of topography, dummies for inland plains, hills, mountains, delta and valley are included. In addition, distance to the nearest: town/township; bank or financial services; hospital or rural health centre, maternity hearth care; primary and monastic school, and finally lower and upper secondary schools, are included to reflect the differences of village tracts and wards.

Infrastructure variables

Infrastructure variables represent the availability of productive economic infrastructure in the local communities as these services have largely been provided by the government. For instance, poor investment in infrastructure, especially in the hill regions, can widen the expenditure consumption gap among households across regions. Road density is the ratio of the length of the state and region's total road network to the state and region's land area. The road network includes all roads in the states and regions: bituminous, metalled, surfaced and earth roads reported for 2004/05 and 2009/10 in the Statistical Yearbook 2011 of Central Statistical Organization published in 2012. Road density is calculated as miles of total road length (in states and regions) per 100 square miles of land area. Proxy variables to assess the level of infrastructure in the community are number of months cars/four-wheel drives are driven in the community in a year, common modes of transportation, and electricity and water supply.

In summary, some of these covariates of the expenditure function above "may be considered endogenous, certainly over longer time periods. For example, household size is affected by migration decisions, and the level of household assets and education depends on the household own decisions. However, it is unclear what instruments could be used for these" (Naschold, 2009, p.766). The gap between two IHLCA surveys is five years. With regard to this research, all household characteristics are treated as exogenous in this study.

Variables grouped for factors for the Fields decomposition

In the inequality decomposition analysis, the classic inequality indices are decomposed only into twelve groups of factors based on the variables explained above as follows:

1) characteristics of household head
2) household size
3) the share of household members with different age groups
4) the share of household members who worked in the last six months, along with their level of education
5) the share of household members who were sick/ill/ injured in the last 30 days
6) the share of household members' occupations in the last seven days
7) land ownership and access, along with cultivation of crops
8) the share household members in the various sectors
9) the share of household members with open unemployment[57] in the last six months
10) spatial variables treated as a location and regional group
11) infrastructure variables treated as a group comprising of infrastructure related variables such as road density, water and electricity supply, modes of transportation.
12) Cyclone Nargis affected area.

5.4 Results and discussions

5.4.1 Sample statistics

Tables 5.1 and 5.2 present the distribution of twelve groups of explanatory variables: sample statistics of all households and panel households, and rural and urban households of the IHLCA Surveys in 2004/05 and 2009/10. The sample statistics relating to all households and panel households are similar. The major sample statistics of all households are mainly discussed in this section, while significant differences between rural and urban households are also reported. The explanatory variables of greatest interest for this study are: the proportion of household members who worked in the last

[57] Variables for open employment denote proportion of household members aged 15 and above, who looked for, but could not find one in the six months prior to the administrations of IHLCA surveys in 2004/05 and 2009/10.

seven days by occupation; the proportion of household members who worked in the last six months by their level of education; and location and regional variables.

For the total households surveyed, the means of nominal consumption expenditures remained almost constant, over time. The mean per adult equivalent household expenditure of the urban population was somewhat higher than that of the rural population. More households were headed by females than by males in 2004/05, relative to the case in 2009/10. Overall, the share of household members aged between 16 and 65 grew slightly. In terms of education levels, more than half of the households surveyed had members with lower secondary education or below in 2004/05. Over time, the larger proportion of household members who had a lower, upper secondary education, or tertiary education increased slightly, while the bigger share of household members who had a primary education or were illiterate declined marginally. The proportion of household members with tertiary education and upper secondary education was about five and three times higher, respectively, in the urban areas than that of the members with same levels of education in rural areas in both years.

The open unemployment rates in the six months prior to the IHLCA surveys is calculated based on the labour force aged 15 and above; it was only about 2% and 1% of all population surveyed in 2004/05 and 2009/10, respectively, in Myanmar. In terms of the labour force participation of population aged 15 and above, the data in 2004/05 and 2009/10 indicate that the share of skilled agricultural and fishery workers was the highest (about one third of all households) among the different types of occupations. This fact also applies to the share of agriculture, forestry and fishery sectors, and may reflect the fact that most people in Myanmar rely mainly on agriculture for their earnings. The open unemployment rates were four times and two times higher in urban areas compared with open unemployment rates in rural areas in 2004/05 and 2009/10, respectively. Not surprisingly, in 2004/05 about 70% of the rural population worked in the agriculture, forestry, fishing and mining sector, while about 68% of the urban population worked in the services sector. However, in 2009/10 the percentage of the rural population working in the agriculture sector declined (66%) while the percentage of the urban population in the services sector increased (72%). The share of skilled agricultural and fishery workers and those working in other sales and services elementary occupations were larger in rural areas. However, the shares of household members with other occupations such as legislators, senior officials and managers, and service and trade workers, were greater in

urban areas. Interestingly, in urban areas the share of household members who were service workers, and shop and market sales workers, increased substantially, while the share of household members with elementary occupations declined.

Among the agricultural families, the unirrigated land areas that households owned and/or had access to were higher compared with the irrigated land areas in both study years. This indicates that most farmers were working in rain-fed areas. Most households cultivated cereal crops in both surveyed years. The cultivation of all other crops declined slightly in 2009/10, while the cultivation of pulses and tuber/root crops, spices/medicinal plants and vegetables increased.

About half of all surveyed households as well as the surveyed rural households, resided in the Central Dry zone, while about half of the surveyed urban population resided in the Delta region. In 2009/10, about half of the urban population surveyed lived in a Cyclone Nargis-affected-area, while only one-fifth of the rural population surveyed resided in the affected area. Among the 1,555 village tracts/wards surveyed, the topography of most village tracts/wards was the inland plains. On average, the distances to the nearest market and health services were about four and two miles respectively. These decreased slightly over time. The distance gaps between rural and urban areas were large in each surveyed year. Over time, the gaps were almost the same for schools, market and financial services but the gap was narrower for health services.

In terms of infrastructure, road density in states and regions increased between 2004/05 and 2009/10, in both urban and rural areas. At the community level (village tracts/wards), the number of villages/wards with laterite roads, gravel and dirt roads rose but villages/wards with bituminous roads remained stable. Obviously, the number of villages/wards with bituminous, gravel, and laterite roads was higher in urban areas, while there were more villages/wards with dirt roads in rural areas in both years. In addition, the number of villages/wards receiving electricity supply and water supply increased over the study periods. Of course, the numbers of urban village/wards receiving water and electricity supplies were greater than that of rural village/wards in both years. Bullock carts were a common mode of transportation in rural areas while taxis and buses were the major modes of transportation in urban areas. Overall, the number of villages using bullock carts and horses as common modes of transportation declined faster at the community level over the years, when compared with other modes of transportation.

Table 5.1 Sample statistics (All households vs. Panel households)

Variables	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Ln per adult equivalent household expenditure	18,634	**13.08**	0.43	18,609	**13.12**	0.38	9,102	**13.08**	0.43	9,102	**13.12**	0.38
Characteristics of the household head												
Age of household head (Years)	18,634	**51.25**	13.50	18,609	**53.53**	13.25	9,102	**51.36**	13.16	9,102	**54.54**	12.94
Age square of household head (Years)	18,634	**2808.55**	1456.69	18,609	**3040.83**	1483.96	9,102	**2811.47**	1416.65	9,102	**3141.71**	1469.85
Gender of household head (Dummy)	18,634	**0.84**	0.37	18,609	**0.82**	0.38	9,102	**0.84**	0.36	9,102	**0.82**	0.39
Ethnicity of household head (Myanmar) (Dummy)	18,634	**0.77**	0.42	18,609	**0.75**	0.43	9,102	**0.77**	0.42	9,102	**0.75**	0.43
Years of non-agricultural business in operation	18,634	**2.11**	6.07	18,609	**2.09**	6.19	9,102	**2.18**	6.21	9,102	**2.07**	6.25
Household size (Number)	18,634	**6.19**	2.48	18,609	**5.94**	2.37	9,102	**6.30**	2.54	9,102	**6.05**	2.45
Household size squared (Number)	18,634	**44.52**	37.34	18,609	**40.90**	35.31	9,102	**46.08**	39.27	9,102	**42.65**	38.23
Age structure of household members												
Proportion of members under 6	18,634	**0.10**	0.13	18,609	**0.07**	0.11	9,102	**0.10**	0.12	9,102	**0.07**	0.11
Proportion of members aged 6-10	18,634	**0.10**	0.12	18,609	**0.09**	0.12	9,102	**0.10**	0.12	9,102	**0.09**	0.12
Proportion of members aged 11-15	18,634	**0.10**	0.12	18,609	**0.10**	0.12	9,102	**0.10**	0.12	9,102	**0.10**	0.12
Proportion of members aged 16- 65	18,634	**0.65**	0.21	18,609	**0.68**	0.22	9,102	**0.65**	0.21	9,102	**0.68**	0.22
Proportion of members aged above 65	18,634	**0.06**	0.13	18,609	**0.06**	0.13	9,102	**0.05**	0.12	9,102	**0.06**	0.14
Education level of household members who worked in the last 6 months												
Proportion of members with Tertiary education	17,874	**0.08**	0.23	17,917	**0.10**	0.25	8,783	**0.09**	0.24	8,743	**0.11**	0.26
Proportion of members with Upper secondary	17,874	**0.12**	0.26	17,917	**0.16**	0.27	8,783	**0.12**	0.25	8,743	**0.16**	0.27
Proportion of members with Lower secondary	17,874	**0.24**	0.33	17,917	**0.25**	0.32	8,783	**0.24**	0.33	8,743	**0.25**	0.32
Proportion of members with Primary education	17,874	**0.48**	0.41	17,917	**0.43**	0.40	8,783	**0.48**	0.41	8,743	**0.42**	0.39
Proportion of members with Illiterate	17,874	**0.07**	0.21	17,917	**0.04**	0.16	8,783	**0.06**	0.20	8,743	**0.04**	0.16
Proportion of members with Unclassified education	17,874	**0.01**	0.08	17,917	**0.02**	0.12	8,783	**0.01**	0.09	8,743	**0.02**	0.12
Health condition of household members in the last 30 days												
Proportion of members being sick/ ill/ injured	18,634	**0.07**	0.14	18,609	**0.08**	0.15	9,102	**0.07**	0.13	9,102	**0.08**	0.15
Proportion of members who were not sick/ ill/ injured	18,634	**0.93**	0.14	18,609	**0.92**	0.15	9,102	**0.93**	0.13	9,102	**0.92**	0.15

Continued over

Continued

Variables	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Proportion of household members who worked in the last 7 days with												
Legislators, senior officials and managers	16,987	**0.05**	0.19	17,764	**0.04**	0.16	8,337	**0.05**	0.19	8,670	**0.03**	0.16
Professionals	16,987	**0.03**	0.13	17,764	**0.03**	0.13	8,337	**0.03**	0.13	8,670	**0.03**	0.14
Technicians and associate professionals	16,987	**0.03**	0.14	17,764	**0.03**	0.15	8,337	**0.03**	0.15	8,670	**0.04**	0.15
Clerks	16,987	**0.02**	0.12	17,764	**0.02**	0.11	8,337	**0.02**	0.12	8,670	**0.02**	0.11
Service workers and shop and market sales workers	16,987	**0.09**	0.25	17,764	**0.12**	0.28	8,337	**0.09**	0.24	8,670	**0.13**	0.28
Skilled agricultural and fishery workers	16,987	**0.35**	0.44	17,764	**0.35**	0.43	8,337	**0.37**	0.44	8,670	**0.35**	0.43
Craft and related trades workers	16,987	**0.12**	0.28	17,764	**0.11**	0.26	8,337	**0.11**	0.27	8,670	**0.12**	0.26
Plant and machine operators and assemblers	16,987	**0.04**	0.16	17,764	**0.04**	0.16	8,337	**0.04**	0.16	8,670	**0.04**	0.15
Elementary occupations	16,987	**0.27**	0.40	17,764	**0.26**	0.39	8,337	**0.27**	0.39	8,670	**0.25**	0.38
Land ownership and access, along with cultivation of crops												
Owned and accessed irrigated land area per capita (Acres)	18,634	**0.19**	0.70	18,609	**0.26**	1.37	9,102	**0.20**	0.69	9,102	**0.27**	1.09
Owned and accessed unirrigated land area per capita (Acres)	18,634	**0.40**	1.52	18,609	**0.39**	1.29	9,102	**0.40**	1.08	9,102	**0.39**	1.22
Landless (Dummy)	18,634	**0.15**	0.36	18,609	**0.13**	0.33	9,102	**0.15**	0.36	9,102	**0.12**	0.32
Cultivation of Cereal crops (Dummy)	18,634	**0.35**	0.48	18,609	**0.32**	0.47	9,102	**0.36**	0.48	9,102	**0.34**	0.47
Cultivation of Pulses (Dummy)	18,634	**0.12**	0.33	18,609	**0.17**	0.38	9,102	**0.13**	0.33	9,102	**0.18**	0.38
Cultivation of Oilseed crops (Dummy)	18,634	**0.17**	0.37	18,609	**0.16**	0.36	9,102	**0.17**	0.38	9,102	**0.16**	0.37
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	18,634	**0.06**	0.23	18,609	**0.07**	0.25	9,102	**0.06**	0.24	9,102	**0.07**	0.26
Cultivation of Fruit crops (Dummy)	18,634	**0.03**	0.17	18,609	**0.01**	0.07	9,102	**0.03**	0.17	9,102	**0.01**	0.08
Cultivation of Industrial crops (Dummy)	18,634	**0.07**	0.26	18,609	**0.04**	0.18	9,102	**0.07**	0.25	9,102	**0.03**	0.18
Proportion of household members with open unemployment in the last 6 months[a]	18,141	**0.02**	0.09	18,144	**0.01**	0.07	8,897	**0.02**	0.09	8,869	**0.01**	0.07
Proportion of household members who worked in the last 6 months	18,141	**0.98**	0.09	18,144	**0.99**	0.07	8,897	**0.98**	0.09	8,869	**0.99**	0.07
Agriculture, Forestry, Fishing and Mining Sector	17,874	**0.55**	0.45	17,917	**0.51**	0.45	8,783	**0.56**	0.45	8,743	**0.52**	0.45
Manufacturing and Construction Sector	17,874	**0.10**	0.25	17,917	**0.11**	0.26	8,783	**0.09**	0.24	8,743	**0.11**	0.25
Services Sector	17,874	**0.33**	0.42	17,917	**0.36**	0.42	8,783	**0.33**	0.41	8,743	**0.36**	0.42
Undefined Private Sector	17,874	**0.03**	0.13	17,917	**0.02**	0.10	8,783	**0.02**	0.13	8,743	**0.02**	0.10

Continued over

Continued

Variables	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Location and regional effects												
Dry Zone region (Dummy)	18,634	**0.44**	0.50	18,609	**0.43**	0.50	9,102	**0.45**	0.50	9,102	**0.44**	0.50
Coastal region (Dummy)	18,634	**0.14**	0.35	18,609	**0.14**	0.35	9,102	**0.14**	0.35	9,102	**0.14**	0.35
Delta region (Dummy)	18,634	**0.27**	0.45	18,609	**0.28**	0.45	9,102	**0.26**	0.44	9,102	**0.27**	0.44
Hills region (Dummy)	18,634	**0.14**	0.35	18,609	**0.15**	0.35	9,102	**0.14**	0.35	9,102	**0.15**	0.36
Village Tract/Wards: Inland plains (Dummy)	18,634	**0.63**	0.48	18,609	**0.57**	0.50	9,102	**0.63**	0.48	9,102	**0.57**	0.49
Village Tract/Wards: Hills (Dummy)	18,634	**0.05**	0.23	18,609	**0.04**	0.19	9,102	**0.05**	0.23	9,102	**0.04**	0.19
Village Tract/Wards: Mountains (Dummy)	18,634	**0.02**	0.15	18,609	**0.05**	0.22	9,102	**0.02**	0.15	9,102	**0.05**	0.22
Village Tract/Wards: Delta (Dummy)	18,634	**0.14**	0.35	18,609	**0.15**	0.36	9,102	**0.13**	0.34	9,102	**0.15**	0.35
Village Tract/Wards: Valley (Dummy)	18,634	**0.03**	0.16	18,609	**0.02**	0.13	9,102	**0.03**	0.17	9,102	**0.02**	0.13
Distance to nearest market (Miles)	18,634	**4.49**	7.35	18,609	**4.13**	4.56	9,102	**4.44**	7.27	9,102	**4.09**	4.54
Distance to nearest financial services (Miles)	18,634	**8.97**	11.79	18,609	**9.75**	11.29	9,102	**8.80**	11.64	9,102	**9.70**	11.28
Distance to nearest health services (Miles)	18,634	**1.76**	3.81	18,609	**1.23**	2.95	9,102	**1.79**	3.83	9,102	**1.24**	2.97
Distance to primary and monastic school (Miles)	18,634	**0.32**	2.11	18,609	**0.37**	2.08	9,102	**0.33**	2.10	9,102	**0.37**	2.08
Distance to lower secondary school (Miles)	18,634	**1.95**	3.79	18,609	**2.29**	4.15	9,102	**1.97**	3.79	9,102	**2.28**	4.08
Distance to upper secondary school (Miles)	18,634	**3.99**	6.05	18,609	**4.07**	6.37	9,102	**3.95**	5.97	9,102	**4.05**	6.36
Infrastructure												
Road Density by state and region	18,634	**8.65**	2.58	18,609	**10.01**	2.85	9,102	**8.61**	2.57	9,102	**9.96**	2.84
Having Bituminous road in the village/ward	18,634	**0.39**	0.49	18,609	**0.38**	0.49	9,102	**0.39**	0.49	9,102	**0.38**	0.49
Having Gravel roads in the village/ward	18,634	**0.30**	0.46	18,609	**0.44**	0.50	9,102	**0.31**	0.46	9,102	**0.44**	0.50
Having Laterite roads in the village/ward	18,634	**0.17**	0.37	18,609	**0.28**	0.45	9,102	**0.17**	0.37	9,102	**0.28**	0.45
Having Dirt roads in the village/ward	18,634	**0.82**	0.39	18,609	**0.91**	0.28	9,102	**0.82**	0.38	9,102	**0.92**	0.28
Months on Road by car/Four Wheels and on water way by boat	18,634	**9.67**	3.88	18,609	**10.16**	3.60	9,102	**9.63**	3.90	9,102	**10.15**	3.61
Water supply (Dummy)	18,634	**0.20**	0.40	18,609	**0.29**	0.45	9,102	**0.21**	0.40	9,102	**0.29**	0.45
Electricity supply (Dummy)	18,634	**0.41**	0.49	18,609	**0.56**	0.50	9,102	**0.41**	0.49	9,102	**0.56**	0.50
Common mode of transportation: Taxi/Bus(Dummy)	18,634	**0.40**	0.49	18,609	**0.36**	0.48	9,102	**0.40**	0.49	9,102	**0.36**	0.48
Common mode of transportation: Ship/Boat(Dummy)	18,634	**0.18**	0.39	18,609	**0.16**	0.37	9,102	**0.18**	0.39	9,102	**0.15**	0.36
Common mode of transportation: Bullock Cart(Dummy)	18,634	**0.53**	0.50	18,609	**0.33**	0.47	9,102	**0.54**	0.50	9,102	**0.33**	0.47
Common mode of transportation: Horse(Dummy)	18,634	**0.15**	0.36	18,609	**0.10**	0.30	9,102	**0.15**	0.36	9,102	**0.10**	0.30
Nargis affected area				18,609	**0.23**	0.42				9,102	**0.22**	0.41
Non-Nargis affected area				18,609	**0.77**	0.42				9,102	**0.78**	0.41

Source: Author's estimations

Note: [a] the open unemployment as defined in the poverty profile IHLCA (2011a) is the per cent of household members aged 15 and above, who did not work in the 6 months prior to the survey periods.

Table 5.2 Sample Statistics (Urban households vs. Rural households)

Variables	Urban Households						Rural Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Ln per adult equivalent household expenditure	5,529	**13.28**	0.52	5,523	**13.30**	0.44	13,105	**13.01**	0.37	13,086	**13.06**	0.33
Characteristics of the household head												
Age of household head (Years)	5,529	**53.82**	13.22	5,523	**56.66**	13.09	13,105	**50.34**	13.48	13,086	**52.43**	13.13
Age square of household head (Years)	5,529	**3071.02**	1476.56	5,523	**3382.05**	1531.87	13,105	**2716.21**	1438.34	13,086	**2920.94**	1447.84
Gender of household head (Dummy)	5,529	**0.77**	0.42	5,523	**0.76**	0.43	13,105	**0.86**	0.35	13,086	**0.84**	0.37
Ethnicity of household head (Myanmar) (Dummy)	5,529	**0.84**	0.37	5,523	**0.81**	0.39	13,105	**0.74**	0.44	13,086	**0.73**	0.44
Years of non-agricultural business in operation	5,529	**4.04**	8.29	5,523	**4.01**	8.26	13,105	**1.43**	4.88	13,086	**1.41**	5.11
Household size (Number)	5,529	**6.21**	2.68	5,523	**5.90**	2.55	13,105	**6.19**	2.41	13,086	**5.95**	2.30
Household size squared (Number)	5,529	**45.82**	42.30	5,523	**41.34**	40.97	13,105	**44.07**	35.42	13,086	**40.75**	33.09
Age structure of household members												
Proportion of members under 6	5,529	**0.08**	0.11	5,523	**0.06**	0.10	13,105	**0.11**	0.13	13,086	**0.08**	0.12
Proportion of members aged 6-10	5,529	**0.08**	0.11	5,523	**0.07**	0.11	13,105	**0.11**	0.12	13,086	**0.10**	0.12
Proportion of members aged 11-15	5,529	**0.09**	0.12	5,523	**0.08**	0.11	13,105	**0.11**	0.12	13,086	**0.10**	0.12
Proportion of members aged 16- 65	5,529	**0.70**	0.21	5,523	**0.72**	0.21	13,105	**0.63**	0.21	13,086	**0.66**	0.22
Proportion of members aged above 65	5,529	**0.06**	0.13	5,523	**0.08**	0.14	13,105	**0.05**	0.12	13,086	**0.06**	0.13
Education level of household members who worked in the last 6 months												
Proportion of members with Tertiary education	5,248	**0.21**	0.35	5,263	**0.25**	0.36	12,626	**0.04**	0.15	12,654	**0.05**	0.17
Proportion of members with Upper secondary	5,248	**0.24**	0.34	5,263	**0.28**	0.34	12,626	**0.08**	0.21	12,654	**0.11**	0.23
Proportion of members with Lower secondary	5,248	**0.27**	0.35	5,263	**0.26**	0.34	12,626	**0.23**	0.32	12,654	**0.25**	0.32
Proportion of members with Primary education	5,248	**0.25**	0.36	5,263	**0.19**	0.31	12,626	**0.56**	0.40	12,654	**0.51**	0.39
Proportion of members with Illiterate	5,248	**0.03**	0.14	5,263	**0.01**	0.09	12,626	**0.08**	0.23	12,654	**0.05**	0.18
Proportion of members with Unclassified education	5,248	**0.01**	0.06	5,263	**0.01**	0.07	12,626	**0.01**	0.09	12,654	**0.03**	0.13
Health condition of household members in the last 30 days												
Proportion of members being sick/ ill/ injured in the last 30 days	5,529	**0.07**	0.13	5,523	**0.08**	0.16	13,105	**0.07**	0.14	13,086	**0.07**	0.15
Proportion of members who were not sick/ ill/ injured	5,529	**0.93**	0.13	5,523	**0.92**	0.16	13,105	**0.93**	0.14	13,086	**0.93**	0.15

Continued over

Continued

Variables	Urban Households						Rural Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Proportion of household members who worked in the last 7 days with												
Legislators, senior officials and managers	5,132	**0.10**	0.27	5,244	**0.06**	0.21	11,855	**0.03**	0.15	12,520	**0.03**	0.14
Professionals	5,132	**0.05**	0.18	5,244	**0.06**	0.19	11,855	**0.02**	0.10	12,520	**0.02**	0.10
Technicians and associate professionals	5,132	**0.07**	0.21	5,244	**0.10**	0.25	11,855	**0.01**	0.10	12,520	**0.01**	0.09
Clerks	5,132	**0.06**	0.19	5,244	**0.06**	0.18	11,855	**0.01**	0.07	12,520	**0.01**	0.07
Service workers and shop and market sales workers	5,132	**0.17**	0.33	5,244	**0.24**	0.36	11,855	**0.06**	0.20	12,520	**0.08**	0.23
Skilled agricultural and fishery workers	5,132	**0.05**	0.20	5,244	**0.05**	0.20	11,855	**0.46**	0.45	12,520	**0.45**	0.45
Craft and related trades workers	5,132	**0.19**	0.33	5,244	**0.17**	0.31	11,855	**0.09**	0.25	12,520	**0.09**	0.24
Plant and machine operators and assemblers	5,132	**0.08**	0.23	5,244	**0.07**	0.22	11,855	**0.02**	0.12	12,520	**0.02**	0.13
Elementary occupations	5,132	**0.22**	0.35	5,244	**0.18**	0.33	11,855	**0.29**	0.41	12,520	**0.28**	0.41
Land ownership and access, along with cultivation of crops												
Owned and accessed irrigated land area per capita (Acre)	5,529	**0.03**	0.38	5,523	**0.06**	1.13	13,105	**0.25**	0.77	13,086	**0.32**	1.44
Owned and accessed unirrigated land area per capita (Acre)	5,529	**0.06**	0.63	5,523	**0.10**	1.05	13,105	**0.52**	1.72	13,086	**0.49**	1.36
Landless (Dummy)	5,529	**0.06**	0.24	5,523	**0.04**	0.20	13,105	**0.18**	0.39	13,086	**0.16**	0.36
Cultivation of Cereal crops (Dummy)	5,529	**0.05**	0.21	5,523	**0.04**	0.20	13,105	**0.45**	0.50	13,086	**0.42**	0.49
Cultivation of Pulses (Dummy)	5,529	**0.01**	0.10	5,523	**0.01**	0.11	13,105	**0.16**	0.37	13,086	**0.23**	0.42
Cultivation of Oilseed crops (Dummy)	5,529	**0.01**	0.11	5,523	**0.01**	0.10	13,105	**0.22**	0.41	13,086	**0.21**	0.41
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	5,529	**0.01**	0.09	5,523	**0.01**	0.09	13,105	**0.08**	0.27	13,086	**0.09**	0.29
Cultivation of Fruit crops (Dummy)	5,529	**0.01**	0.10	5,523	**0.00**	0.03	13,105	**0.04**	0.19	13,086	**0.01**	0.08
Cultivation of Industrial crops (Dummy)	5,529	**0.01**	0.12	5,523	**0.00**	0.07	13,105	**0.09**	0.29	13,086	**0.05**	0.21
Proportion of household members with open unemployment in the last 6 months	5,333	**0.04**	0.12	5,342	**0.02**	0.09	12,808	**0.01**	0.08	12,802	**0.01**	0.06
Proportion of household members who worked in the last 6 months	5,333	**0.96**	0.12	5,342	**0.98**	0.09	12,808	**0.99**	0.08	12,802	**0.99**	0.06
Agriculture, Forestry, Fishing and Mining Sector	5,248	**0.11**	0.27	5,263	**0.09**	0.25	12,626	**0.70**	0.40	12,654	**0.66**	0.41
Manufacturing and Construction Sector	5,248	**0.16**	0.31	5,263	**0.16**	0.31	12,626	**0.07**	0.22	12,654	**0.09**	0.24
Services Sector	5,248	**0.68**	0.39	5,263	**0.72**	0.38	12,626	**0.21**	0.35	12,654	**0.24**	0.36
Undefined Private Sector	5,248	**0.05**	0.18	5,263	**0.03**	0.13	12,626	**0.02**	0.11	12,654	**0.01**	0.09

Continued over

Continued

Variables	Urban Households						Rural Households Only					
	2004/05			2009/10			2004/05			2009/10		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Location and regional effects												
Dry Zone region (Dummy)	5,529	**0.30**	0.46	5,523	**0.30**	0.46	13,105	**0.49**	0.50	13,086	**0.48**	0.50
Coastal region (Dummy)	5,529	**0.11**	0.31	5,523	**0.11**	0.32	13,105	**0.15**	0.36	13,086	**0.15**	0.36
Delta region (Dummy)	5,529	**0.47**	0.50	5,523	**0.46**	0.50	13,105	**0.20**	0.40	13,086	**0.21**	0.41
Hills region (Dummy)	5,529	**0.12**	0.32	5,523	**0.13**	0.34	13,105	**0.15**	0.35	13,086	**0.15**	0.36
Village Tract/Wards: Inland plains (Dummy)	5,529	**0.72**	0.45	5,523	**0.70**	0.46	13,105	**0.59**	0.49	13,086	**0.52**	0.50
Village Tract/Wards: Hills (Dummy)	5,529	**0.04**	0.19	5,523	**0.01**	0.11	13,105	**0.06**	0.24	13,086	**0.05**	0.21
Village Tract/Wards: Mountains (Dummy)	5,529	**0.01**	0.12	5,523	**0.04**	0.20	13,105	**0.03**	0.16	13,086	**0.05**	0.23
Village Tract/Wards: Delta (Dummy)	5,529	**0.10**	0.30	5,523	**0.09**	0.29	13,105	**0.16**	0.37	13,086	**0.17**	0.38
Village Tract/Wards: Valley (Dummy)	5,529	**0.01**	0.10	5,523	**0.01**	0.09	13,105	**0.03**	0.18	13,086	**0.02**	0.14
Distance to nearest market (Miles)	5,529	**0.40**	2.63	5,523	**0.31**	0.28	13,105	**5.93**	7.91	13,086	**5.47**	4.60
Distance to nearest financial services (Miles)	5,529	**1.60**	7.08	5,523	**1.53**	3.63	13,105	**11.49**	12.05	13,086	**12.57**	11.62
Distance to nearest health services (Miles)	5,529	**0.22**	0.48	5,523	**0.80**	1.91	13,105	**2.30**	4.29	13,086	**1.36**	3.23
Distance to primary and monastic school (Miles)	5,529	**0.14**	0.20	5,523	**0.19**	0.30	13,105	**0.39**	2.45	13,086	**0.44**	2.40
Distance to lower secondary school (Miles)	5,529	**0.40**	0.96	5,523	**0.52**	0.72	13,105	**2.51**	4.24	13,086	**2.91**	4.65
Distance to upper secondary school (Miles)	5,529	**0.44**	0.67	5,523	**0.60**	0.65	13,105	**5.09**	6.13	13,086	**5.29**	6.99
Infrastructure												
Road Density by state and region	5,529	**10.11**	3.18	5,523	**11.45**	3.34	13,105	**8.13**	2.10	13,086	**9.51**	2.46
Having Bituminous road in the village/ward	5,529	**0.91**	0.28	5,523	**0.90**	0.30	13,105	**0.21**	0.41	13,086	**0.20**	0.40
Having Gravel roads in the village/ward	5,529	**0.53**	0.50	5,523	**0.67**	0.47	13,105	**0.22**	0.42	13,086	**0.36**	0.48
Having Laterite roads in the village/ward	5,529	**0.30**	0.46	5,523	**0.39**	0.49	13,105	**0.12**	0.32	13,086	**0.24**	0.43
Having Dirt roads in the village/ward	5,529	**0.66**	0.47	5,523	**0.77**	0.42	13,105	**0.87**	0.33	13,086	**0.96**	0.19
Months on Road by car/Four Wheels and on water way by boat	5,529	**11.73**	1.38	5,523	**11.90**	0.92	13,105	**8.94**	4.21	13,086	**9.55**	3.97
Water supply (Dummy)	5,529	**0.43**	0.50	5,523	**0.61**	0.49	13,105	**0.12**	0.33	13,086	**0.18**	0.38
Electricity supply (Dummy)	5,529	**0.88**	0.32	5,523	**0.95**	0.22	13,105	**0.24**	0.43	13,086	**0.43**	0.49
Common mode of transportation: Taxi/Bus(Dummy)	5,529	**0.68**	0.47	5,523	**0.64**	0.48	13,105	**0.30**	0.46	13,086	**0.26**	0.44
Common mode of transportation: Ship/Boat(Dummy)	5,529	**0.03**	0.18	5,523	**0.02**	0.15	13,105	**0.24**	0.43	13,086	**0.21**	0.41
Common mode of transportation: Bullock Cart(Dummy)	5,529	**0.17**	0.37	5,523	**0.08**	0.27	13,105	**0.66**	0.47	13,086	**0.42**	0.49
Common mode of transportation: Horse(Dummy)	5,529	**0.25**	0.43	5,523	**0.14**	0.35	13,105	**0.12**	0.32	13,086	**0.08**	0.27
Nargis affected area				5,523	**0.42**	0.49				13,086	**0.16**	0.37
Non-Nargis affected area				5,523	**0.58**	0.49				13,086	**0.84**	0.37

Source: Author's estimations

5.4.2 Regression results

The regression tables and discussions on the results for all households and for panel households, and for rural and urban households are detailed in Appendix: 5-B.

5.4.3 Field's decomposition results of the level of consumption expenditure inequality, 2004/05 and 2009/10

The analyses of the contributing factors to the level of inequality in 2004/05 and 2009/10 for all households and for panel households are presented in Table 5.3. The first column of each year reports the factors that contribute to expenditure inequality, listed under the twelve components. The second column reports the relative factor inequality weights (S_j) with respect to the determinants of the household consumption expenditure function. The third column shows the proportion of the inequality explained by different variables/factors, with the total explained proportion, R2, as 100%. The independent variables in the expenditure functions are represented by the R2 as percentages. The remainder of the inequality is attributed to the residuals. The R2 statistics vary from 0.38 to 0.34 for the expenditure regressions between the 2004/05 and 2009/10 survey periods. Given that the two equations explain more than one-third of the household expenditure per adult equivalent as in other studies (for example, Gunatilaka & Chotikapanich, 2009; Deng & Shi, 2009) the decomposition results are reliable. This study also presents the contributions of the residual to total inequality together with the explanatory variables to account for total inequality.

In the 2004/05 survey period, the analysis of the factors contributing to the level of inequality for all households indicates that the level of education of household members was the most significant factor determining the level of inequality, followed by household members with different occupations, location and regional effect variables of the households, household size and infrastructure. However, the sequence of the factors changed somewhat in the 2009/10 survey period, and the most distinguishing factors explaining the level of inequality were the level of education of household members, household size, occupations, infrastructure and location and regional effect variables of the households. The group of the location and regional effect variables of the households was no longer an important contributing factor in 2009/10—it decreased from 19% of the explained part in 2004/05 to 8% in 2009/10.

Within the education levels of household members in 2004/05, the tertiary education level of household members contributed 18% to the inequality level (about 25% of the explained portion to the R2 by all levels of education of household members). Five years later, its importance increased and it accounted for 24% out of 26% of the R2 even though it was offset by the negative contribution of the proportion of household members who had a primary education when the disaggregate results of the education variables were reviewed. In addition, in 2004/05, among the different occupations, the share of household members with legislators, senior officials and managers contributed 16%, followed by the share of members with service workers and shop and market sales workers accounting for 10%, (about 20% of the explained portion to R2 by the proportion of household members with different occupations). Over time, their shares substantially declined and accounted for about 7% each out of 15% of the R2.

Within the location and regional effect variables, the Delta region was the key contributor to expenditure inequality, accounting for 14% in 2004/05. The contribution of household size was about 15% of the R2 in 2004/05 and this increased to 22% of the R2 over time. This factor is a combined effect of household size and household size squared. According to the literature, having several household members in a family up to a certain household size reduces the per capita consumption expenditures because of the economies of scale, but after reaching a certain household size, their expenditures increase.

In the analysis of the contributing factors to the level of inequality for panel households, the sequences of the most important factors change slightly for the two survey periods. In 2004/05 these factors were: the level of education of household members (27%), location (20%), occupations (16%) and household size (15%), and in 2009/10 there was a change to the level of education of household members (25%), household size (23%), infrastructure (15%), and occupations (13%).

In the analysis of the contributing factors to the level of inequality for urban households, the important factors in 2004/05 were, in order of importance, occupations (26%), the level of education of household members (20%), location (15%), household size (15%) and infrastructure (15%); in 2009/10 the order changed to infrastructure (25%), household size (21%), occupations (18%), education (17%), and location (8%). Interestingly, in the analysis of the contributing factors to the level of inequality for rural households, the most influencing factors change only moderately between each survey period. In 2004/05 the

factors were: land ownership and access, along with cultivation of crops (22%), household size (21%), the level of education of household members (19%), occupations (15%) and location (15%); in 2009/10 the order changed to household size (28%), land ownership and access, along with cultivation of crops (18%), the level of education of household members (18%), occupations (13%) and location (9%). The most important factor in the rural areas reflects the basic requirement of rural households for their livelihood.

5.4.4 Fields' decomposition of the contributing variables to the level of, and changes in, consumption inequality

5.4.4.1 Gini coefficient

Table 5.5 reports the percentage contribution of each explanatory factor to the level of, and changes in, inequality, as measured by the Gini coefficient to explore the extent of different contributing factors imparting on the decline in expenditure inequality. Yun (2006) notes that "a positive (negative) value means that the factor contributes to increasing (leveling) earnings inequality in time period A relative to time period B when $I_A > I_B$." (p.130). The Fields decomposition approach can explain net 57% and 52% of changes in the Gini coefficient for all households and for panel households, respectively, after cancelling out the positive and negative factors. As shown in Table 5.5, the location and regional effects, the occupations and all levels of education of household members are key to explaining both the level of, and changes in, inequality measured for all households and for panel households.

Regional specific variables are the main contributors to the narrowing of the expenditure inequality and they explain about 35% (all households) and 43% (panel households) of the changes in the Gini coefficient. In fact, the location and regional effects are a proxy to assess a combination of different variables across the region, as explained above. Other variables can be associated with location and regional factors, in addition to the access to different services such as market, financial and health services, and schools. Fixed natural resources such as jade mines or teak forests and other factors can be correlated in each region and each community with different topography. But these location-correlated variables are not themselves captured by the IHLCA data sets, so their impact is captured only via 'location'.

Table 5.3 The Fields decomposition of the level of consumption expenditure inequality, 2004/05 and 2009/10 (All households vs. Panel households)

Variable	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Characteristics of the household head												
Age of household head (Years)	-0.10	-0.27	4.89	-0.04	-0.13	4.95	-0.32	-0.87	5.08	-0.21	-0.61	4.03
Age square of household head (Years)	0.16	0.42		0.02	0.06		0.40	1.10		0.19	0.56	
Gender of household head (Dummy)	0.00	0.00		-0.03	-0.10		0.01	0.02		-0.05	-0.13	
Ethnicity of household head (Myanmar) (Dummy)	0.28	0.75		0.30	0.88		0.37	1.02		0.40	1.16	
Years of non-agricultural business in operation	1.50	3.99		1.45	4.23		1.39	3.81		1.06	3.05	
Household size (Number)	12.12	32.29	15.42	15.90	46.38	22.23	11.26	30.88	15.38	16.35	47.30	23.01
Household size squared (Number)	-6.33	-16.87		-8.28	-24.15		-5.65	-15.49		-8.39	-24.29	
Age structure of household members												
Proportion of members aged under 6	-0.20	-0.54	-1.99	-0.26	-0.75	-2.69	-0.26	-0.70	-1.93	-0.30	-0.88	-2.72
Proportion of members aged 6-10	-0.51	-1.35		-0.35	-1.02		-0.66	-1.81		-0.21	-0.61	
Proportion of members aged 11-15	-0.32	-0.85		-0.29	-0.84		-0.38	-1.04		-0.31	-0.89	
Proportion of members aged 16- 65	0.28	0.75		-0.03	-0.08		0.59	1.62		-0.12	-0.35	
Education level of household members who worked in the last 6 months												
Proportion of member with Tertiary education	6.88	18.32	25.44	8.12	23.67	25.87	6.24	17.11	26.81	8.11	23.46	25.27
Proportion of members with Upper secondary	2.45	6.52		3.02	8.81		1.69	4.62		2.75	7.97	
Proportion of members with Lower secondary	0.51	1.35		0.21	0.62		0.17	0.48		-0.05	-0.15	
Proportion of members with Primary education	-1.08	-2.89		-2.53	-7.37		0.72	1.98		-2.17	-6.27	
Proportion of members with Illiterate	0.80	2.14		0.05	0.14		0.96	2.63		0.09	0.26	
Health condition of household members in the last 30 days												
Proportion of members being sick/ ill/ injured	0.41	1.08	1.08	0.77	2.26	2.26	0.46	1.25	1.25	0.85	2.46	2.46

Continued over

Continued

Variable	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Proportion of household members who worked in the last 7 days with												
Legislators, senior officials and managers	6.01	16.01	20.23	2.37	6.91	15.15	4.75	13.01	16.21	2.23	6.45	13.37
Professionals	0.79	2.09		0.25	0.72		0.92	2.52		0.42	1.23	
Technicians and associate professionals	1.45	3.86		0.94	2.75		0.97	2.66		1.34	3.87	
Service workers and shop and market sales workers	3.86	10.28		2.13	6.20		4.12	11.30		2.38	6.88	
Skilled agricultural and fishery workers	-2.46	-6.55		-0.56	-1.64		-2.59	-7.10		-0.56	-1.63	
Craft and related trades workers	-0.17	-0.44		-0.12	-0.35		-0.41	-1.12		-0.24	-0.70	
Plant and machine operators and assemblers	0.84	2.23		0.46	1.35		0.95	2.62		0.28	0.80	
Elementary occupations	-2.72	-7.25		-0.27	-0.79		-2.80	-7.68		-1.22	-3.52	
Land ownership and access, along with cultivation of crops												
Owned and accessed irrigated land area per capita (Acres)	0.88	2.34	6.30	0.37	1.06	5.28	1.04	2.85	7.20	1.14	3.29	8.14
Owned and accessed unirrigated land area per capita (Acres)	1.10	2.94		0.67	1.94		1.12	3.06		0.92	2.68	
Landless (Dummy)	0.62	1.65		0.84	2.46		0.47	1.29		0.74	2.14	
Cultivation of Cereal crops (Dummy)	-0.16	-0.42		-0.13	-0.38		-0.07	-0.19		-0.09	-0.27	
Cultivation of Pulses (Dummy)	-0.04	-0.10		0.03	0.08		-0.04	-0.10		0.03	0.08	
Cultivation of Oilseed crops (Dummy)	-0.04	-0.10		0.00	0.00		0.13	0.36		0.01	0.03	
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	-0.04	-0.11		0.00	-0.01		-0.05	-0.14		0.00	-0.01	
Cultivation of Fruit crops (Dummy)	0.04	0.10		0.01	0.04		0.03	0.07		0.02	0.04	
Cultivation of Industrial crops (Dummy)	0.00	0.00		0.03	0.08		0.00	-0.01		0.06	0.16	
Proportion of household members with open unemployment in the last 6 months	0.10	0.26	0.26	0.21	0.61	0.61	0.08	0.21	0.21	0.37	1.08	1.08
Proportion of household members who worked in the last 6 months with												
Agriculture, Forestry, Fishing and Mining Sector	-0.21	-0.57	1.65	-0.34	-0.98	0.66	-2.26	-6.19	3.31	-0.66	-1.91	0.35
Manufacturing and Construction Sector	0.04	0.12		0.07	0.20		0.12	0.32		0.10	0.28	
Services Sector	0.79	2.11		0.49	1.44		3.35	9.18		0.68	1.98	

Continued over

Continued

Variable	All Households						Panel Households Only					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Location and regional effects												
Dry Zone region (Dummy)	-0.06	-0.17	19.42	0.17	0.50	7.87	0.01	0.02	19.96	0.31	0.89	8.15
Coastal region (Dummy)	-0.06	-0.16		0.26	0.76		-0.04	-0.11		0.22	0.65	
Delta region (Dummy)	5.22	13.92		-0.34	-1.00		4.97	13.63		-0.09	-0.27	
Village Tract/Wards: Inland plains (Dummy)	0.15	0.39		0.42	1.22		0.25	0.69		0.42	1.20	
Village Tract/Wards: Hills (Dummy)	-0.03	-0.07		0.01	0.04		-0.02	-0.05		0.01	0.03	
Village Tract/Wards: Mountains (Dummy)	1.08	2.87		0.08	0.23		1.08	2.95		0.04	0.11	
Village Tract/Wards: Delta (Dummy)	-0.16	-0.42		0.49	1.42		-0.20	-0.55		0.41	1.18	
Village Tract/Wards: Valley (Dummy)	-0.05	-0.14		-0.03	-0.10		-0.07	-0.19		0.03	0.08	
Distance to nearest market (Miles)	-0.09	-0.24		0.55	1.61		-0.10	-0.28		0.62	1.78	
Distance to nearest financial services (Miles)	0.52	1.38		0.29	0.85		0.77	2.11		0.11	0.31	
Distance to nearest health services (Miles)	0.42	1.12		0.35	1.01		0.17	0.46		0.30	0.88	
Distance to primary and monastic school (Miles)	-0.03	-0.07		0.00	-0.01		-0.02	-0.04		-0.01	-0.02	
Distance to lower secondary school (Miles)	0.29	0.78		0.58	1.69		0.34	0.95		0.52	1.51	
Distance to upper secondary school (Miles)	0.09	0.23		-0.11	-0.33		0.14	0.38		-0.06	-0.18	
Infrastructure												
Road Density by states and regions	-2.40	-6.39	7.29	-0.71	-2.06	14.83	-2.10	-5.76	6.52	-0.64	-1.85	14.76
Bituminous (Dummy)	-0.10	-0.26		2.00	5.83		0.09	0.25		2.44	7.05	
Gravel roads (Dummy)	-0.16	-0.42		-0.13	-0.37		0.00	0.01		-0.09	-0.25	
Laterite roads (Dummy)	-0.22	-0.58		0.01	0.02		-0.19	-0.53		-0.04	-0.13	
Dirt roads (Dummy)	0.87	2.33		1.50	4.38		0.60	1.64		1.33	3.84	
Months on Road by car/Four Wheels and on water way by boat	1.05	2.81		-0.20	-0.59		0.76	2.08		-0.22	-0.62	
Water supply (Dummy)	1.19	3.17		0.62	1.81		0.90	2.48		0.49	1.42	
Electricity supply (Dummy)	0.56	1.48		1.14	3.32		0.38	1.05		0.96	2.78	
Common mode of transportation: Taxi/Bus (Dummy)	0.93	2.49		0.89	2.60		1.04	2.85		0.96	2.78	
Common mode of transportation: Ship/Boat (Dummy)	-0.07	-0.20		-0.08	-0.23		-0.07	-0.20		-0.16	-0.46	
Common mode of transportation: Bullock Cart (Dummy)	0.92	2.46		0.07	0.21		0.85	2.32		0.11	0.31	
Common mode of transportation: Horse (Dummy)	0.15	0.41		-0.03	-0.09		0.13	0.34		-0.04	-0.11	
Nargis affected area (Dummy)				1.02	2.99	2.99				0.72	2.09	2.09
Explained	**37.52**	**37.52**		**34.29**	**34.29**		**36.48**	**36.48**		**34.56**	**34.56**	
Residual	**62.48**	**62.48**		**65.71**	**65.71**		**63.52**	**63.52**		**65.44**	**65.44**	
Total	**100**	**100.00**	**100.00**	**100**	**100.00**	**100.00**	**1.00**	**100.00**	**100.00**	**1.00**	**100.00**	**100.00**

Source: Author's estimations

Table 5.4 The Fields decomposition of the level of consumption expenditure inequality, 2004/05 and 2009/10 (Urban households vs. Rural households)

Variable	Urban Households						Rural Households					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Characteristics of the household head												
Age of household head (Years)	-0.03	-0.07	6.51	2.98	7.73	7.33	-0.06	-0.19	2.09	-0.03	-0.10	3.55
Age square of household head (Years)	0.02	0.04		-2.52	-6.55		0.10	0.33		0.03	0.09	
Gender of household head (Dummy)	0.60	1.42		0.21	0.54		0.00	0.00		0.00	0.00	
Ethnicity of household head (Myanmar) (Dummy)	0.20	0.47		0.04	0.09		0.17	0.56		0.68	2.32	
Years of non-agricultural business in operation	1.96	4.64		2.13	5.52		0.43	1.39		0.36	1.24	
Household size (Number)	13.95	33.14	14.68	16.90	43.87	21.10	13.47	44.07	20.61	17.66	60.54	27.88
Household size squared (Number)	-7.77	-18.46		-8.77	-22.77		-7.17	-23.46		-9.53	-32.66	
Age structure of household members												
Proportion of members aged under 6	-0.22	-0.53	-1.08	-0.19	-0.49	-0.63	-0.11	-0.36	-1.66	-0.21	-0.74	-2.57
Proportion of members aged 6-10	-0.27	-0.64		-0.16	-0.41		-0.32	-1.04		-0.32	-1.08	
Proportion of members aged 11-15	-0.13	-0.30		0.10	0.27		-0.26	-0.86		-0.24	-0.84	
Proportion of members aged 16- 65	0.16	0.39		0.00	0.00		0.18	0.60		0.03	0.09	
Education level of household members who worked in the last 6 months												
Proportion of members with Tertiary education	6.02	14.31	20.22	8.26	21.46	17.30	2.40	7.85	18.93	3.48	11.92	17.82
Proportion of members with Upper secondary	0.48	1.13		0.83	2.16		1.95	6.38		2.20	7.53	
Proportion of members with Lower secondary	-0.02	-0.04		-1.22	-3.16		1.48	4.85		1.05	3.58	
Proportion of members with Primary education	1.78	4.22		-1.18	-3.05		-0.93	-3.05		-1.51	-5.18	
Proportion of members with Illiterate	0.26	0.61		-0.04	-0.11		0.89	2.91		-0.01	-0.04	
Health condition of household members in the last 30 days												
Proportion of members being sick/ ill/ injured	0.16	0.37	0.37	0.52	1.36	1.36	0.68	2.22	2.22	0.89	3.05	3.05

Continued over

Continued

Variable	Urban Households						Rural Households					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Proportion of household members who worked in the last 7 days with												
Legislators, senior officials and managers	9.36	22.23	26.20	3.76	9.75	17.91	1.97	6.43	14.96	1.01	3.47	12.88
Professionals	0.78	1.85		0.39	1.01		0.29	0.95		-0.02	-0.07	
Technicians and associate professionals	1.41	3.36		1.20	3.12		0.47	1.52		0.07	0.23	
Service workers and shop and market sales workers	2.55	6.05		1.96	5.09		2.36	7.74		0.60	2.05	
Skilled agricultural and fishery workers	-0.94	-2.22		-0.41	-1.05		0.46	1.50		0.99	3.38	
Craft and related trades workers	-1.01	-2.41		-0.71	-1.84		-0.15	-0.50		-0.04	-0.15	
Plant and machine operators and assemblers	0.05	0.11		0.40	1.05		0.68	2.24		0.09	0.32	
Elementary occupations	-1.17	-2.78		0.30	0.78		-1.50	-4.92		1.07	3.66	
Land ownership and access, along with cultivation of crops												
Owned and accessed irrigated land area per capita (Acres)	0.12	0.28	0.65	0.10	0.26	1.23	2.30	7.53	22.08	0.84	2.86	17.85
Owned and accessed unirrigated land area per capita (Acres)	0.04	0.10		0.10	0.26		2.91	9.53		1.78	6.09	
Landless (Dummy)	-0.02	-0.05		0.17	0.45		0.97	3.18		1.11	3.80	
Cultivation of Cereal crops (Dummy)	0.03	0.06		0.07	0.19		0.22	0.73		0.68	2.35	
Cultivation of Pulses (Dummy)	0.03	0.08		-0.02	-0.06		0.04	0.14		0.30	1.02	
Cultivation of Oilseed crops (Dummy)	-0.03	-0.07		0.01	0.02		0.00	0.01		0.24	0.81	
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	0.07	0.17		0.02	0.04		0.03	0.10		0.03	0.09	
Cultivation of Fruit crops (Dummy)	0.01	0.04		0.01	0.02		0.15	0.48		0.06	0.21	
Cultivation of Industrial crops (Dummy)	0.02	0.04		0.02	0.05		0.12	0.38		0.18	0.62	
Proportion of household members with open unemployment in the last 6 months	0.54	1.29	1.29	0.57	1.48	1.48	0.07	0.22	0.22	0.20	0.69	0.69
Proportion of household members who worked in the last 6 months with												
Agriculture, Forestry, Fishing and Mining Sector	1.29	3.07	1.79	-0.31	-0.81	-0.18	-1.32	-4.33	1.53	-0.08	-0.27	1.24
Manufacturing and Construction Sector	0.09	0.21		0.06	0.15		0.01	0.04		0.06	0.21	
Services Sector	-0.63	-1.49		0.18	0.48		1.78	5.82		0.38	1.30	

Continued over

Continued

Variable	Urban Households						Rural Households					
	2004/05			2009/10			2004/05			2009/10		
	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$	$\%S_j$	$\% P_j$	$\% GpP_j$
Location and regional effects												
Dry Zone region (Dummy)	0.23	0.54	14.85	0.15	0.39	7.77	-0.14	-0.47	14.69	0.01	0.04	8.93
Coastal region (Dummy)	0.23	0.55		0.05	0.12		0.09	0.29		0.37	1.26	
Delta region (Dummy)	4.55	10.80		-0.27	-0.69		3.25	10.62		0.34	1.16	
Village Tract/Wards: Inland plains (Dummy)	0.05	0.12		0.08	0.20		0.02	0.07		0.51	1.74	
Village Tract/Wards: Hills (Dummy)	-0.01	-0.03		0.03	0.09		-0.01	-0.05		0.00	0.00	
Village Tract/Wards: Mountains (Dummy)	0.50	1.20		0.00	0.00		1.43	4.69		0.31	1.06	
Village Tract/Wards: Delta (Dummy)	0.31	0.75		0.14	0.36		-1.01	-3.30		0.42	1.43	
Village Tract/Wards: Valley (Dummy)	0.05	0.11		0.12	0.31		-0.03	-0.11		0.05	0.16	
Distance to nearest market (Miles)	-0.01	-0.03		0.04	0.10		-0.06	-0.18		0.01	0.03	
Distance to nearest financial services (Miles)	0.18	0.43		0.61	1.58		0.16	0.51		0.00	0.00	
Distance to nearest health services (Miles)	0.21	0.50		1.31	3.39		0.45	1.47		0.16	0.54	
Distance to primary and monastic school (Miles)	0.08	0.19		-0.02	-0.05		-0.02	-0.08		0.00	0.00	
Distance to lower secondary school (Miles)	-0.04	-0.11		0.62	1.60		0.34	1.12		0.42	1.43	
Distance to upper secondary school (Miles)	-0.07	-0.17		0.15	0.38		0.03	0.08		0.02	0.08	
Infrastructure												
Road Density by state and region	-3.66	-8.70	14.52	-0.31	-0.81	25.15	-0.28	-0.91	4.33	0.49	1.68	9.24
Bituminous (Dummy)	0.05	0.13		0.74	1.92		-0.01	-0.04		0.50	1.72	
Gravel roads (Dummy)	0.89	2.12		1.57	4.08		0.09	0.29		0.20	0.69	
Laterite roads (Dummy)	1.41	3.36		0.77	2.01		0.00	0.02		0.37	1.28	
Dirt roads (Dummy)	1.44	3.43		2.12	5.49		0.01	0.03		0.04	0.13	
Months on Road by car/Four Wheels and on water way by boat	1.94	4.60		0.01	0.04		0.65	2.12		-0.01	-0.03	
Water supply (Dummy)	2.34	5.56		1.83	4.75		0.04	0.12		0.04	0.15	
Electricity supply (Dummy)	0.32	0.77		0.02	0.05		0.20	0.67		0.95	3.25	
Common mode of transportation: Taxi/Bus (Dummy)	1.30	3.09		2.07	5.38		0.13	0.43		0.07	0.24	
Common mode of transportation: Ship/Boat (Dummy)	-0.13	-0.30		0.07	0.17		0.06	0.21		0.01	0.03	
Common mode of transportation: Bullock Cart (Dummy)	0.27	0.64		0.09	0.25		0.08	0.25		0.03	0.10	
Common mode of transportation: Horse (Dummy)	-0.07	-0.17		0.71	1.84		0.35	1.16		0.00	0.01	
Nargis affected area (Dummy)				0.08	0.21	0.21				-0.17	-0.58	-0.58
Explained	**42.10**	**42.10**		**38.52**	**38.52**		**69.45**	**69.45**		**29.18**	**29.18**	
Residual	**57.90**	**57.90**		**61.48**	**61.48**		**30.55**	**30.55**		**70.82**	**70.82**	
Total	**100**	**100.00**	**100.00**	**100**	**100.00**	**100.00**	**1.00**	**100.00**	**100.00**	**1.00**	**100.00**	**100.00**

Source: Author's estimations

A favourable change (about 22% (all households) and 16% (panel households)) comes from household members engaging in the different types of occupation; this reduces the expenditure inequality over time. The analysis also indicates that education reduces inequality by about 14% (all households) and 18% (panel households). The negative contribution is intensified for infrastructure, and accounts for 12% (all households) and 20% (panel households), and household size and its squared amounts to 5% (all households), and 13% (panel households). In terms of infrastructure, it seems that infrastructure facilities are better utilized by rich households—for example, business owners in the teak industry mainly use roads for extracting their products in the forests and export it to other countries such as China. Thus, their expenditure rises, offsetting the reduction in inequality.

In the analyses of the decompositions of the contributing factors to the level of, and changes in, the Gini coefficient for rural and urban households, the factors are somewhat different in importance, as shown in Table 5.6. The major influencing factors to explain the reduction in the expenditure inequality over time are: occupations accounting for 32% (urban) and 11% (rural); location and regional effects amounting to 23% (urban) and 19% (rural); and the level of education of household members accounting for 18% (urban) and 10% (rural). Importantly, the third major influencing factor for rural areas is land ownership and access, along with cultivation of crops (19%). A major negative contribution is reported for infrastructure, accounting for 12% (urban) and 9% (rural), and household size and its squared amounting to 4% (urban) and 8% (rural).

5.4.4.2 Generalized Entropy measures

It can be seen in Table 5.7 that results are sensitive to which inequality measure and weight for the Generalized Entropy measures one uses. The results of the decomposition of GE(0), GE(1) and GE(2) in terms of the percentage share of total inequality as explained by the grouped factors for all households are presented in Table 5.7. Regional and locational effects of the village tracts/wards of household members are the main contributors throughout the study period with 20% as measured by GE(0), and GE(1) (17%) and GE(2) (11%). The results in this study are in line with other research using the Fields (2003) approach, for example, the study of Heltberg (2002) in Vietnam, which finds that the regional effect is a prominent factor to reduction in inequality.

Next, the share of household members working in different types of occupation is the important contributor to the reduction in inequality (14%, 13% and 9% as measured by GE(0), GE(1) and GE(2), respectively). Thirdly, the share of household members with their levels of education contributes about 11% each to the reduction in inequality as measured by GE(0) and GE(1) and about 10% by GE(2). Nonetheless, this was offset by infrastructure, households residing in the Nargis-affected area, health condition of household members, the share of household members with different age groups (especially aged below 15), open unemployment as measured by GE(0) and GE(1). This was also counterbalanced by households living in the Nargis-affected area and the share of household members with different age groups (especially aged below 15) as measured by GE(2). The negative contribution of infrastructure accounts for 2–4 % using the GE(1) and GE(0) measures.

With regard to household size, with larger households, expenditures per person decrease up to a certain household size due to economies of scale. After a certain household size, having more household members in a family costs more. Even though household size substantially contributes to the level of inequality, it is not a key indicator of changes in inequality as measured by GE(0) and GE(1), but it is one of the indicators contributing to the reduction in expenditure inequality, as measured by GE (2). As household size also causes the reduction in inequality, especially as measured by GE (2), the results show that the economies of scale are also true for rich families even though more household members of rich families could lead to spending more as they have more flexible constraints on their family budgets.

Interestingly, the impact of Nargis in particular has gained ground registering with a negative contribution of 3% and 2% (measured in terms of the R2) in GE(0) and GE(1) respectively to the reduction in inequality. As GE(0) gives more weight to the lower part of the expenditure distribution, it is likely that some poor households spent more after Nargis. Then this leads to a cancelling out of the reduction in inequality. In addition, the narrowing of Myanmar's expenditure inequality hides significant adverse changes in inequality that stems from the residual effects.

Table 5.5 The Fields decomposition of the contributing variables to the level of, and changes in, the Gini coefficient

(All households vs. Panel households)

Variable Group	All Households			Panel Households Only		
	2004/05 (Gini=0.2564)*Sj_1 (%) Gini 1	**2009/10 (Gini=0.2205)*Sj_2 (%) Gini 2**	**09/10-04/05 (Gini=-0.0360) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)**	**2004/05 (Gini=0.2564)*Sj_1 (%) Gini 1**	**2009/10 (Gini=0.2205)*Sj_2 (%) Gini 2**	**09/10-04/05 (Gini=-0.0360) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)**
Characteristics of the household head	0.47	0.37	2.68	0.47	0.31	5.54
Household size and its squared	1.48	1.68	-5.46	1.44	1.75	-13.23
Proportion of HH members with different age groups	-0.19	-0.20	0.32	-0.18	-0.21	1.20
Proportion of HH members with their level of education (Last 6 months)	**2.45**	**1.96**	**13.69**	**2.51**	**1.93**	**18.22**
Health condition of household members in the last 30 days	0.10	0.17	-1.85	0.12	0.19	-2.71
Proportion of HH members with occupation (Last 7 days)	**1.95**	**1.15**	**22.29**	**1.52**	**1.02**	**16.32**
Land ownership and access, along with cultivation of crops	0.61	0.40	5.74	0.67	0.62	1.11
Proportion of household members with open unemployment in the last 6 months	0.02	0.05	-0.58	0.02	0.08	-2.33
Proportion of HH members with industry (Last 6 months)	0.16	0.05	3.03	0.31	0.03	9.96
Location and regional effects	**1.87**	**0.59**	**35.42**	**1.87**	**0.62**	**43.22**
Infrastructure	0.70	1.12	-11.66	0.61	1.12	-19.55
Nargis affected area		0.23	-6.28		0.16	-5.83
Explained	**9.62**	**7.56**	**57.34**	**9.35**	**7.62**	**51.92**
Residual	**16.02**	**14.49**	**42.66**	**16.29**	**14.43**	**48.08**
Total	**25.64**	**22.05**	**100.00**	**25.64**	**22.06**	**100.00**

Source: Author's estimations

Table 5.6 The Fields decomposition of the contributing variables to the level of, and changes in, the Gini coefficient (Urban households vs. Rural households)

Variable Group	Urban Households			Rural Households Only		
	2004/05 (Gini=0.3146)*Sj_1 (%) Gini 1	2009/10 (Gini=0.2625)*Sj_2 (%) Gini 2	09/10-04/05 (Gini=-0.0521) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)	2004/05 (Gini=0.2118)*Sj_1 (%) Gini 1	2009/10 (Gini=0.1879)*Sj_2 (%) Gini 2	09/10-04/05 (Gini=-0.0239) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)
Characteristics of the household head	0.86	0.74	2.33	0.14	0.19	-2.48
Household size and its squared	1.94	2.13	-3.61	1.33	1.53	-8.12
Proportion of HH members with different age groups	-0.14	-0.06	-1.51	-0.11	-0.14	1.38
Proportion of HH members with their level of education (Last 6 months)	**2.68**	**1.75**	**17.84**	**1.23**	**0.98**	**10.37**
Health condition of household members in the last 30 days	0.05	0.14	-1.68	0.14	0.17	-0.98
Proportion of HH members with occupation (Last 7 days)	**3.47**	**1.81**	**31.84**	**0.97**	**0.71**	**10.95**
Land ownership and access, along with cultivation of crops	0.09	0.12	-0.74	1.43	0.98	18.80
Proportion of household members with open unemployment in the last 6 months	0.17	0.15	0.41	0.01	0.04	-1.01
Proportion of HH members with industry (Last 6 months)	0.24	-0.02	4.90	0.10	0.07	1.30
Location and regional effects	**1.97**	**0.79**	**22.69**	**0.95**	**0.49**	**19.26**
Infrastructure	1.92	2.54	-11.91	0.28	0.51	-9.45
Nargis affected area		0.02	-0.40		-0.03	1.33
Explained	**13.24**	**10.11**	**60.15**	**6.47**	**5.48**	**41.36**
Residual	**18.21**	**16.14**	**39.85**	**14.71**	**13.30**	**58.64**
Total	**31.46**	**26.25**	**100.00**	**21.18**	**18.79**	**100.00**

Source: Author's estimations

Table 5.7 The Fields decomposition of the contributing variables to the level of, and changes in, the Generalized Entropy indices (All households)

Variable Group	Total % GE (0)*(Sj)			Total % GE (1)*(Sj)			Total % GE (2)*(Sj)		
	04/05	09/10	Total % Δ 09/10–04/05	04/05	09/10	Total % Δ 09/10–04/05	04/05	09/10	Total % Δ 09/10–04/05
Characteristics of the household head	0.20	0.14	2.22	0.26	0.16	2.14	0.73	0.29	1.94
Household size & its squared	0.64	0.62	0.71	0.81	0.74	1.71	2.29	1.32	4.35
Proportion of HH members with different age groups	-0.08	-0.07	-0.26	-0.10	-0.09	-0.36	-0.30	-0.16	-0.61
Proportion of HH member with their level of education (Last 6 months)	**1.06**	**0.72**	**11.42**	**1.34**	**0.86**	**11.05**	**3.77**	**1.54**	**10.08**
Health condition of household members in the last 30 days	0.04	0.06	-0.61	0.06	0.07	-0.41	0.16	0.13	0.12
Proportion of HH members with occupation (Last 7 days)	**0.84**	**0.42**	**14.23**	**1.06**	**0.50**	**12.92**	**3.00**	**0.90**	**9.47**
Land ownership and access, along with cultivation of crops	0.26	0.15	3.89	0.33	0.18	3.59	0.93	0.31	2.79
Proportion of household members with open unemployment in the last 6 months	0.01	0.02	-0.21	0.01	0.02	-0.15	0.04	0.04	0.01
Proportion of HH members with industry (Last 6 months)	0.07	0.02	1.71	0.09	0.02	1.49	0.25	0.04	0.93
Location and regional effects	**0.81**	**0.22**	**19.99**	**1.02**	**0.26**	**17.49**	**2.88**	**0.47**	**10.89**
Infrastructure	0.30	0.41	-3.76	0.38	0.49	-2.48	1.08	0.88	0.89
Nargis affected area		0.08	-2.83		0.10	-2.28		0.18	-0.80
Explained	**4.15**	**2.78**	**46.47**	**5.26**	**3.32**	**44.71**	**14.83**	**5.95**	**40.06**
Residual	**6.91**	**5.34**	**53.53**	**8.76**	**6.35**	**55.29**	**24.68**	**11.41**	**59.94**
Total	**11.06**	**8.12**	**100**	**14.02**	**9.67**	**100**	**39.51**	**17.36**	**100.00**

Source: Author's estimations

In summary, between 2004/05 and 2009/10, this analysis uncovers the most important drivers of the reduction in expenditure inequality in Myanmar. They are: geographical location of household members, household members who work in different types of occupation, and their level of educations. The contribution of the regional effect comes especially from the Delta region where most paddy is produced. The contribution of occupation is mainly driven by those working in white collar jobs such as legislators, senior officials and managers, and also by those in services and sales workers.

Interestingly, when the education factor is examined in the disaggregated components as measured by the Gini coefficient for all households, the major contribution of education to the reduction in consumption expenditure inequality is determined by the proportion of household members who have a primary level of education. In contrast household members who have a tertiary, or upper secondary education contribute to an increase in consumption expenditure inequality. However, when the education factor is measured by the Generalized Entropy indices with weights 0, 1 and 2 for all households, the key contribution of education to the decline in consumption expenditure inequality is influenced by the share of household members with all levels of education, especially household members who have a tertiary level of education. Thus, the findings measured by the Gini coefficient and GE indices are contradictory for the education factor for all households. However, this is not the case for the findings measured by the Gini coefficient and GE indices for panel households. Household members who have a tertiary, or upper secondary education contribute to an increase in consumption expenditure inequality as measured by the Gini coefficient and GE indices for panel households, while the reduction in consumption expenditure inequality is determined by the proportion of household members who have a primary level of education.

The other variables that contribute to the reduction in inequality in a small percentage are land ownership and access, along with cultivation of crops; characteristics of household heads; household size and its squared; and the proportion of household members working in different industry sectors. When the factor of land ownership and access, along with cultivation of crops is investigated in disaggregate components measured by the Gini coefficient and Generalized Entropy measures, the ownership of irrigated and unirrigated land contributes mainly to a reduction in the expenditure inequality.

5.4.5 Yun's unified approach

Yun (2006) attempts to unify the approaches of Juhn et al. (1993) and Fields (2003) to decompose the changes of inequality between two time periods. Using the Fields approach, any inequality measure[58] can be decomposed into individual factors, whereas in the approach of Juhn et al. (1993), percentile differences in log-earnings (for example, 90–10, 90–50, and 50–10), can be decomposed into coefficients and characteristics effects by using an auxiliary expenditure equation at the aggregate level. However, the synthesis of the Yun (2006) approach can only apply to the variances of the log of earnings/income[59] (expenditure). The Yun unified method decomposes the difference in the variance of log of income between two time periods, into the characteristics, coefficients, and residuals effects.

It is argued here that the application of Yun's approach entails a serious problem. In Yun (2006), the author subtracts the variance of log of earnings of the earlier year from the variance of log of earnings of the later year. This becomes the left-hand side of his estimated equation. Then, the auxiliary expenditure equation is specified such that the coefficients of the log of earnings function for the later year is replaced with those of the log of earnings function of the previous year, while keeping the quantities (characteristics) and residuals of the log of earnings function for the later year unchanged. However, some researchers who apply the Yun (2006) approach do the opposite, by subtracting the smaller inequality index from the larger inequality index to get a positive sign in the difference of the variance of log of income (expenditure). It would seem equally reasonable to do either, especially when the inequality measure is declining over time. But are the results in terms of signs and magnitudes the same for the above two scenarios? Unfortunately, they are not.

Firstly, both ways of differencing are calculated below for the Gini coefficient and Generalized Entropy measures between 2004/05 and 2009/10 by using the Fields (2003)

[58] According to the six axioms developed by Shorrocks (1982), the relative contribution of a factor *j* to total inequality is constant to any inequality measures chosen.

[59] Barrett et al. (2000) argue that "the variance of log earnings is scale dependent and therefore sensitive to the choice of reference year prices" (p.118). Moreover, the variance of logarithms does not satisfy 'Principle of transfers' (Dalton, 1920; Pigou, 1912), when the transfer is between two particularly rich observations (Jolliffe & Krushelnytskyy, 2000).

approach. The signs and magnitudes of the results for contributing factors are exactly the same. The results produced by the Fields (2003) method do not change because of different ways of subtracting to obtain the dependent variable. Secondly, the Yun (2006) approach is also examined both ways.

Following the Yun (2006) approach, let E_1 and E_2 be the variances of log of expenditure per adult equivalent in 2004/05 and 2009/10. The auxiliary expenditure equation can be specified such that the coefficients of the consumption expenditure function for 2004/05 are used with the quantities (characteristics) and residuals of the expenditure function for 2009/10 as follows:

$$\ln E_i^* = \beta_{\mathbf{04/05}} + \sum_{j=1}^{j=j-1} \beta_{j\mathbf{04/05}}\, x_{j09/10} + e_{09/10} \ . \tag{5.12}$$

Based on the Equation (5.12), the variance of $\ln E_i^*$ can be computed as follows:

$$\sigma^2(\ln E_i^*) = \sum_{j=1}^{j=J} \left[\beta_{j\mathbf{04/05}} \cdot \sigma_{x_{j09/10}} \cdot \rho_{(x_{j09/10}, \ln E^*)} \cdot \sigma_{(\ln E^*)}\right], \tag{5.13}$$

where $\rho_{(x_{j09/10}, \ln E^*)}$ is the correlation coefficient between $x_{j09/10}$ and $\ln E^*$

$$\sigma^2(\ln E_i^*) = \sum_{j=1}^{j=J} (S_{j \ln E^*} \cdot \sigma^2{}_{\ln E^*}) \ . \tag{5.14}$$

Using the auxiliary function of Equation (5.12), the difference in the variances of log expenditure (as inequality measures) of the 2004/05 and 2009/10 distributions can be given as follows:

$$I_{09/10} - I_{04/05} = \left(I_{09/10} - I^*\right) + \left(I^* - I_{04/05}\right) \tag{5.15}$$

$$\begin{aligned} \sigma^2\left(\ln E_{\frac{09}{10}}\right) - \sigma^2\left(\ln E_{\frac{04}{05}}\right) = {} & \left[\sigma^2\left(\ln E_{\frac{09}{10}}\right) - \sigma^2(\ln E^*)\right] \\ & + \left[\sigma^2(\ln E^*) - \sigma^2\left(\ln E_{\frac{04}{05}}\right)\right] \\ & + \left[\sigma^2\left(\varepsilon_{09/10}\right) - \sigma^2\left(\varepsilon_{04/05}\right)\right], \end{aligned} \tag{5.16}$$

which then

$$= \sum_{j=1}^{j=J} \left(S_{j \ln E_{\frac{09}{10}}} \cdot \sigma^2{}_{E_{\frac{09}{10}}} - S_{j \ln E^*} \cdot \sigma^2{}_{\ln E^*} \right)$$

$$+ \sum_{j=1}^{j=J} \left(S_{j \ln E^*} \cdot \sigma^2{}_{\ln E^*} - S_{j \ln E_{\frac{04}{05}}} \cdot \sigma^2{}_{E_{\frac{04}{05}}} \right)$$

$$+ \left[\sigma^2\left(\varepsilon_{09/10}\right) - \sigma^2\left(\varepsilon_{04/05}\right) \right], \qquad (5.17)$$

where $S_{j \ln E^*}, S_{j \ln E_{09/10}}$, and $S_{j \ln E_{04/05}}$ are relative factor inequality weights for a factor j using consumption expedition distributions of $\ln E^*, E_{09/10}$, and $E_{04/05}$ respectively. On the right-hand side of Equation (5.16), the first, second, and third parts are the coefficients, the characteristics, and the residuals effects, respectively. Brewer and Wren-Lewis (2016) explain the effects of coefficients and characteristics as "a price effect is the part of an inequality change explained by a change in the influence of a particular characteristic on income (e.g. a rise in the education price effect is due to education becoming a more important determinant of an individual's income). The quantity effect is due to a change in the distribution of a characteristic among the population (e.g. a rise in the education quantity effect might be due to education becoming less equally distributed among the population)" (p.7). The effect of residuals means the contribution of unexplained factors to the change in variances of log expenditure at the aggregate level by the model specifications.

The auxiliary expenditure Equation (5.12) can be specified so that the coefficients of consumption expenditure function of 2004/05 are replaced with those of consumption expenditure function of 2009/10, while keeping the quantities (characteristics) and residuals of the expenditure function of 2004/05 as in other studies, (for example, Liu, 2008, p. 419). Then, the difference in the variances of log expenditure (as inequality measures) of the 2004/05 and 2009/10 distributions can be given as follows:

$$I_{04/05} - I_{09/10} = \left(I_{04/05} - I^*\right) + \left(I^* - I_{09/10}\right) \ , \qquad (5.18)$$

where I^* is the inequality of an auxiliary distribution.

For the above changes in the auxiliary expenditure Equation (5.12), and as in Equation (5.18), this study finds that the key contributing results to the changes of variances of log of expenditures shift between the coefficients effect and the characteristics effect. The findings can be seen in Table 5.8.

Table 5.8 presents the results of decomposing the differences in the variances of log expenditures in both ways (described above). As shown in the second column, the effect of characteristics or quantity is the key contributor to a fall in the natural log of variance of consumption expenditures if its difference over time is -0.04485 and the specification is as in the Equation (5.12). The results are also consistent with Yun's (2006) finding. This outcome explains that the change of expenditure inequality is mainly due to the changes in distribution of key factors among the population. Of the 62.95% contribution from the characteristics effect, the location and regional effects (15%), all levels of education of household members (15%), and the occupations (14%) are major explanatory factors for changes in inequality measured for all households. Conversely, the coefficients effect increases the log of variance of expenditure, but the coefficients effect is offset and surpassed by the bigger effect of characteristics and the residuals. Table 5.8 also shows a large residual effect in the reduction of log of variance of consumption expenditures as in the study of Kang and Yun (2008).

As shown in Column 3 of Table 5.8, the effect of coefficients plays the major role in the reduction in natural log of variance of consumption expenditure if its difference is 0.04485 over time and when the auxiliary expenditure Equation (5.12) is defined the other way around. This highlights the fact that the change of expenditure inequality is mostly from the factors becoming increasing important determinants of the individual's expenditure. Of the 96.85% of coefficients effect, the location and regional effects (26%), all levels of education of household members (24%), and the occupations (21%) are key contributing factors to changes of the inequality measured for all households. Conversely, the characteristics effect increases the log of variance of expenditure, but the effect is somewhat cancelled out and overtaken by the greater effect of coefficients.

Table 5.8 Yun's unified decomposition of the contributing variables to the changes in variance of log expenditure for all households

Variable Group	Var of ln exp 2009/10 – Var of ln exp 2004/05 0.1430 - 0.1878 = - 0.04485 (- 24%)				Var of ln exp 2004/05 – Var of ln exp 2009/10 0.1878 - 0.1430 = 0.04485 (24%)			
	Coeff. effect	**%**	**Char. effect**	**%**	**Coeff. effect**	**%**	**Char. effect**	**%**
Characteristics of the household head	0.00027	-0.61	-0.0013	2.89	0.00205	4.58	-0.00103	-2.31
Household size and its squared	0.00357	-7.95	-0.0035	7.89	0.00471	10.50	-0.00474	-10.56
Proportion of HH members with different age groups	-0.00044	0.99	0.0005	-1.18	-0.00046	-1.02	0.00037	0.83
Proportion of HH members with their level of education (Last 6 months)	**0.00130**	**-2.89**	**-0.0065**	**14.59**	**0.01059**	**23.60**	**-0.00534**	**-11.90**
Health condition of household members in the last 30 days	0.00046	-1.03	-0.0001	0.26	0.00025	0.55	-0.00059	-1.31
Proportion of HH members with occupation (Last 7 days)	**-0.00072**	**1.61**	**-0.0061**	**13.63**	**0.00937**	**20.89**	**-0.00254**	**-5.66**
Land ownership and access, along with cultivation of crops	-0.00061	1.35	-0.0012	2.77	0.00304	6.79	-0.00120	-2.67
Proportion of household members did not work in the last 6 months	0.00018	-0.39	-0.0001	0.14	-0.00001	-0.02	-0.00011	-0.24
Proportion of HH members with industry (Last 6 months)	-0.00034	0.76	-0.0005	1.11	0.00106	2.37	-0.00022	-0.50
Location and regional effects	**-0.00329**	**7.33**	**-0.0065**	**14.59**	**0.01187**	**26.47**	**-0.00204**	**-4.55**
Infrastructure	0.00494	-11.01	-0.0028	6.26	0.00096	2.14	-0.00309	-6.90
Nargis affected area	0.00146	-3.27	0.0000	0.00	0.00000	0.0000	-0.00146	-3.27
Aggregate	**0.00678**	**-15.12**	**-0.0282**	**62.95**	**0.04344**	**96.85**	**-0.02199**	**-49.02**
Explained (Coeff. + Char.)			**-0.0215**	**47.83**			**0.0215**	**47.83**
Residual			**-0.0234**	**52.17**			**0.0234**	**52.17**
Total				**100.00**				**100.00**

Source: Author's estimations

Note: Coeff. and Char. are coefficients and characteristics respectively.

According to Table 5.8, the effects of coefficients and characteristics on the change of inequality measure vary depending on whether the differences of natural log of variances of consumption expenditures are positive or negative, and how the auxiliary expenditure Equation (5.12) is alternatively defined. Thus, the results produced by the Yun unified approach are inconsistent and provide a seemingly arbitrary choice for researchers. In summary, when the changes of inequality measures over time are studied, researchers normally define the dependent variable as the inequality indices of, the later year minus the inequality indices of the previous year. But this is arbitrary and the results can depend on the choice, as shown above.

5.5 Conclusions

This chapter examines the factors contributing to expenditure inequality in Myanmar and the factors explaining the changes in inequality over time. The Fields (2003) regression-based analysis approach is used to decompose inequality into explanatory factors, such as endowments and characteristics of households, and geographical location factors. The classic inequality measures—the Gini coefficient and Generalized Entropy measures—are decomposed using the IHLCA surveys for 2004/05 and 2009/10. The regression results are used to calculate the so-called relative factor inequality weights using the Fields approach in order 1) to decompose the level of inequality in each survey year by each factor, and 2) to calculate further the contributions of each factor or groups of factors to its changes. Thus the results are only as good as the regressions on which they are based, which in turn depend on the quality and completeness of the available data. While this type of decomposition can be useful for understanding the driving factors behind changes in inequality, its main limitation is the fact that the narrowing of Myanmar expenditure inequality hides significant changes captured in the residual effect.

The findings of the study show that the largest contributor to Myanmar's declining inequality is determined by the spatial variables (that is, location dummies and distances to the public services). This is followed, in order of importance, by occupation and education, which have also contributed towards the declining inequality. Regional specific variables are the main driver of the narrowing of expenditure inequality and (as measured by the Gini coefficient) these explain about 35% and 43% of the changes of the expenditure inequality for all households and for panel households, respectively. In fact, location and regional effects capture several things. Other variables can be associated

with location, and regional factors, in addition to the access to different services such as markets, financial and health services, and schools. Fixed natural resources such as jade mines or teak forests can be correlated in each region and each community with a different topography. But these location-correlated variables are not themselves directly captured by the IHLCA data set, so their impact is captured only via 'location'.

The analysis also indicates that, in Myanmar, over the study period, about 22% of the average decline in inequality for all households and 16% for panel households were due to changes in the share of household members in different occupations. Among the variables of household characteristics, white collar occupations such as legislators, senior officials and managers, (whose return to expenditure somewhat reduced over time) can be singled out as the most influential on declining inequality. In addition, education of working-age adults has an impact on decreasing inequality by about 14% and 18% for all households and for panel households, respectively. Household members who have a tertiary, or upper secondary education contribute to an increase in consumption expenditure inequality as measured by the Gini coefficient and GE indices for panel household members. However, this outcome only holds for the change in the Gini coefficient for all households and not for the change in GE indices. The major contribution of education to the reduction in inequality is determined by the proportion of household members who have a primary school education, when the education factor is examined in disaggregate components as measured by the Gini coefficient and GE indices for both panel households. The results are robust to the inclusion and exclusion of concerned variables such as household home and business assets in analysing for all households and for panel households.

In the analyses of the decompositions of the level of, and changes in, the Gini coefficients for rural and urban households, the contributing factors are somewhat different. In order of importance, the major influencing factors which explain the reduction in the expenditure inequality over time are occupations accounting for 32% (urban) and 11% (rural), location and regional effects, amounting to 23% (urban) and 19% (rural), and the level of education of household members which accounts for 18% (urban) and 10% (rural). As expected, the third influencing factor for rural areas is land ownership and access, along with cultivation of crops (19%). Summing up, spatial factors are found to constitute the single largest cause of the changes in the expenditure inequality, as measured both by the Gini coefficient and Generalized Entropy indices.

This research is the first study to explore the factors influencing the level of, and changes in, expenditure inequality for Myanmar. This study also contributes to extending the existing regression-based decomposition of inequality. This empirical assessment of the relative contribution to expenditure inequality has several implications for future research. The empirical findings will be helpful in balancing poverty reduction and inequality in Myanmar, as "poverty will fall, and at a faster rate the lower the inequality" (Ravallion, 1997, p.55). According to the findings of this study, most of the reduction in inequality can be attributed to an increase in the provision of public services at the regional and community levels. In addition, it is important to ensure the provision of quality education in order to allow individuals to work in higher employment and in high productivity jobs. More than half of the households surveyed have members with lower secondary education or below. Thus it is crucial to provide necessary education facilities, especially in rural areas. As the level of education is a key indicator in reducing inequality, its role will presumably be higher in the near future because of the demand for more skill-demanding labour that may result from democratic and economic reforms in Myanmar.

In addition, this study is the first to point out that Yun's approach entails a serious problem. The changes of inequality between two time periods are decomposed further by using the synthesis of the Yun (2006) approach by combining the methods of Juhn et al. (1993) and Fields (2003). The difference in variances of log of expenditure is decomposed into the characteristics, coefficients, and residuals effects. However, the effects of coefficients and characteristics on the change of inequality measure vary, depending on whether the differences of natural log of variances of consumption expenditures are positive or negative, and how the auxiliary expenditure equation is alternatively defined. Thus, the results produced by the Yun unified approach are inconsistent and depend upon a seemingly arbitrary choice on the part of the researcher.

The empirical assessment of returns to location is of substantial interest for policy makers and researchers. However, some questions remain to be answered. What are the other variables correlated with the location and regional factors apart from the variables considered in this study, and how they are correlated? Therefore, further research is needed to explain the nature of those location-correlated variables. Also, this study can be improved by developing further the decomposition techniques such as the Shapley value-based methodology.

Chapter 6

Conclusions

6.1 Executive summary of the findings

6.1.1 Inequality estimates for Myanmar

This thesis investigates consumption expenditure inequality in Myanmar utilising comprehensive household expenditure data sets from 2004/05 and 2009/10 called the Integrated Household Living Conditions Assessment (IHLCA) surveys. The research contributes to the small inequality literature on Myanmar by adding health expenditures and user costs of durables into the existing consumption aggregates calculated by the IHLCA team, to investigate accounting for consumption expenditure inequality for both surveyed years. The study also deals with the issues of negative depreciation rates of durables and negative real interest rates when constructing user costs of durable goods. The distributions of revised comprehensive total household consumption expenditures per adult equivalent indicate the decline in different measures of expenditure inequality over the study period. These data suggest that both 'relative inequality' and 'absolute inequality' have fallen over this five year period. Regarding national inequality, poorer population groups had greater rapid growth than richer ones over the whole consumption distribution.

The nationwide Gini coefficient for consumption expenditure per adult equivalent decreased from 0.256 to 0.220 over the period studied. The low inequality indices found in Myanmar, particularly the Gini index, can be explained in several ways. One possibility is that survey designs may exclude poor people in urban slums and very rich people in cities, and also rich households may under-report their consumption expenditures, and thus urban inequality may be under-estimated. Another possibility is that, because of the conditions under which Myanmar existed during the socialist period as noted by Kyi et al. (2000), the majority of the population in Myanmar was likely to have remained homogeneous around 2004/05 and 2009/10. Nationally, the declines in the Gini

coefficient, Theil index, Mean Log Deviation (MLD) and Atkinson indices are each statistically significant. The same trend is found for rural and urban areas, but the changes in the Gini coefficient are more prominent for rural areas. The analyses using both Generalized Entropy (GE) with changing weight values, and Atkinson classes with different levels of 'inequality aversion', reveal that most of the changes in the distributions occur at the bottom end. However, the Atkinson class with aversion 0.5 reports that significant changes are also found in the top part of the distributions. Not surprisingly, inequality in the urban areas of Myanmar is greater than that in the rural areas, as reported by all inequality measures.

The central findings of this research are statistically significant. This study reports the statistical precision of differences of consumption expenditure inequalities between 2004/05 and 2009/10, following the basic theory of estimation for repeated surveys used by Steel and McLaren (2009), Zheng and Cushing (2001), Barrett and Pendakur, (1995), and Davidson and Duclos (2000). For a comparison of inequality indices over the study years, the standard errors (SEs) of differences are calculated both with and without taking into account covariance terms when calculating inequality indices by using the consumption aggregates of all households in 2004/05 and 2009/10 surveys. In general, the SEs reported without consideration on covariance terms are slightly higher than those reported by taking account of covariance parts. However, statistical significances are similar for almost all inequality indices reported for both survey periods, as well as the SEs of the differences of two values of inequality indices between the two assumptions applied. A comparison of the asymptotic and bootstrap standard errors of the inequality indices of each year indicates that they are similar within the panel household component of the data sets. This could be due to the re-sampling procedure of bootstrapping, which automatically takes into account the covariance structure (Biewen, 2002). However, the linearization approach based on the standard normal test statistic for dependent samples also removes the correlation between panel households. Horowitz (2001) argues that bootstrapping asymptotic pivotal statistics provides a powerful test (the 'bootstrap t method'). However, this approach is not further employed in this research due to the complexity of the IHLCA survey design.

To illustrate the consumption expenditure inequality, this study derives the Lorenz curves for all households and panel households. The Lorenz curve for 2009/10 lies strictly above that for 2004/05, indicating that the 2009/10 Lorenz curve dominates that for 2004/05;

consumption expenditures in 2009/10 are more equally distributed. The two distributions are unambiguously ranked, as the Lorenz curves for the study years do not cross. The tests for statistical significance in differences between the ordinates of Lorenz curves also reveal that the changes at the bottom 50% of the population are highly statistically significant at the 1% level, and fewer changes are observed in the top part of the real consumption expenditure distributions. When illustrating the welfare of households using the Pen's parade, the curves of the Pen's parade cross near the top end, demonstrating that the decline at the top part of consumption expenditure distribution in 2009/10 led to a reduction in consumption expenditure inequality at the national level. The growth incidence curves comparing the relative changes in real consumption expenditures per adult equivalent of all households, as well as rural and urban households, between 2004/05 and 2009/10 also demonstrate that consumption expenditures declined for those in the top part of the consumption expenditure distribution while consumption expenditures rose for those who were poor. The absolute change illustrated by the growth incidence curves confirm this same pattern.

The impact of Cyclone Nargis is also investigated using consumption expenditure growth incidence curves. The relative and absolute inequalities illustrated by the curves reveal that the impact of Cyclone Nargis was that consumption expenditure inequality declined —especially in the top part of the distribution in the Nargis-affected-regions—compared with the smaller reduction that would have occurred anyway, as in the non-Nargis-affected regions. The results using the classic inequality measurement also confirm that Cyclone Nargis lowered consumption expenditure inequality in the affected regions, compared with the smaller reduction that would normally have occurred. The analysis of the GE measurement significantly affirms that changes mainly occurred in the lower parts of the consumption expenditure distributions in both the Nargis- and the non-Nargis-affected areas. On the other hand, the largest percentage changes are found in those variations of the GE and Atkinson indices that are most sensitive to the change in the upper end of the distribution in the Nargis-affected area, indicating that the reduction in consumption expenditure inequality among higher income groups is more substantial. However, while the change of the GE measurement of the Nargis-affected area is not statistically significant, the change of the Atkinson index is significant at the 5% level, confirming the changes also occurred at the top parts of the consumption expenditure distributions. Therefore, Cyclone Nargis contributed to the decline in real consumption expenditure per adult equivalent that occurred in the Nargis-affected area between

2004/05 and 2009/10, and it also contributed to the observed decline in national inequality. Of course, the reduction in consumption expenditure inequality in the Nargis-affected areas is not a socially desirable outcome as the poverty incidences in Ayeyarwady and Yangon regions increased, while the poverty incidence declined substantially in other parts of Myanmar, that is, in the non-Nargis affected areas.

6.1.2 Decomposition of inequality analyses by rural and urban areas, states and regions, and population groups, 2004/05 and 2009/10

Disparities in socio-economic conditions between rural and urban areas, states and regions have persistently been claimed, especially by people in rural areas and minority states who believe that they do not receive equal redistributions of their country's resources. These states and regions (except for Bago (West)), all recorded reductions in inequality over time. Mon, Rakhine, Bago (West) and Kayin have the lowest inequality indices in consumption expenditures, while the consumption expenditure inequality is high in Chin, Yangon and Taninthayi as measured by the Gini coefficient in 2004/05. The lowest Gini coefficients are found in Kayah, Sagaing, Kayin and Chin, while the highest Gini coefficients reported are in Yangon, Mandalay and Taninthayi in 2009/10. However, the analyses of P90/P10 ratios reveal that Yangon and Taninthayi had the highest inequality in consumption expenditures in both surveyed years, while Kayin state was consistently lowest in the ranking of inequality in both 2004/05 and 2009/10.

The patterns of consumption expenditure distributions of the between-group and within-group inequalities of rural and urban areas, states and regions to total national inequality are also examined. This analysis has potential implications for the redistribution of resources. This study uses the GE class of decomposable inequality measures to disaggregate total inequality in each year into its various components additively. First, the analysis decomposes Myanmar's total inequality into their intra (within-group) and inter (between-group) components of rural and urban areas. The contribution of within-group inequality to total inequality of rural and urban areas in both levels and changes is higher than that of the between-group inequality. Over the period 2004/05 and 2009/10, the changes of both between-group and within-group inequalities of rural and urban areas decreased significantly. The contribution of between-group inequality of rural and urban areas to total inequality in Myanmar decreased over the study years, while that of within-group inequality to total inequality correspondingly increased. A similar trend is found

for the level of, and changes in, contributions of states and regions to total inequality, as in the case of rural and urban areas. Therefore, the results confirm that a substantial part of expenditure inequality in Myanmar is not spatial. These findings are also in line with other studies in this field. Furthermore, the analysis of the ELMO's (2008) approach reveals that the distributions of per adult equivalent expenditures of households among states and regions have little overlap as the observed 'maximum possible' between-components do not vary with the results of the conventional approach. However, the 'maximum possible' between-group inequality reveals that some overlaps are found in the distribution of per adult equivalent consumption expenditures in rural and urban areas.

Further investigation of the between-group and within-group inequalities of Nargis- and non-Nargis-affected areas verify the robustness of the previous findings. The reduction in expenditure inequality of the between-group inequality of Nargis- and non-Nargis-affected areas is significantly larger compared to the declines in the within-group inequality between the two surveyed years. The findings again confirm that Cyclone Nargis is a big part of the explanation for why inequality decreased in Myanmar, and the changes of the within-group inequality were bigger in the top parts of expenditure distributions (though this is not significant).

This study also disaggregates total consumption expenditure inequalities in each year into their intra (within), inter (between) components by population groups: ethnicity, employment, industry, occupation, and land ownership as a proxy for most of the important structural changes over the study periods. There are significant differences in household consumption expenditures among the population groups. However, despite these differences, between-group inequality accounts only for a small component of the overall inequality in all groups. For ethnicity differences, among those who spoke any of the 12 main languages, household heads who spoke a Chinese language had the highest GE indices in both study years, despite their share of the population were being only 1%.

In terms of the employment status of household head, household heads who were employers had the highest GE indices, but the population shares of own-account workers were the highest in both survey years among different employment types, either with, or without, the inclusion of those household heads who did not participate in the labour force. In addition, household heads who worked in the fields of electricity, gas and water supply, and transport, storage and communications in 2004/05, along with those who

were employers working in the private sector in 2009/10, had the highest GE indices. The GE indices of white collar jobs such as those working as legislators, senior officials and managers were the highest, while the GE indices of low-skilled occupations (for example, sales and services elementary occupations, agricultural, fishery and related labourers) were the lowest among main types of occupation in both surveyed years. Overall, the agriculture, hunting and forestry industries are by far the biggest employers, accounting for half of total employment, and the relative size of agriculture has remained unchanged since 2004/05. However, consumption expenditure inequalities do not vary between land owners and the landless in all GE indices.

6.1.3 Regression-based analysis of the factors contributing to consumption expenditure inequality in Myanmar: 2004/05 and 2009/10

Using the IHLCA surveys of 2004/05 and 2009/10, this study investigates the factors contributing to the level of, and changes in, consumption expenditure inequality over time. For all households and panel households, as well as rural and urban households, the regression-based methodology of Fields (2003), built on Shorrocks' (1982) inequality decomposition techniques, is employed. The cross-sectional expenditure functions are regressed on economically meaningful variables relating to the household, community, state and regional level factors in line with standard human capital and production theories, and past empirical analyses. Subsequently, the so-called 'relative factor inequality weights' are calculated using the estimates of the expenditure equations for 2004/05 and 2009/10, which allows the expenditure functions to be decomposed into exogenous causes of factors. The Fields (2003) technique is exact (adds to one), independent of choice of inequality index, and allows analytical explanations. This study chooses the Gini coefficient and Generalized Entropy indices to identify and quantify the contributions of variables to the level of, and changes in, expenditure inequality.

This case study on Myanmar contributes to the regression-based consumption expenditure inequality decomposition approach. This is the first application to exploit the IHLCA data sets, given the fact that access to the Myanmar nationally representative data is difficult for researchers and analysts to obtain. The findings of this study show that location and regional effects, occupations, and levels of education of household members are major factors in explaining both the level of, and changes in, inequality for all households and for panel households, as well as rural and urban households. Regional

specific variables are the main contributors to the narrowing of consumption expenditure inequality and they explain about 35% and 43% of the changes in the Gini coefficient for all households and panel households, respectively. Regional specific variables are the key factor in the reduction in consumption expenditure inequality, but these factors have complex origins. Other variables that are beyond the available data can be correlated with these regional specific variables. For example, fixed natural resources (such as jade mines or teak forests) and other factors can be associated in each region and in each community with a different topography. Thus some information can be still missing and its impact is not directly captured in this study. The second largest contributor is the share of household members with different types of occupation, accounting for 22% (all households) and 16% (panel households). The third major influencing factor decomposed by the Gini coefficient is the level of education of working-age adults (aged 15-64), constituting about 14% and 18% for all households and panel households, respectively. The decomposition using the GE indices for all households also shows the same contributing factors to the level of, and changes in, total GE indices over time.

The findings are robust, as the same key contributing factors are found in both the decomposition of Gini coefficients and the GE indices generated by the different regression specifications (with inclusion of household home and business assets, remittances, and savings, and debts of all households and panel households in both surveyed years; or for the 2009/10 regression with 2004/05, home and business assets, remittances, saving, and debts for panel households). For rural and urban households, the results decomposed by the Gini coefficient differ somewhat in order of importance. The major contributing factors in explaining the level of, and the reduction in, inequality are: occupations accounting for 32% (urban) and 11% (rural); location and regional effects amounting to 23% (urban) and 19% (rural); and the level of education of household members accounting for 18% (urban) and 10% (rural). As expected, the third influencing factor for rural areas is land ownership and access, along with cultivation of crops (19%). The validity and reliability of findings are only as good as the regression specifications on which they are based, which in turn rely upon the standard and completeness of the existing data. The Fields decomposition is useful for observing the drivers of narrowing the gap of consumption expenditure inequality for Myanmar. However, one limitation is that some factors are hidden in the residual effect.

This study is the first to demonstrate that the Yun (2006) approach entails a serious problem. In fact, the Yun approach is a synthesis, exploiting the strength of the methods of Juhn et al. (1993) and Fields (2003). Using the Yan approach, an attempt is made to decompose the changes in variances of the log of expenditure into characteristics, coefficients, and residuals effects. However, it is found that the results depend on two factors: the signs of the differences of natural log of variances of consumption expenditures and the way the auxiliary expenditure equation is defined. The effects of characteristics and coefficients are inconsistent, based on specifications and calculations of the differences in variances of log of consumption expenditures, and thus dependent upon a seemingly arbitrary choice on the part of the researcher.

6.2 Considerations for future research

This study accounting for Myanmar consumption expenditure inequality, 2004/05-2009/10, finds low Gini coefficients in both regional and global contexts. As explained in this thesis, the results of the inequality indices depend solely on the soundness and completeness of the surveyed data sets. In fact, in other developing countries the collection of nationally representative household surveys is often led by the World Bank. For the case of Myanmar, the IHLCA data sets were conducted with the support of UNDP Myanmar, in response to a request from the Myanmar government. Technical assistance was provided by the IDEA international institute and UNDP Myanmar for the 2004/05 survey, and by Statistics Sweden and UNDP Myanmar for the 2009/10 survey. However, it is likely that the future surveys will be led by the World Bank, as they began their operations in Myanmar in 2012. There is a clear message for the statistical agencies and the responsible government agencies that it is necessary to provide a high quality and complete data set for researchers and policy analysts, in order to get the best estimates for further informed research and policy analyses.

It is also important to survey a common set of households repeatedly over the years. This would allow an estimation of the panel regression models over the years, and the identification of the causes of changes of inequality will be stronger. In addition, there was a weakness in the IHLCA surveys when it came to providing information for the regional price data set and community data in order to allow researchers and policy analysts to be able to control for the identification of the key policy variables in the regression analyses. Thus, the government of Myanmar should consider providing full

data, consisting of household data, along with price and community data sets to enable the researchers and policy analysts to be able to produce the best estimates and forecasts as much as possible.

This study also finds that regional disparities are pronounced in Myanmar, as the highest inequality indices are observed in the region where the business capital city is situated, such as Yangon, and regions close to the Thai border, such as Tanintharyi. Obviously, the findings reflect that the government could not provide equal infrastructure and economic development to different states and regions, given Myanmar is a least-developed country. However, if the new civilian democratic government, starting from 2016, attempts to reduce regional barriers and promotes regional markets along with the other political and social-economic reform processes, the variation in poverty incidences and inequality across the states and regions, and between rural and urban areas, may no longer be as pronounced.

This study also observes that the contribution of between-group inequality to total inequality is always low when the patterns of inequality in the different population groups are assessed. Even the proposed maximum between-group analysis—ELMO (2008) statistic—cannot show the significant contribution of maximum plausible between-group inequality to total inequality for this study, as there is little overlap in per adult equivalent household expenditure. However, the decomposition exercises allow us to pin down the levels of aggregation at which the policy intervention should be considered—for example, in order to reduce within-group inequality in Myanmar. On the other hand, as Kanbur (2006) suggests, a thorough investigation of the structures of inequality, the impacts, and costs of the policy instruments are required when controlling for inequality to avoid the negative consequences of the implementation of the policies.

Politically, the Myanmar government will need to implement redistribution policies to reduce disparities in per adult equivalent household expenditures among the populations with different ethnicities and jobs. According to the change in the structure of the Myanmar economy between 2004/05 and 2009/10, it is apparent that the economy will shift from relying heavily on agriculture towards industry and services. So, the effort should be concentrated on addressing the potential increase in inequality among those with different occupations working in the various sectors along with the structural changes.

This empirical assessment also has several implications not only for the inequality issue but also to reduce poverty incidences as Ravallion (1997) argues that poverty reduction will be faster among low-inequality countries than among high-inequality countries. According to the findings of this study, an increase in the provision of quality public services at the regional and community levels, along with enhancing market integration, will close the gap in regional and locational disparities. In addition, necessary education facilities and quality education are key for the household members to be able to join the job market with different occupations. The role of education will presumably be higher in the near future because of the demand for more skill-demanding labour that may result from democratic and economic reforms in Myanmar.

The importance of location and regional effects for the reduction in inequality should be of substantial interest for policy and research. However, some information is still missing for a full understanding of what is meant by these effects. What are the other variables associated with the location and regional factors apart from the variables considered in this study, and how they are correlated? Thus, further research is needed to explain the nature of those location-correlated variables. Also, the regression-based inequality decomposition analyses can be further improved by developing further the decomposition techniques such as the Shapley value-based methodology.

Appendix: 3-A

Table 3.19 Consumption share of the top 20%, 2004/05 and 2009/10

	IHLCA (June, 2011) (without health expenditures and user costs of durables)					Present Study (with health expenditures and user costs of durables)				
State/ Region	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**	**2005**	**2010**	**% Δ '05-'10**	**Mean Difference**	**P value**
Kachin	32.4 (5.49)	31.0 (2.02)	-4	-1.37 [5.71]	0.810	35.4 (4.89)	32.4 (4.90)	-9	-3.0 [6.66]	0.648
Kayah	30.9 (6.30)	29.0 (9.62)	-6	-1.96 [11.10]	0.860	32.4 (5.66)	30.5 (8.82)	-6	-1.8 [10.12]	0.857
Kayin	29.4 (7.31)	29.3 (0.65)	0	-0.03 [7.29]	0.997	30.6 (6.81)	30.1 (1.68)	-2	-0.5 [6.89]	0.941
Chin	37.9 (8.88)	28.5 (2.87)	-25	-9.47 [9.13]	0.300	40.8 (2.16)	28.7 (4.04)	-30	-12.1*** [4.44]	0.006
Sagaing	30.4 (3.00)	29.2 (2.99)	-4	-1.15 [4.07]	0.779	32.7 (2.52)	31.0 (3.17)	-5	-1.7 [3.91]	0.661
Taninthayi	33.4 (6.95)	32.4 (8.88)	-3	-1.01 [10.86]	0.926	36.2 (4.69)	34.4 (8.45)	-5	-1.9 [9.36]	0.841
Bago (East)	30.7 (6.39)	29.0 (5.52)	-6	-1.72 [8.13]	0.832	34.5 (5.77)	31.4 (5.34)	-9	-3.1 [7.56]	0.683
Bago (West)	29.7 (6.64)	29.4 (4.93)	-1	-0.24 [7.97]	0.976	31.0 (6.46)	31.8 (6.71)	3	0.8 [8.96]	0.927
Magwe	31.1 (6.77)	29.8 (2.69)	-4	-1.28 [7.09]	0.857	33.1 (7.38)	31.6 (1.78)	-4	-1.5 [7.46]	0.842
Mandalay	32.1 (5.23)	32.1 (2.79)	0	-0.02 [5.74]	0.997	37.1 (6.48)	35.3 (3.42)	-5	-1.8 [7.10]	0.801
Mon	29.7 (6.71)	29.0 (2.15)	-2	-0.71 [6.90]	0.918	31.9 (2.30)	31.8 (5.34)	0	-0.1 [5.66]	0.986
Rakhine	29.9 (4.36)	30.5 (7.42)	2	0.58 [8.32]	0.945	30.9 (4.85)	31.3 (7.39)	1	0.4 [8.53]	0.959
Yangon	35.7 (12.50)	34.6 (7.71)	-3	-1.07 [14.19]	0.940	41.6 (11.09)	36.9 (7.79)	-11	-4.7 [13.07]	0.717
Shan (South)	32.1 (15.17)	31.2 (16.81)	-3	-0.91 [21.79]	0.967	34.8 (15.29)	32.3 (14.12)	-7	-2.5 [20.02]	0.901
Shan (North)	33.4 (6.54)	31.8 (8.73)	-5	-1.66 [10.51]	0.875	36.8 (8.22)	33.2 (8.57)	-10	-3.5 [11.43]	0.757
Shan (East)	32.5 (10.68)	29.0 (7.51)	-11	-3.54 [12.59]	0.778	36.8 (11.52)	32.5 (9.31)	-12	-4.3 [14.26]	0.763
Ayeyawaddy	31.7 (3.99)	30.7 (4.48)	-3	-1.00 [5.77]	0.862	34.4 (4.69)	33.1 (5.06)	-4	-1.3 [6.64]	0.842
UNION	**32.9 (2.72)**	**31.5 (1.63)**	**-4**	**-1.43 [3.07]**	**0.642**	**36.4 (2.52)**	**33.7 (1.74)**	**-7**	**-2.6 [2.95]**	**0.373**
Number of Sample HHs	**18,634**	**18,609**								

Source: IHLCA (2011a) and Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated using the methods of Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.
6) The calculations for consumption share of the top 20% of IHLCA data without health expenditures and user costs of durables in 2004/05 and 2009/10 surveys are also weighted by (survey weights X household size). Therefore, the results are slightly different from the reports of IHLCA (June, 2011).

Appendix: 4-A

Table 4.20. Gini coefficients by state/region (urban)

States / Regions	No. of HHs 04/05	No. of HHs 09/10	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Kachin	168	168	0.272 (0.049)	0.218 (0.050)	**-0.054 [0.067]**	0.421	-20
Kayah	48	48	0.233 (0.041)	0.157 (0.044)	**-0.076 [0.058]**	0.187	-33
Kayin	191	191	0.204 (0.021)	0.190 (0.033)	**-0.014 [0.037]**	0.696	-7
Chin	96	96	0.182 (0.021)	0.161 (0.027)	**-0.021 [0.033]**	0.533	-11
Sagaing	558	562	0.287 (0.019)	0.252 (0.022)	**-0.035 [0.027]**	0.187	-12
Taninthayi	180	178	0.278 (0.051)	0.246 (0.018)	**-0.031 [0.052]**	0.544	-11
Bago (East)	240	240	0.273 (0.012)	0.239 (0.005)	**-0.034*** [0.012]**	0.005	-13
Bago (West)	216	216	0.220 (0.027)	0.359 (0.080)	**0.139* [0.084]**	0.098	63
Magwe	430	432	0.285 (0.012)	0.231 (0.005)	**-0.053*** [0.013]**	0.000	-19
Mandalay	959	958	0.323 (0.032)	0.289 (0.035)	**-0.034 [0.047]**	0.469	-10
Mon	192	192	0.212 (0.024)	0.293 (0.035)	**0.081** [0.040]**	0.042	38
Rakhine	311	312	0.199 (0.009)	0.189 (0.007)	**-0.010 [0.011]**	0.371	-5
Yangon	803	795	0.341 (0.032)	0.263 (0.026)	**-0.078* [0.038]**	0.041	-23
Shan (South)	168	168	0.284 (0.011)	0.219 (0.026)	**-0.065** [0.027]**	0.018	-23
Shan (North)	239	239	0.309 (0.020)	0.238 (0.001)	**-0.071*** [0.020]**	0.000	-23
Shan (East)	156	156	0.288 (0.037)	0.265 (0.039)	**-0.023 [0.053]**	0.661	-8
Ayeyawaddy	574	572	0.280 (0.008)	0.260 (0.014)	**-0.021 [0.015]**	0.181	-7

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized Standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated by taking into account of correlation, following the concepts of Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 4.21. Gini coefficients by state/region (rural)

States / Regions	No. of HHs 04/05	No. of HHs 09/10	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Kachin	504	504	0.241	0.201	**-0.040*** **		-17
			(0.005)	(0.011)	**[0.012]**	0.001	
Kayah	108	108	0.191	0.198	**0.007**		3
			(0.024)	(0.009)	**[0.025]**	0.788	
Kayin	528	524	0.170	0.162	**-0.007**		-4
			(0.004)	(0.012)	**[0.013]**	0.567	
Chin	228	227	0.342	0.135	**-0.207*** **		-61
			(0.043)	(0.016)	**[0.046]**	0.000	
Sagaing	1,649	1,655	0.194	0.164	**-0.029*** **		-15
			(0.005)	(0.008)	**[0.009]**	0.001	
Taninthayi	540	537	0.250	0.220	**-0.030**		-12
			(0.024)	(0.002)	**[0.024]**	0.214	
Bago (East)	696	695	0.215	0.181	**-0.034** **		-16
			(0.008)	(0.013)	**[0.015]**	0.024	
Bago (West)	624	624	0.180	0.170	**-0.010**		-6
			(0.003)	(0.015)	**[0.015]**	0.515	
Magwe	1,319	1,319	0.198	0.180	**-0.019***		-9
			(0.009)	(0.006)	**[0.010]**	0.069	
Mandalay	1,728	1,725	0.197	0.185	**-0.012**		-6
			(0.010)	(0.013)	**[0.015]**	0.439	
Mon	576	575	0.196	0.168	**-0.028**		-14
			(0.018)	(0.005)	**[0.018]**	0.114	
Rakhine	936	936	0.184	0.170	**-0.014**		-8
			(0.009)	(0.003)	**[0.009]**	0.122	
Yangon	420	417	0.188	0.189	**0.001**		1
			(0.034)	(0.008)	**[0.034]**	0.977	
Shan (South)	456	454	0.208	0.182	**-0.027** **		-13
			(0.013)	(0.003)	**[0.013]**	0.046	
Shan (North)	693	695	0.232	0.196	**-0.037** **		-16
			(0.018)	(0.004)	**[0.019]**	0.048	
Shan (East)	444	442	0.223	0.150	**-0.073*** **		-33
			(0.015)	(0.015)	**[0.021]**	0.000	
Ayeyawaddy	1,656	1,649	0.220	0.194	**-0.026**		-12
			(0.007)	(0.014)	**[0.016]**	0.102	

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated by taking into account of correlation, following the concepts of Steel and McLaren (2009) and Zheng and Cushing (2001).
4) For a two tailed test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 4.22. Gini coefficients by state/region (urban panel households)

States / Regions	Number of Sample Households	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Kachin	84	0.249 (0.044)	0.220 (0.060)	**-0.029 [0.063]**	0.650	-11
Kayah	24	0.144 (0.017)	0.123 (0.068)	**-0.021 [0.065]**	0.741	-15
Kayin	96	0.199 (0.029)	0.177 (0.042)	**-0.022 [0.043]**	0.612	-11
Chin	48	0.158 (0.042)	0.157 (0.043)	**-0.001 [0.050]**	0.990	0
Sagaing	274	0.252 (0.020)	0.235 (0.017)	**-0.018 [0.022]**	0.419	-7
Taninthayi	87	0.320 (0.070)	0.230 (0.035)	**-0.090 [0.068]**	0.187	-28
Bago (East)	119	0.268 (0.005)	0.221 (0.018)	**-0.047*** [0.017]**	0.006	-18
Bago (West)	105	0.224 (0.032)	0.467 (0.095)	**0.244*** [0.090]**	0.007	109
Magwe	216	0.247 (0.017)	0.219 (0.019)	**-0.029 [0.022]**	0.183	-12
Mandalay	460	0.342 (0.043)	0.290 (0.028)	**-0.052 [0.043]**	0.226	-15
Mon	96	0.207 (0.042)	0.194 (0.019)	**-0.013 [0.041]**	0.742	-6
Rakhine	154	0.194 (0.015)	0.182 (0.018)	**-0.013 [0.019]**	0.510	-7
Yangon	378	0.299 (0.037)	0.275 (0.032)	**-0.024 [0.041]**	0.548	-8
Shan (South)	84	0.279 (0.032)	0.206 (0.050)	**-0.072 [0.051]**	0.153	-26
Shan (North)	120	0.300 (0.025)	0.225 (0.023)	**-0.075*** [0.028]**	0.009	-25
Shan (East)	77	0.269 (0.022)	0.233 (0.041)	**-0.036 [0.040]**	0.372	-13
Ayeyawaddy	284	0.273 (0.016)	0.267 (0.013)	**-0.006 [0.017]**	0.706	-2

Source: Author's estimations

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated by taking into account of correlation, following the concepts of Steel and McLaren (2009) for the asymptotic SEs.
4) For a two tailed test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 4.23. Gini coefficients by state/region (rural panel households)

States / Regions	Number of Sample Households	2004/05	2009/10	Difference	P-value	% Δ (2004/05 vs. 2009/10)
Kachin	252	0.235 (0.005)	0.198 (0.012)	**-0.037*** [0.011]**	**0.001**	-16
Kayah	54	0.167 (0.017)	0.199 (0.011)	**0.032* [0.017]**	**0.068**	19
Kayin	261	0.176 (0.005)	0.156 (0.022)	**-0.020 [0.021]**	**0.334**	-11
Chin	113	0.435 (0.050)	0.133 (0.019)	**-0.302*** [0.047]**	**0.000**	-69
Sagaing	809	0.187 (0.010)	0.167 (0.008)	**-0.020* [0.010]**	**0.061**	-10
Taninthayi	264	0.222 (0.009)	0.233 (0.017)	**0.011 [0.016]**	**0.487**	5
Bago (East)	346	0.218 (0.020)	0.189 (0.012)	**-0.028 [0.020]**	**0.153**	-13
Bago (West)	304	0.168 (0.007)	0.157 (0.006)	**-0.010 [0.008]**	**0.182**	-6
Magwe	659	0.196 (0.012)	0.175 (0.010)	**-0.021 [0.013]**	**0.102**	-11
Mandalay	860	0.199 (0.010)	0.185 (0.016)	**-0.014 [0.016]**	**0.382**	-7
Mon	276	0.192 (0.020)	0.181 (0.006)	**-0.011 [0.019]**	**0.574**	-6
Rakhine	460	0.183 (0.013)	0.176 (0.009)	**-0.007 [0.013]**	**0.586**	-4
Yangon	208	0.188 (0.037)	0.185 (0.008)	**-0.003 [0.036]**	**0.926**	-2
Shan (South)	226	0.217 (0.002)	0.171 (0.009)	**-0.046*** [0.008]**	**0.000**	-21
Shan (North)	336	0.239 (0.029)	0.196 (0.008)	**-0.042 [0.027]**	**0.124**	-18
Shan (East)	213	0.215 (0.018)	0.160 (0.008)	**-0.055*** [0.017]**	**0.002**	-25
Ayeyawaddy	755	0.217 (0.010)	0.204 (0.019)	**-0.013 [0.018]**	**0.480**	-6

Source: Author's estimations

Notes:

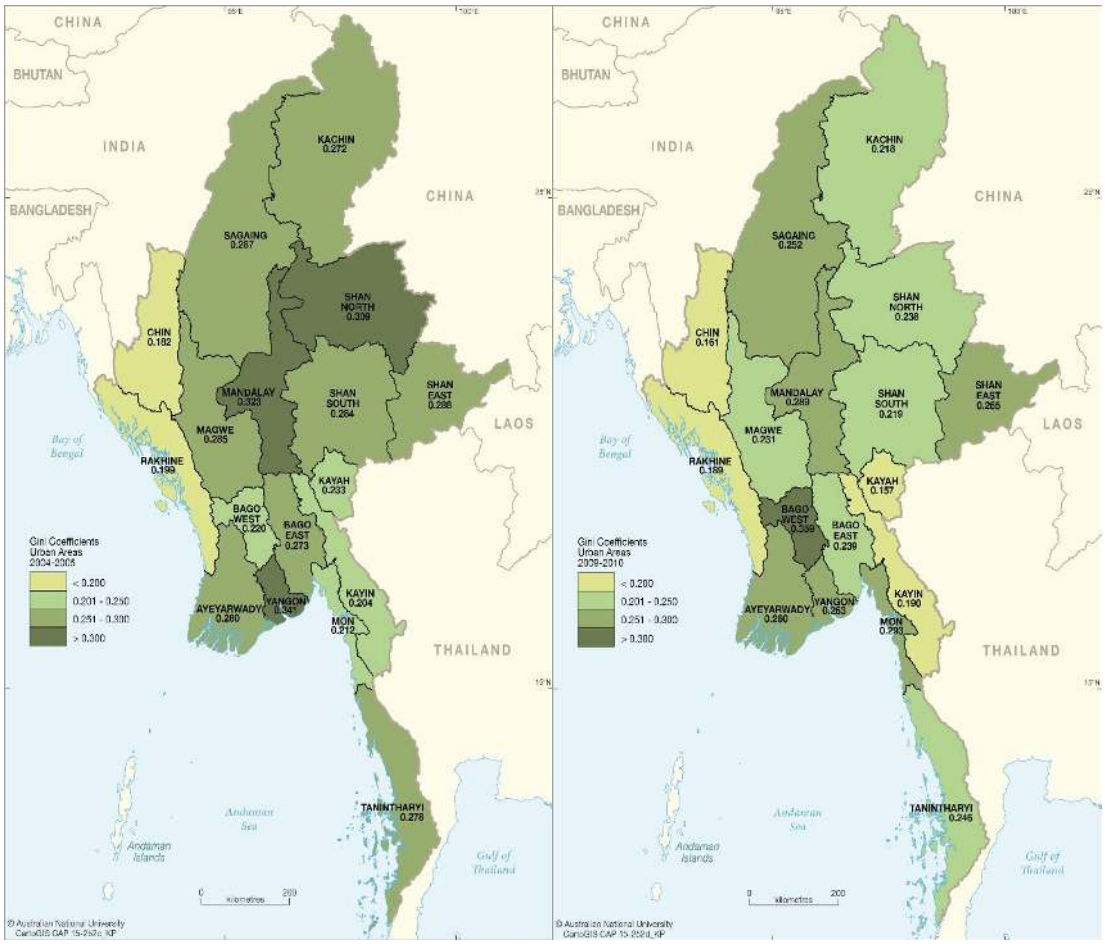
1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized standard errors of point estimates are in round parentheses, and standard errors of changes are in square parentheses.
3) Z-statistics are calculated by taking into account of correlation, following the concepts of Steel and McLaren (2009) for the asymptotic SEs.
4) For a two tailed test of 2004/05=2009/10 the 5% critical value for the z-statistic is 1.96.
5) ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Table 4.24. Consumption expenditure inequality, by state/region

State/ Region	GE(0), Theil's L (Mean Log Deviation)			GE(1), Theil's T			GE(2)			Atkinson (0.5)			Atkinson (1)			Atkinson (2)		
	04/05	09/10	% Δ	04/05	09/10	% Δ	04/05	09/10	% Δ	04/05	09/10	% Δ	04/05	09/10	% Δ	04/05	09/10	% Δ
Kachin	0.106 (0.014)	0.070 (0.006)	**-34**	0.113 (0.020)	0.074 (0.006)	**-34**	0.144 (0.040)	0.089 (0.006)	**-38**	0.053 (0.008)	0.035 (0.003)	**-34**	0.101 (0.013)	0.067 (0.005)	**-33**	0.184 (0.018)	0.124 (0.008)	**-33**
Kayah	0.075 (0.002)	0.057 (0.010)	**-24**	0.080 (0.002)	0.061 (0.011)	**-24**	0.094 (0.009)	0.071 (0.013)	**-24**	0.038 (0.000)	0.029 (0.005)	**-24**	0.072 (0.002)	0.055 (0.009)	**-24**	0.131 (0.007)	0.101 (0.015)	**-23**
Kayin	0.052 (0.003)	0.046 (0.008)	**-12**	0.054 (0.003)	0.048 (0.008)	**-11**	0.061 (0.004)	0.054 (0.010)	**-12**	0.026 (0.001)	0.023 (0.004)	**-11**	0.051 (0.003)	0.045 (0.007)	**-11**	0.097 (0.005)	0.085 (0.012)	**-12**
Chin	0.200 (0.056)	0.041 (0.008)	**-79**	0.327 (0.146)	0.043 (0.007)	**-87**	1.210 (0.775)	0.047 (0.006)	**-96**	0.115 (0.038)	0.021 (0.004)	**-82**	0.181 (0.045)	0.040 (0.007)	**-78**	0.282 (0.049)	0.076 (0.015)	**-73**
Sagaing	0.075 (0.010)	0.055 (0.008)	**-27**	0.082 (0.015)	0.062 (0.011)	**-25**	0.105 (0.032)	0.082 (0.020)	**-22**	0.038 (0.006)	0.028 (0.004)	**-25**	0.072 (0.009)	0.053 (0.008)	**-26**	0.132 (0.013)	0.097 (0.012)	**-27**
Taninthayi	0.117 (0.018)	0.092 (0.009)	**-22**	0.131 (0.032)	0.096 (0.009)	**-27**	0.191 (0.083)	0.113 (0.012)	**-41**	0.060 (0.011)	0.046 (0.004)	**-23**	0.110 (0.016)	0.087 (0.009)	**-21**	0.196 (0.019)	0.162 (0.017)	**-17**
Bago (East)	0.082 (0.004)	0.060 (0.011)	**-27**	0.091 (0.005)	0.066 (0.013)	**-28**	0.113 (0.008)	0.081 (0.020)	**-28**	0.042 (0.002)	0.031 (0.006)	**-27**	0.079 (0.004)	0.058 (0.010)	**-26**	0.139 (0.005)	0.106 (0.016)	**-24**
Bago (West)	0.057 (0.003)	0.072 (0.022)	**26**	0.060 (0.005)	0.111 (0.056)	**85**	0.070 (0.010)	0.379 (0.308)	**440**	0.029 (0.002)	0.041 (0.016)	**45**	0.055 (0.003)	0.069 (0.021)	**25**	0.103 (0.004)	0.112 (0.024)	**9**
Magwe	0.075 (0.010)	0.060 (0.006)	**-19**	0.080 (0.011)	0.067 (0.008)	**-16**	0.095 (0.015)	0.086 (0.012)	**-10**	0.038 (0.005)	0.031 (0.003)	**-18**	0.072 (0.009)	0.059 (0.006)	**-19**	0.132 (0.016)	0.106 (0.010)	**-20**
Mandalay	0.114 (0.022)	0.099 (0.017)	**-13**	0.146 (0.034)	0.132 (0.035)	**-9**	0.271 (0.101)	0.366 (0.188)	**35**	0.061 (0.012)	0.054 (0.011)	**-12**	0.108 (0.019)	0.095 (0.016)	**-12**	0.177 (0.026)	0.161 (0.021)	**-9**
Mon	0.064 (0.009)	0.069 (0.021)	**8**	0.067 (0.010)	0.088 (0.038)	**32**	0.075 (0.015)	0.153 (0.095)	**104**	0.032 (0.005)	0.037 (0.013)	**16**	0.062 (0.009)	0.067 (0.020)	**7**	0.117 (0.015)	0.115 (0.024)	**-2**
Rakhine	0.059 (0.005)	0.056 (0.004)	**-5**	0.060 (0.005)	0.059 (0.004)	**-2**	0.065 (0.006)	0.067 (0.006)	**3**	0.029 (0.002)	0.028 (0.002)	**-4**	0.057 (0.005)	0.054 (0.004)	**-5**	0.109 (0.008)	0.100 (0.007)	**-8**
Yangon	0.177 (0.037)	0.106 (0.020)	**-40**	0.261 (0.071)	0.119 (0.023)	**-54**	1.088 (0.747)	0.155 (0.032)	**-86**	0.098 (0.020)	0.055 (0.010)	**-44**	0.163 (0.031)	0.101 (0.018)	**-38**	0.259 (0.047)	0.175 (0.030)	**-33**
Shan (South)	0.096 (0.020)	0.071 (0.004)	**-26**	0.107 (0.026)	0.075 (0.006)	**-30**	0.140 (0.042)	0.087 (0.009)	**-38**	0.049 (0.011)	0.036 (0.002)	**-27**	0.092 (0.018)	0.069 (0.004)	**-25**	0.163 (0.027)	0.128 (0.006)	**-21**
Shan (North)	0.113 (0.016)	0.077 (0.009)	**-31**	0.128 (0.022)	0.083 (0.009)	**-35**	0.174 (0.041)	0.101 (0.014)	**-42**	0.058 (0.009)	0.039 (0.004)	**-32**	0.107 (0.015)	0.074 (0.008)	**-30**	0.185 (0.022)	0.135 (0.016)	**-27**
Shan (East)	0.109 (0.024)	0.075 (0.028)	**-31**	0.124 (0.032)	0.110 (0.049)	**-12**	0.173 (0.059)	0.261 (0.153)	**52**	0.056 (0.013)	0.043 (0.017)	**-23**	0.103 (0.022)	0.073 (0.026)	**-30**	0.178 (0.032)	0.116 (0.035)	**-35**
Ayeyawaddy	0.090 (0.008)	0.075 (0.016)	**-17**	0.097 (0.009)	0.090 (0.025)	**-8**	0.119 (0.011)	0.156 (0.074)	**32**	0.046 (0.004)	0.040 (0.009)	**-13**	0.087 (0.007)	0.072 (0.015)	**-16**	0.158 (0.011)	0.127 (0.021)	**-19**

Source: Author's estimations

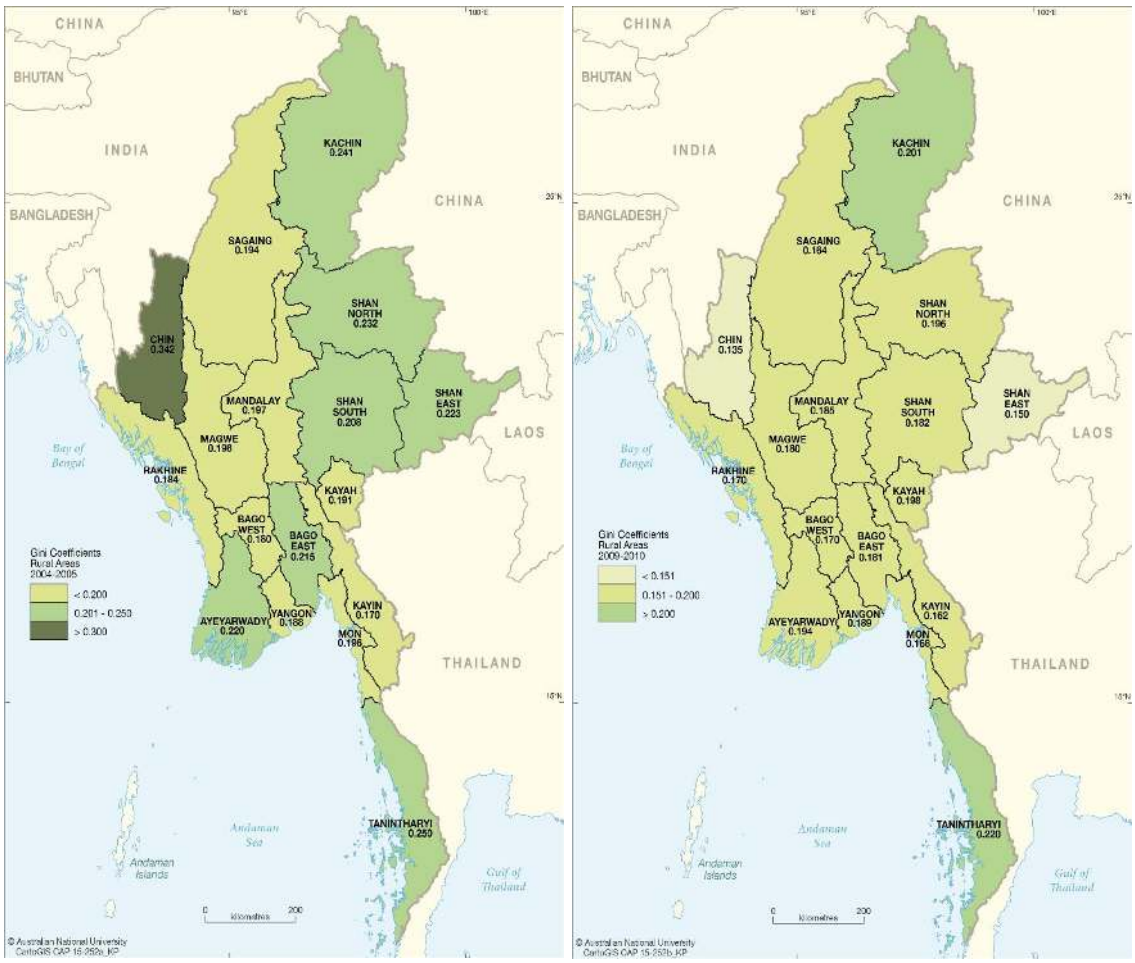
Appendix: 5-A



Source: Author's estimation

2004/05 2009/10

Map 5.2. Gini coefficients by state and region in urban areas, Myanmar 2004/05 and 2009/10



Source: Author's estimation

2004/05 2009/10

Map 5.3. Gini coefficients by state and region in rural areas, Myanmar 2004/05 and 2009/10

Appendix: 5-B

Regression results for all, and for panel, households

Table 5.9 reports the regression coefficients for the surveys in 2004/05 and 2009/10, calculated for all households and for panel households, estimated using *Stata*. The regressions appear to perform well. $R2$ (0.38) in 2004/05 and $R2$ (0.34) in 2009/10 are similar between the two regressions run for all households, which is reasonable for these cross-sectional regressions. Most of the included regressors have the expected signs and are significant. As both magnitudes and directions of the regression coefficients for all households and panel households are not noticeably different, the discussion of the results of the regressions focuses mainly on the regression coefficients for all households.

The positive sign and significance of the coefficients of gender of the household heads in both study years, indicate that the male-headed households had higher expenditure compared with the female-headed households. The gap between the male- and female-headed households decreased over time. Households with more years of working experience in a non-agricultural business spent more in both years. Households with more family members spent less, but after a certain household size their expenditure increased, and the results were similar in both years. In terms of the age structure of household members, the reference group is household members aged above 65. The coefficients of the share of members aged 6–0 and 1–5 are positive and significant, while those in the other age structure groups are not significant in 2004/05, but the coefficients of the share of members aged under 6 are significant in 2009/10. Regarding demographics, the results show that per adult equivalent consumption expenditure of the households increased with the proportion of children in both study years, compared with the reference group. Households with a larger share of children under 16 may need to spend more on education. Over time, the consumption expenditure increased for the households with the largest share of children between 11 and 15, while the consumption expenditure for the households with the largest share of children between 6 and 10 fell by about a half, and the effects on both groups are significant.

In terms of the education levels of household members who worked in the last six months, the reference group is the household members of working-age with unclassified/unknown

education. The education variables are statistically significant and education increases expenditure. This is so for tertiary levels. Over the years, households with more tertiary, upper and lower secondary graduates showed a significantly greater increase in their consumption level than others. Households with a higher proportion of the members who had a primary education and/or were illiterate spent even less. As the size of the coefficients of the education variables increased between 2004/05 and 2009/10, the impact of the education levels of household members on expenditure increased over time. Households with sick/ill/injured members in the last 30 days had to spend more and the coefficients are significant at the 1% level in both years. The effect was moderately larger in 2009/10. Having sick household members burdens the household, as the activities of ill persons are reduced, especially when they stay in bed all day or are hospitalized. As a result of the health problem, the ill member's earnings could be reduced on the one hand, while consumption expenditures could increase on the other.

In terms of the occupation of household members, the reference group is the share of household members who were clerks. Compared with the households with members who were clerks, white collar workers (such as legislators, senior officials and managers, technicians) and service workers spent more. The expenditure of households with a greater proportion of members working as legislators, senior officials and managers was about 55% higher compared with the reference group in 2004/05. Further, returns to occupations with white collar jobs also changed over time. Their consumption expenditure fell somewhat. In addition, consumption significantly increased with the share of service workers, and shop and market sales workers, skilled agricultural and fishery workers, craft and related trades, and plant and machine operators and assemblers in household members (relative to the reference group) especially in 2004/05. Households with members who were blue collar workers (working in craft and related trades, and other sales and services elementary occupations, agricultural and fishery and related labourers), spent significantly less than those with other jobs, and were the lowest expenditure groups. In addition, the gap between the consumption expenditure of households with members who were clerks and that of skilled agricultural and fishery workers, plant, machine operators and assemblers significantly declined over the year.

In terms of the industry sector, the reference group is the share of household working members engaging in the activities of private work as employers, and undifferentiated production activities. The coefficients of industry sector variables for all households are

not significant. As shown in the study of panel households in 2004/05, household members engaging in agriculture, forestry, fishing and mining sector, manufacturing and construction sector, and services sector spent about 9-13% higher expenditure with respect to the reference group. As shown in the study of all households in 2004/05, it is found that household members with open unemployment in the last six months spent about 17% significantly less than those working in the undifferentiated private sector. The expenditure of a larger share of household members with open unemployment was worsened significantly over the years.

In 2004/05, those who owned and had access to irrigated land were strongly associated with higher levels of household consumption in both survey years, and spent more than those with unirrigated land. The more land area a household had the more those households spent. A comparison of the coefficients of ownership of irrigated land area suggests that the returns declined over time. In both years, households who did not have land spent approximately 4–5% less than those who owned land. In 2004/05, households with cultivation of fruit crops (citrus, pome, stone, edible nuts and other fruits) spent the highest (about 6%) compared with households with other crops. In 2009/10, households with cultivation of cereal crops (paddy, wheat, millet and sorghum, maize, and other grains/cereals) and industrial crops (tea, coffee, coconut, oil palm, turmeric ginger, black pepper, rubber, betel nut, toddy palm and other permanent industrial crops) spent (about 4% and 5%, respectively) significantly more than households with cultivation of other crops.

With regard to the location and regional effects, the reference group is the Hills region. An important fact to note is that the business capital city is situated in the Delta region, which is the most favoured region in terms of both infrastructure development and economic activity. Thus, not surprisingly, in 2004/05, the residents living in the Delta region spent on average about 26 % more compared with those in the Hills region. However, consumption expenditure of those residing in the Delta region was substantially lowered on average in 2009/10, though the coefficient is not significant. At the community level, the types of topography vary largely among the 1,555 village tracts/wards. In 2004/05, households living in village tracts or wards situated on mountains spent less by about 23%, while those residing in the village tracts or wards on the Delta topography spent about 19% less compared with those living in other types of topography.

In Myanmar, health and education facilities are provided by the government but financial services are provided by both the public and private sectors. With regard to the access to the nearest health services; the further the distance, the less the expenditure: this effect was slightly greater in 2009/10. Similarly, in 2009/10, those who lived further from a nearest lower secondary school spent less compared with those living closer to the facilities.

In terms of infrastructure, households living in states and regions with a higher road density (miles of total road length per 100 square miles of land area) spent less and the coefficients are statistically significant at the 1% level in 2004/05 and the 5% level in 2009/10. The reason for this could be that both the government and private sector provide public or private transportation if the road infrastructure network is good, which could contribute to lower transportation costs for households. In 2009/10, at the community level, households living in village tracts or wards with bituminous roads spent more (about 6%) compared with households residing in village tracts or wards with other type of roads. The reason could be that bituminous roads provide better opportunities for the households to be involved in different types of business activities, thus leading to higher expenditure. Households residing in village tracts or wards with dirt roads spent less from 6% to 11% over time as their coefficients are negative and significant. In 2004/05, households living in village tracts or wards with laterite roads spent about 7% less. Households residing in wards/village tracts where cars/four-wheel drives were driven for a longer period (months) spent more compared with those where they were driven for a shorter period (months), especially in 2004/05.

While the electricity supply is mainly provided by the government, in some rural areas in Myanmar, the water supply is provided by the government and community development projects. In 2004/05, households in village tracts or wards with access to a water supply spent more (about 7%) compared with those without a water supply, and their spending reduced significantly over time. Similarly, households with access to electricity in both survey years had higher consumption expenditure compared with those without access, and their spending increased over the study period. The findings reflect that households who can access water and electricity can presumably operate some economic activities and thus spend more.

Households using taxies or buses as their common mode of transportation spent more per adult equivalent consumption expenditure in both years and the coefficients are positive and statistically significant. They could be living in ward segments in an urban area. The gap significantly declined in 2009/10 compared with those without access to taxies or buses. Those who used bullock carts as a mode of transportation in the village tracts spent significantly less in 2004/05 and they were presumably mostly farmers living in rural areas. The Nargis affected area dummy shows a positive and significant relationship with household expenditure. Thus, households living in the Nargis affected area spent more compared with the non-Nargis affected areas. This could be due to higher spending on rehabilitation and reconstruction by the Cyclone Nargis victims.

Household assets are probably a major factor of consumption expenditure that differs substantially across rural and urban areas. Even though household assets could create an endogeneity problem, the results do not vary across the different specifications, indicating some degree of robustness in the analyses. Thus, the regression results are robust for the results of 1) a regression for panel households in 2009/10 with household home and business assets, remittances, savings, and debts of panel households in 2004/05, 2) cross-sectional regressions for 2004/05 and 2009/10, with household home and business assets, remittances, and savings, and debts of all households surveyed and panel households. However, these variables are not included in the final specifications of expenditure functions as they are endogenous to the expenditure functions.

To prove the robustness of the findings of the above decompositions, the following decomposition exercises are conducted, and the results are presented at Tables 5.10, 5.11, and 5.12, based on the regressions with household assets. These are:

1) The Fields decomposition of the contributing variables to the level of, and changes in, the Gini coefficients and Generalized Entropy measures of the 2009/10 regression with 2004/05 home and business assets, remittances, saving, and debts for panel households
2) The Fields decomposition of the contributing variables to the level of, and changes in, the Gini coefficients with the 2004/05 and 2009/10 regressions, including home and business assets, remittances, savings, and debts for all households and panel households
3) The Fields decomposition of the contributing variables to the level of, and changes in, the Generalized Entropy measures with the 2004/05 and 2009/10 regressions, including home and business assets, remittances, saving, and debts for all households.

Table 5.9. Regression Results (All households vs. Panel households)

Dependent Variable = Ln per adult equivalent household expenditure	All Households				Panel Households Only			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Characteristics of the household head								
Age of household head (Years)	**-0.0009**	0.0021	**-0.0010**	0.0018	**-0.0027**	0.0025	**-0.0015**	0.0030
Age square of household head (Years)	**0.0000**	0.0000	**0.0000**	0.0000	**0.0000**	0.0000	**0.0000**	0.0000
Gender of household head (Dummy)	**0.0453*** **	0.0133	**0.0282*** **	0.0084	**0.0325***	0.0183	**0.0188**	0.0114
Ethnicity of household head (Myanmar) (Dummy)	**0.0257**	0.0230	**0.0211**	0.0197	**0.0332**	0.0240	**0.0259**	0.0237
Years of non-agricultural business in operation	**0.0064*** **	0.0006	**0.0056*** **	0.0009	**0.0059*** **	0.0009	**0.0049*** **	0.0009
Household size (Number)	**-0.0992*** **	0.0064	**-0.1019*** **	0.0077	**-0.0902*** **	0.0082	**-0.1001*** **	0.0097
Household size squared (Number)	**0.0041*** **	0.0004	**0.0043*** **	0.0006	**0.0035*** **	0.0005	**0.0041*** **	0.0007
Age structure of household members								
Proportion of members aged under 6	**0.0586**	0.0674	**0.1162*** **	0.0396	**0.0749**	0.0710	**0.1346*** **	0.0492
Proportion of members aged 6-10	**0.2547*** **	0.0578	**0.1436*** **	0.0439	**0.3301*** **	0.0716	**0.0814**	0.0602
Proportion of members aged 11-15	**0.2070*** **	0.0613	**0.2111*** **	0.0392	**0.1775*** **	0.0661	**0.2068*** **	0.0583
Proportion of members aged 16- 65	**0.0531**	0.0493	**-0.0069**	0.0315	**0.1033***	0.0572	**-0.0365**	0.0459
Education level of household members who worked in the last 6 months								
Proportion of members with Tertiary education	**0.4136*** **	0.0462	**0.4242*** **	0.0336	**0.3505*** **	0.0549	**0.4122*** **	0.0466
Proportion of members with Upper secondary	**0.2168*** **	0.0433	**0.2478*** **	0.0278	**0.1463*** **	0.0518	**0.2409*** **	0.0366
Proportion of members with Lower secondary	**0.1304*** **	0.0391	**0.1713*** **	0.0273	**0.0536**	0.0500	**0.1536*** **	0.0322
Proportion of members with Primary education	**0.0484**	0.0361	**0.1061*** **	0.0268	**-0.0295**	0.0471	**0.0998*** **	0.0369
Proportion of members with Illiterate	**-0.0923***	0.0494	**-0.0083**	0.0336	**-0.1272*** *	0.0600	**-0.0151**	0.0440
Health condition of household members in the last 30 days								
Proportion of members being sick/ ill/ injured	**0.1874*** **	0.0336	**0.2075*** **	0.0269	**0.2053*** **	0.0411	**0.2311*** **	0.0380

Continued over

Continued

Dependent Variable = Ln per adult equivalent household expenditure	All Households				Panel Households Only			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Proportion of household members who worked in the last 7 days with								
Legislators, senior officials and managers	**0.5486*** **	0.0532	**0.3335*** **	0.0544	**0.4951*** **	0.0649	**0.3494*** **	0.0705
Professionals	**0.2249*** **	0.0466	**0.0602** **	0.0297	**0.2282*** **	0.0689	**0.0985** **	0.0427
Technicians and associate professionals	**0.3396*** **	0.0709	**0.1783** **	0.0673	**0.2515*** **	0.0868	**0.2433*** **	0.0837
Service workers and shop and market sales workers	**0.3682*** **	0.0513	**0.1804*** **	0.0504	**0.3792*** **	0.0670	**0.2093*** **	0.0597
Skilled agricultural and fishery workers	**0.2298*** **	0.0402	**0.1168** **	0.0491	**0.2565*** **	0.0496	**0.1392** **	0.0622
Craft and related trades workers	**0.1622*** **	0.0420	**0.0667**	0.0432	**0.1608*** **	0.0462	**0.1074***	0.0608
Plant and machine operators and assemblers	**0.2822*** **	0.0451	**0.1550*** **	0.0496	**0.2913*** **	0.0582	**0.1613** **	0.0614
Elementary occupations	**0.1255*** **	0.0398	**0.0103**	0.0441	**0.1366*** **	0.0498	**0.0502**	0.0559
Land ownership and access, along with cultivation of crops								
Owned and accessed irrigated land area per capita (Acres)	**0.0610*** **	0.0059	**0.0153** **	0.0066	**0.0677*** **	0.0063	**0.0360*** **	0.0067
Owned and accessed unirrigated land area per capita (Acres)	**0.0326*** **	0.0061	**0.0211*** **	0.0032	**0.0467*** **	0.0072	**0.0278*** **	0.0073
Landless (Dummy)	**-0.0381** **	0.0148	**-0.0495*** **	0.0161	**-0.0295**	0.0196	**-0.0483*** **	0.0172
Cultivation of Cereal crops (Dummy)	**0.0219**	0.0143	**0.0366*** **	0.0096	**0.0094**	0.0152	**0.0327** **	0.0129
Cultivation of Pulses (Dummy)	**0.0144**	0.0205	**0.0205**	0.0123	**0.0236**	0.0222	**0.0164**	0.0153
Cultivation of Oilseed crops (Dummy)	**0.0063**	0.0168	**0.0180**	0.0144	**-0.0192**	0.0180	**0.0137**	0.0160
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	**0.0249**	0.0208	**0.0020**	0.0246	**0.0358**	0.0248	**0.0027**	0.0264
Cultivation of Fruit crops (Dummy)	**0.0597***	0.0313	**0.0609**	0.0407	**0.0543**	0.0380	**0.0606**	0.0522
Cultivation of Industrial crops (Dummy)	**0.0225**	0.0214	**0.0464** **	0.0215	**0.0079**	0.0272	**0.0554** **	0.0269
Proportion of household members with open unemployment in the last 6 months	**-0.1689*** **	0.0626	**-0.2385*** **	0.0739	**-0.1773***	0.0975	**-0.3048*** **	0.0941
Proportion of household members who worked in the last 6 months with								
Agriculture, Forestry, Fishing and Mining Sector	**0.0083**	0.0353	**0.0158**	0.0339	**0.0886** **	0.0438	**0.0350**	0.0398
Manufacturing and Construction Sector	**0.0239**	0.0350	**-0.0388**	0.0327	**0.1105** **	0.0430	**-0.0446**	0.0399
Services Sector	**0.0330**	0.0358	**0.0214**	0.0309	**0.1317*** **	0.0483	**0.0322**	0.0397

Continued over

Continued

Dependent Variable = Ln per adult equivalent household expenditure	All Households				Panel Households Only			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Location and regional effects								
Dry Zone region (Dummy)	**0.0059**	0.0381	**0.0410**	0.0368	**-0.0005**	0.0398	**0.0543**	0.0403
Coastal region (Dummy)	**0.0266**	0.0480	**-0.0365**	0.0320	**0.0185**	0.0461	**-0.0297**	0.0371
Delta region (Dummy)	**0.2644*** **	0.0803	**-0.0475**	0.0544	**0.2448*** **	0.0788	**-0.0143**	0.0568
Village Tract/Wards: Inland plains (Dummy)	**0.0175**	0.0253	**0.0253**	0.0226	**0.0295**	0.0275	**0.0276**	0.0256
Village Tract/Wards: Hills (Dummy)	**0.0236**	0.0309	**-0.0088**	0.0245	**0.0446**	0.0475	**-0.0082**	0.0275
Village Tract/Wards: Mountains (Dummy)	**-0.2333*** **	0.0380	**-0.0260**	0.0486	**-0.2224*** **	0.0390	**-0.0128**	0.0519
Village Tract/Wards: Delta (Dummy)	**-0.1924*** **	0.0681	**-0.0637**	0.0429	**-0.1842*** **	0.0650	**-0.0669**	0.0488
Village Tract/Wards: Valley (Dummy)	**0.0481**	0.0410	**0.0204**	0.0424	**0.0578**	0.0409	**-0.0126**	0.0363
Distance to nearest market (Miles)	**0.0004**	0.0004	**-0.0030**	0.0021	**0.0004**	0.0004	**-0.0036**	0.0022
Distance to nearest financial services (Miles)	**-0.0012**	0.0007	**-0.0007**	0.0007	**-0.0016** **	0.0008	**-0.0003**	0.0008
Distance to nearest health services (Miles)	**-0.0032***	0.0017	**-0.0051***	0.0027	**-0.0013**	0.0019	**-0.0048***	0.0029
Distance to primary and monastic school (Miles)	**0.0025**	0.0027	**0.0004**	0.0027	**0.0012**	0.0023	**0.0014**	0.0024
Distance to lower secondary school (Miles)	**-0.0021**	0.0021	**-0.0037** **	0.0015	**-0.0024**	0.0020	**-0.0035** **	0.0017
Distance to upper secondary school (Miles)	**-0.0004**	0.0015	**0.0006**	0.0009	**-0.0006**	0.0014	**0.0003**	0.0013
Infrastructure								
Road Density by state and region	**-0.0242*** **	0.0076	**-0.0108** **	0.0045	**-0.0210*** **	0.0073	**-0.0139*** **	0.0049
Bituminous (Dummy)	**-0.0038**	0.0140	**0.0604*** **	0.0140	**0.0034**	0.0170	**0.0744*** **	0.0173
Gravel roads (Dummy)	**-0.0201**	0.0179	**-0.0131**	0.0152	**0.0002**	0.0205	**-0.0089**	0.0162
Laterite roads (Dummy)	**-0.0656** **	0.0267	**0.0014**	0.0159	**-0.0420**	0.0267	**-0.0109**	0.0176
Dirt roads (Dummy)	**-0.0565***	0.0292	**-0.1117** **	0.0462	**-0.0413**	0.0310	**-0.1071** **	0.0441
Months on Road by car/Four Wheels and on water way by boat	**0.0061** **	0.0024	**-0.0024**	0.0017	**0.0045***	0.0025	**-0.0029**	0.0018
Water supply (Dummy)	**0.0689** **	0.0262	**0.0322** **	0.0154	**0.0549***	0.0287	**0.0275**	0.0187
Electricity supply (Dummy)	**0.0214***	0.0118	**0.0378** **	0.0153	**0.0149**	0.0138	**0.0338** **	0.0167
Common mode of transportation: Taxi/Bus (Dummy)	**0.0430** **	0.0183	**0.0388** **	0.0154	**0.0473*** **	0.0176	**0.0429** **	0.0169
Common mode of transportation: Ship/Boat (Dummy)	**0.0191**	0.0193	**0.0079**	0.0158	**0.0235**	0.0221	**0.0207**	0.0199
Common mode of transportation: Bullock Cart (Dummy)	**-0.0525*** **	0.0171	**-0.0086**	0.0150	**-0.0480*** **	0.0165	**-0.0149**	0.0158
Common mode of transportation: Horse (Dummy)	**0.0248**	0.0170	**-0.0300**	0.0188	**0.0203**	0.0173	**-0.0273**	0.0229
Nargis affected area (Dummy)			**0.0964*** **	0.0328			**0.0775** **	0.0299
Constant	**13.1297*** **	0.1317	**13.3738*** **	0.1169	**13.0503*** **	0.1548	**13.3790*** **	0.1509
Number of Observations		**16,987**		**17,764**		**8,337**		**8,670**
F -statistics		**0.0001**		**0.0004**		**0.0001**		**0.0011**
R2		**0.3752**		**0.3429**		**0.3648**		**0.3456**

Source: Author's estimations

Continued over

Notes:

1) All estimates are computed using probability weights which are calculated by taking the inverse of the sampling fraction. Calculations are weighted by (survey weights X household size).
2) Linearized standard errors are reported and ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.
3) The education variables denote the proportion of household members of working age (15 to 64) who have completed the five levels of education. Primary education denotes 5 years of schooling or less, lower secondary education denotes between 6 and 8 years of schooling, upper secondary education denotes 9 and 10 years of education. Tertiary education denotes undergraduate diploma, bachelor degree, and post graduate diploma. The reference category of education is the share of household members of working age with unclassified/unknown education.
4) The health variables denote the proportion of household members being sick/ ill/ injured in the last 30 days. The reference category of health condition is the share of household members who were not sick/ ill/ injured in the last 30 days.
5) Variables for occupation status denote the proportion of household members of working age (15 to 64) in 9 categories: legislators, senior officials and managers, professionals, technicians and associate professionals, service workers and shop and market sales workers, skilled agricultural and fishery workers, craft and related trades workers and plant and machine operators and assemblers, and elementary occupations. The reference category in occupation variables is the share of household members who were clerks.
6) Variables for open employment denote the proportion of household members aged 15 to 64, who looked for, but could not find one in the 6 months prior to the administrations of IHLCA surveys in 2004/05 and 2009/10.
7) Variables for industry denote the proportion of household members of working age (15 to 64) in 4 sectors combining of 11 categories. The reference category is: the share of household working members engaging in the activities of private work as employers and undifferentiated production activities.
8) Of the region dummies, the reference category is residents in the Hill region. At community level, dummies for different types of topography are included.
9) Of the infrastructure dummies, different types of roads and types of the most common mode of transportation in the community level are included.

Table 5.10. The Fields decomposition of the contributing variables to the level of, and changes in, inequality indices: the 2009/10 regression with 2004/05 household assets for panel households

Variables	Gini coefficient		GE (0)		GE (1)		GE (2)	
	Sj	Pj	Sj	Pj	Sj	Pj	Sj	Pj
Characteristics of the household head	0.52	5.76	0.21	5.76	0.28	5.76	0.39	5.76
Household size and its squared	**2.67**	**29.77**	**1.06**	**29.77**	**1.46**	**29.77**	**1.99**	**29.77**
Proportion of HH members with different age groups	-0.30	-3.38	-0.12	-3.38	-0.17	-3.38	-0.23	-3.38
Proportion of HH members with their level of education (Last 6 months)	**1.82**	**20.31**	**0.73**	**20.31**	**0.99**	**20.31**	**1.36**	**20.31**
Health condition of household members in the last 30 days	0.19	2.07	0.07	2.07	0.10	2.07	0.14	2.07
Proportion of HH members with occupation (Last 7days)	**1.09**	**12.15**	**0.43**	**12.15**	**0.59**	**12.15**	**0.81**	**12.15**
Household home and business assets (2004/05)	0.65	7.26	0.26	7.26	0.36	7.26	0.49	7.26
Proportion of household members with open unemployment in the last 6 months	0.05	0.60	0.02	0.60	0.03	0.60	0.04	0.60
Proportion of HH members with industry (Last 6 months)	0.19	2.07	0.07	2.07	0.10	2.07	0.14	2.07
Location and regional effects	0.82	9.18	0.33	9.18	0.45	9.18	0.61	9.18
Infrastructure	**1.14**	**12.73**	**0.46**	**12.73**	**0.62**	**12.73**	**0.85**	**12.73**
Nargis affected area	0.13	1.48	0.05	1.48	0.07	1.48	0.10	1.48
Explained	**8.95**	**100.00**	**3.58**	**100.00**	**4.82**	**100.00**	**6.69**	**100.00**
Residual	**16.69**		**6.66**		**9.13**		**12.47**	
Total	**25.64**		**10.24**		**13.95**		**19.16**	

Source: Author's estimations

Table 5.11. The Fields decomposition of the contributing variables to the level of, and changes in, the Gini coefficients: the 2004/05 and 2009/10 regressions with household assets

Variable Group	All Households			Panel Households Only		
	2004/05 (Gini=0.2564)*Sj_1 (%) Gini 1	2009/10 (Gini=0.2205)*Sj_2 (%) Gini 2	09/10-04/05 (Gini=-0.0360) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)	2004/05 (Gini=0.2564)*Sj_1 (%) Gini 1	2009/10 (Gini=0.2205)*Sj_2 (%) Gini 2	09/10-04/05 (Gini=-0.0360) Sj_2-Sj_1/ (Gini 2 – Gini 1) (%)
Characteristics of the household head	0.45	0.35	2.85	0.46	0.26	5.48
Household size and its squared	1.47	1.67	-5.66	1.42	1.76	-9.33
Proportion of HH members with different age groups	-0.19	-0.20	0.43	-0.18	-0.2	0.76
Proportion of HH members with their level of education (Last 6 months)	**2.35**	**1.84**	**14.16**	**2.38**	**1.76**	**17.35**
Health condition of household members in the last 30 days	0.10	0.17	-1.79	0.12	0.18	-1.69
Proportion of HH members with occupation (Last 7days)	**1.89**	**1.12**	**21.33**	**1.47**	**1.01**	**12.85**
Household home and business assets (2004/05)	1.08	0.97	3.12	1.2	1.44	-6.64
Proportion of household members with open unemployment in the last 6 months	0.02	0.04	-0.55	0.02	0.08	-1.67
Proportion of HH members with industry (Last 6 months)	0.16	0.04	3.24	0.3	0.02	7.78
Location and regional effects	**1.86**	**0.59**	**35.49**	**1.89**	**0.61**	**35.49**
Infrastructure	0.70	1.09	-10.84	0.59	1.07	-13.26
Nargis affected area		0.23	-6.40		0.18	-4.97
Explained	**9.91**	**7.92**	**55.38**	**9.68**	**8.17**	**42.14**
Residual	**15.74**	**14.13**	**44.62**	**15.96**	**13.88**	**57.86**
Total	**25.64**	**22.05**	**100**	**25.64**	**22.05**	**100**

Source: Author's estimations

Table 5.12. The Fields decomposition of the contributing variables to the level of, and changes in, the Generalized Entropy measures: the 2004/05 and 2009/10 regressions with household assets (All Households)

Variable Group	Total % GE (0)*(Sj)			Total % GE (1)*(Sj)			Total % GE (2)*(Sj)		
	04/05	09/10	Total % Δ 09/10–04/05	04/05	09/10	Total % Δ 09/10–04/05	04/05	09/10	Total % Δ 09/10–04/05
Characteristics of the household head	0.18	0.13	2.45	0.25	0.15	2.16	0.34	0.29	4.68
Household size and its squared	0.59	0.62	-1.48	0.80	0.73	1.61	1.10	1.37	-24.85
Proportion of HH members with different age groups	-0.08	-0.08	0.00	-0.10	-0.09	-0.31	-0.14	-0.17	2.40
Proportion of HH members with their level of education (Last 6 months)	**0.94**	**0.68**	**12.33**	**1.29**	**0.81**	**10.98**	**1.76**	**1.51**	**22.56**
Health condition of household members in the last 30 days	0.04	0.06	-0.98	0.06	0.07	-0.39	0.08	0.14	-5.48
Proportion of HH members with occupation (Last 7days)	**0.75**	**0.41**	**16.21**	**1.03**	**0.49**	**12.43**	**1.41**	**0.92**	**44.84**
Household home and business assets (2004/05)	0.43	0.36	3.52	0.59	0.42	3.81	0.81	0.79	1.30
Proportion of household members with open unemployment in the last 6 months	0.01	0.02	-0.31	0.01	0.02	-0.14	0.02	0.04	-1.64
Proportion of HH members with industry (Last 6 months)	0.06	0.02	2.28	0.09	0.02	1.58	0.12	0.04	7.64
Location and regional effects	**0.74**	**0.22**	**25.14**	**1.02**	**0.26**	**17.49**	**1.39**	**0.48**	**83.04**
Infrastructure	0.28	0.40	-5.86	0.38	0.48	-2.19	0.52	0.89	-33.70
Nargis affected area		0.09	-4.06		0.10	-2.32		0.19	-17.20
Explained	**3.96**	**2.92**	**49.24**	**5.42**	**3.47**	**44.71**	**7.40**	**6.49**	**83.58**
Residual	**6.28**	**5.22**	**50.76**	**8.60**	**6.20**	**55.29**	**11.76**	**11.58**	**16.42**
Total	**10.24**	**8.14**	**100.00**	**14.02**	**9.67**	**100.00**	**19.16**	**18.06**	**100.00**

Source: Author's estimations

Regression results for rural and urban households

Table 5.13 presents the regression coefficients for the surveys in 2004/05 and 2009/10, calculated for rural households and urban households. *R*2 (0.42) in 2004/05 and *R*2 (0.39) in 2009/10 are for urban households, and *R2* for rural households are lower than that for urban households in both study years. Most of the included regressors are significant and have the expected signs, which are the same as in the regression results of all households and panel households. The findings of the regression coefficients for rural and urban households are compared to investigate the gap between them.

The male-headed households had higher expenditure (about 10%) in 2004/05, (accounting for 5%) in 2009/10 compared with the female-headed households in urban areas. However, the magnitudes of the coefficients of the male-headed households in rural areas are lower about four times in 2004/05 and two times in 2009/10 compared with the urban male-headed households. The gap between the male- and female-headed urban households decreased but rural households increased slightly over time. Rural and urban households with more years of experience working in a non-agricultural business spent more in both years. Rural and urban households with more family members spent less, but after reaching the threshold, their expenditure increased and the results are similar in both years. The coefficients of the share of urban household members under 6 and aged 11–15 in 2009/10, and aged 6–10 in 2004/05 are positive and significant. In rural areas, the coefficients of the share of household members aged under 6 in 2009/10, and aged 6–15 in both years are positive and significant. The results show that the per adult equivalent consumption expenditures of the urban households at all age levels were higher compared with that of rural households in both years, apart from the consumption of the rural households with the share of members aged 6–10 in 2009/10. Over time, the consumption expenditure of the rural households with the largest share of children between 6 and 10 fell, while the consumption expenditure of the rural households with the largest share of children between 11 and 15 rose slightly, and the effects on both groups are statistically significant.

The education variables are statistically significant and education increases expenditure in both study years especially for rural households. Interestingly, rural households with the largest share of members who had a lower, or upper secondary education spent significantly more compared with urban households in both years. However, rural

households with more shares of members who had a primary education or who were illiterate, spent significantly less compared with rural household members with shares of other education levels in both years. The return to education of the urban household members with the largest share of tertiary education was significantly less than that of the rural household members with the share of tertiary education in 2004/05 but the condition was opposite in 2009/10. Over the years, rural and urban households with more tertiary, upper and lower secondary graduates, and primary education, showed a significantly greater increase in their consumption level. Rural household members with a higher proportion of the members who were illiterate spent significantly less, but their consumption increased overtime. Rural households with sick/ill/injured members in the last 30 days spent more compared with the urban households with sick members in both years, and the coefficients are significant at the 1% level. The effect is moderately larger in urban households, and slightly larger in rural households over time.

The consumption expenditure significantly increased with the urban households with different occupations, and were higher compared with the consumption of rural households in both study years. Obviously, rural and urban households with the largest share of legislators, senior officials and managers spent significantly more than the households with other types of occupations. Over time, the gap between households with the share of members who were clerks (the reference group) and households with the share of other occupations in rural and urban areas declined.

Rural household members engaging in services sector spent about 13% while rural households with the larger share of manufacturing and construction, and agriculture, forestry, fishing and mining sector consumed about 9% and 10% respectively in 2004/05. Their spending was significantly higher compared with the rural private households as employers and undifferentiated production activities (the reference group). However, urban households with the share of members with agriculture, forestry, fishing and mining sector spent 19% less than the reference group. The expenditures of the largest share of rural and urban household members with open unemployment were significantly worse off over the years.

Rural and urban households who owned and had access to irrigated land were strongly associated with higher levels of household consumption, spent more than those with unirrigated land in 2004/05 but spent less in 2009/10. A comparison of the coefficients of

ownership of both irrigated and unirrigated land areas of rural and urban households suggests that the returns to land ownership declined over time. Rural households who did not have land spent 5% less than those who owned land in both years. The coefficients of cultivation of cereal, fruit, and industrial crops for rural households were positively and significantly associated with their consumption expenditures in both years, and also increased over time. In addition, the coefficients of cultivation of tuber/root crops, spices/medicinal plants, vegetables of rural households in 2004/05, pulses, and oilseed crops of rural households in 2009/10 were positively and significantly associated with their consumption expenditures. Urban dwellers living in the Delta region spent on average about 29 % more compared with those in the Hills region (the reference group) in 2004/05. The rural households in the Delta and Coastal regions spent 27% and 6% respectively more than those in the reference group in 2004/05 but their consumption significantly declined over time. This reflects that in general, business activities are greater in the regions where there is access to the Andaman Sea, thus those who are involved in different business activities in the Delta and Coastal regions spend more.

At the community level, urban households living in the wards situated on mountains spent less by about 25% in 2004/05 while in 2009/10 those residing in a valley spent about 25% more compared with those living in other types of topography. Those living in the valley normally have higher agriculture productivity as they can benefit from growing their crops in fertile soil. Rural households residing in village tracts with mountain and delta topography spent significantly less in 2009/10. Normally neither rural nor urban households living on mountains have good infrastructure to deal with different business activities, as in other types of topography.

The coefficients of the distance to the nearest market of urban households in 2009/10 and rural households in 2004/05 are positive and significant at the 10% level. This highlights the fact that the households closer to markets spend more whether the households are in urban or rural areas. With regard to the distances to the nearest financial and health services of urban households in 2009/10 and rural households in 2004/05, the further the distance, the less the expenditure compared with those living closer to the services. Similarly, rural households who were far from the nearest lower secondary school spent less compared with those living closer to the facilities in both years. The consumption expenditures of urban households who were far from primary and lower secondary school were significantly less in 2009/10.

In terms of infrastructure, rural households living in the different states and regions with higher road density spent less, and the coefficients are statistically significant at the 1% level in both years. Probably, cost of transportation may not be high in rural areas of states and regions with a higher road density. In 2009/10, at the community level, urban households living in wards with bituminous roads spent three times more than rural households residing in village tracts with the same roads. Interestingly, urban households residing in wards with gravel, laterite and dirt roads in both years spent less, about 5% to 12% respectively, as their coefficients are negative and significant. However, households living in rural villages with gravel and laterite roads spent more, about 2% and 4% respectively, compared with those having other types of roads but those living in rural villages with dirt roads spent significantly less in 2009/10. It is obvious that rural and urban households residing in wards/village tracts where cars/four-wheel drives were driven for a longer period (months) spent more compared with those wards/village tracts where they were driven for a shorter period especially in 2004/05.

Urban households with access to water and electricity supply spent significantly more (about 11%and 5% respectively) compared with those not receiving such supply in both years, and their spending reduced over time. Rural households with access to water and electricity supply in village tracts in 2004/05 had higher consumption expenditure compared with those without access to the services. However, the consumption of rural households with an electricity supply increased while that of rural households who could access a water supply declined substantially over the study period.

Urban households using taxis or buses as their common modes of transportation spent more about, 8% and 11% respectively in 2004/05 and 2009/10, and the coefficients are positive and statistically significant at the 1% level. However, urban households who used horses spent 12% less compared with those who did not in 2009/10. Those in the village tracts who used bullock carts in rural areas as a common mode of transportation spent less significantly but those who used a horse in rural areas spent 5% more in 2004/05 compared with those using other modes of transportation. The Nargis-affected area dummy for rural areas shows a positive and significant relationship with household expenditure in 2009/10. Thus, households living in the Nargis-affected area spent more compared with the non-Nargis-affected rural areas. It is likely that those in the Nargis-affected area had to spend for reconstruction of their houses and rehabilitation of their lives.

Table 5.13. Regression Results (Urban households vs. Rural households)

Dependent Variable = Ln per adult equivalent household expenditure	Urban Households				Rural Households			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Characteristics of the household head								
Age of household head (Years)	**0.00254**	0.00315	**-0.01525*** **	0.00420	**-0.00196**	0.00206	**0.00066**	0.00192
Age square of household head (Years)	**-0.00002**	0.00003	**0.00013*** **	0.00004	**0.00002**	0.00002	**-0.00001**	0.00002
Gender of household head (Dummy)	**0.09435*** **	0.02086	**0.04658*** **	0.01610	**0.02233** **	0.01063	**0.02436*** **	0.00895
Ethnicity of household head (Myanmar) (Dummy)	**0.02815**	0.04333	**0.00569**	0.02670	**0.01668**	0.01200	**0.04030*** **	0.01126
Years of non-agricultural business in operation	**0.00669*** **	0.00106	**0.00642*** **	0.00132	**0.00438*** **	0.00081	**0.00354*** **	0.00070
Household size (Number)	**-0.11478*** **	0.01147	**-0.11379*** **	0.01138	**-0.09491*** **	0.00686	**-0.09761*** **	0.00724
Household size squared (Number)	**0.00471*** **	0.00070	**0.00471*** **	0.00091	**0.00396*** **	0.00048	**0.00414*** **	0.00053
Age structure of household members								
Proportion of members aged under 6	**0.08381**	0.15124	**0.26131*** **	0.07783	**0.03723**	0.05340	**0.10283** **	0.04746
Proportion of members aged 6-10	**0.38642*** **	0.12919	**0.13895**	0.08785	**0.18737*** **	0.05170	**0.16100*** **	0.04485
Proportion of members aged 11-15	**0.19559**	0.14851	**0.27442*** **	0.07526	**0.19401*** **	0.05214	**0.20414*** **	0.04552
Proportion of members aged 16- 65	**0.06335**	0.10569	**0.02149**	0.04900	**0.04120**	0.04292	**0.00778**	0.03548
Education level of household members who worked in the last 6 months								
Proportion of members with Tertiary education	**0.27904*** **	0.08626	**0.39530*** **	0.07286	**0.34804*** **	0.04580	**0.37060*** **	0.03318
Proportion of members with Upper secondary	**0.07667**	0.09239	**0.22752*** **	0.07344	**0.22565*** **	0.03594	**0.23213*** **	0.02623
Proportion of members with Lower secondary	**0.00266**	0.08600	**0.15249** **	0.06874	**0.15357*** **	0.03358	**0.16138*** **	0.02398
Proportion of members with Primary education	**-0.09937**	0.08087	**0.08437**	0.06299	**0.07288** **	0.03241	**0.10287*** **	0.02312
Proportion of members with Illiterate	**-0.08583**	0.12863	**0.02522**	0.10668	**-0.08051** **	0.03470	**0.00160**	0.02795
Health condition of household members in the last 30 days								
Proportion of members being sick/ ill/ injured	**0.14753** **	0.07182	**0.18432*** **	0.05731	**0.20072*** **	0.02656	**0.20678*** **	0.02114

Continued over

Continued

Dependent Variable = Ln per adult equivalent household expenditure	Urban Households				Rural Households			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Proportion of household members who worked in the last 7 days with								
Legislators, senior officials and managers	**0.59401*** **	0.04260	**0.40687*** **	0.07364	**0.36037*** **	0.05619	**0.22221*** **	0.04682
Professionals	**0.22628*** **	0.05705	**0.11439*** **	0.04226	**0.13329** **	0.05866	**-0.00807**	0.04491
Technicians and associate professionals	**0.31165*** **	0.06646	**0.21866*** **	0.06692	**0.24319*** **	0.06002	**0.05521**	0.05117
Service workers and shop and market sales workers	**0.32588*** **	0.05579	**0.20937*** **	0.06247	**0.30171*** **	0.05438	**0.09635** **	0.04003
Skilled agricultural and fishery workers	**0.34856*** **	0.05333	**0.15149***	0.08452	**0.14794*** **	0.05157	**0.06265**	0.03942
Craft and related trades workers	**0.12926*** **	0.03995	**0.08708**	0.05990	**0.10743** **	0.05233	**0.01572**	0.04049
Plant and machine operators and assemblers	**0.21372*** **	0.04198	**0.22147*** **	0.05025	**0.28091*** **	0.05940	**0.06704**	0.04298
Elementary occupations	**0.05867**	0.03571	**-0.01659**	0.05215	**0.06864**	0.05107	**-0.03615**	0.03862
Land ownership and access, along with cultivation of crops								
Owned and accessed irrigated land area per capita (Acres)	**0.05173*** **	0.01723	**0.01230**	0.00838	**0.06446*** **	0.00627	**0.01627** **	0.00737
Owned and accessed unirrigated land area per capita (Acres)	**0.01821***	0.00938	**0.01435*** **	0.00297	**0.03441*** **	0.00766	**0.02432*** **	0.00477
Landless (Dummy)	**0.00379**	0.04203	**-0.05500**	0.07325	**-0.04935*** **	0.01236	**-0.05206*** **	0.01146
Cultivation of Cereal crops (Dummy)	**-0.00862**	0.04106	**-0.02219**	0.03392	**0.02488** **	0.00982	**0.03912*** **	0.00892
Cultivation of Pulses (Dummy)	**-0.04963**	0.05009	**0.06051**	0.05299	**0.01384**	0.01177	**0.02023** **	0.00912
Cultivation of Oilseed crops (Dummy)	**0.07400**	0.05263	**-0.02283**	0.05584	**0.01315**	0.01105	**0.02016** **	0.00935
Cultivation of Tuber/root crops, spices/medicinal plants and vegetables (Dummy)	**-0.09503**	0.06405	**-0.03343**	0.06761	**0.03102** **	0.01316	**0.00943**	0.01201
Cultivation of Fruit crops (Dummy)	**0.06011**	0.08699	**-0.08725**	0.13630	**0.05883*** **	0.01918	**0.07625***	0.04241
Cultivation of Industrial crops (Dummy)	**-0.03285**	0.03849	**-0.03785**	0.05269	**0.02778** **	0.01286	**0.04957*** **	0.01584
Proportion of household members with open unemployment in the last 6 months	**-0.22560** **	0.09579	**-0.31720*** **	0.10364	**-0.08705**	0.05425	**-0.17295*** **	0.06209
Proportion of household members who worked in the last 6 months with								
Agriculture, Forestry, Fishing and Mining Sector	**-0.19190*** **	0.07128	**0.05832**	0.07843	**0.10112*** **	0.03026	**0.04568**	0.03374
Manufacturing and Construction Sector	**-0.04685**	0.06063	**-0.01166**	0.05283	**0.09015*** **	0.03134	**-0.01415**	0.03378
Services Sector	**-0.06433**	0.05512	**0.01719**	0.05391	**0.12803*** **	0.02947	**0.05802***	0.03348

Continued over

Continued

Dependent Variable = Ln per adult equivalent household expenditure	Urban Households				Rural Households			
	2004/05		2009/10		2004/05		2009/10	
	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.	Coefficient	Std. Errors.
Location and regional effects								
Dry Zone region (Dummy)	**-0.03458**	0.04043	**0.07045**	0.04797	**0.02521**	0.01587	**0.00074**	0.01508
Coastal region (Dummy)	**-0.04517**	0.05318	**-0.01068**	0.04995	**0.05631*** **	0.01535	**-0.04804*** **	0.01350
Delta region (Dummy)	**0.28722** **	0.11796	**-0.04984**	0.07224	**0.26869*** **	0.02616	**-0.07213*** **	0.02530
Village Tract/Wards: Inland plains (Dummy)	**0.00623**	0.04077	**0.01161**	0.02598	**0.00833**	0.01269	**0.03518*** **	0.00906
Village Tract/Wards: Hills (Dummy)	**0.02219**	0.04332	**-0.03775**	0.06975	**0.02998**	0.01914	**0.00151**	0.01532
Village Tract/Wards: Mountains (Dummy)	**-0.25411*** **	0.07968	**0.00919**	0.06833	**-0.22400**	0.02277	**-0.06654*** **	0.01609
Village Tract/Wards: Delta (Dummy)	**-0.18769** *	0.09840	**-0.03710**	0.05074	**-0.17586**	0.02302	**-0.06523*** **	0.01819
Village Tract/Wards: Valley (Dummy)	**0.16481**	0.11771	**0.24706*** **	0.05972	**0.03474**	0.02302	**-0.01888**	0.01953
Distance to nearest market (Miles)	**0.00082**	0.00152	**0.06870** *	0.03472	**0.00046** *	0.00025	**-0.00029**	0.00083
Distance to nearest financial services (Miles)	**-0.00113**	0.00147	**-0.00714** **	0.00314	**-0.00074** **	0.00037	**0.00058** *	0.00034
Distance to nearest health services (Miles)	**-0.02565**	0.02541	**-0.02635*** **	0.00456	**-0.00350*** **	0.00075	**-0.00264*** **	0.00095
Distance to primary and monastic school (Miles)	**0.07625**	0.03774	**-0.08287** *	0.04213	**0.00228** *	0.00117	**0.00036**	0.00127
Distance to lower secondary school (Miles)	**0.00438**	0.00879	**-0.03904*** **	0.01336	**-0.00256*** **	0.00093	**-0.00331*** **	0.00076
Distance to upper secondary school (Miles)	**0.00588**	0.01735	**-0.01016**	0.01328	**-0.00017**	0.00074	**-0.00034**	0.00061
Infrastructure								
Road Density by state and region	**-0.03465*** **	0.01148	**-0.00461**	0.00868	**-0.02413*** **	0.00247	**-0.01334*** **	0.00179
Bituminous (Dummy)	**0.01634**	0.03349	**0.09423*** **	0.03217	**-0.00136**	0.00989	**0.03783*** **	0.00932
Gravel roads (Dummy)	**-0.06932** *	0.03554	**-0.09413*** **	0.03410	**0.01178**	0.00889	**0.02166*** **	0.00723
Laterite roads (Dummy)	**-0.11731*** **	0.03074	**-0.05138** **	0.01987	**0.00091**	0.01181	**0.04012*** **	0.00795
Dirt roads (Dummy)	**-0.07412** **	0.03538	**-0.11186** **	0.05010	**-0.00199**	0.01118	**-0.03443** **	0.01758
Months on Road by car/Four Wheels and on water way by boat	**0.04738*** **	0.01418	**0.00120**	0.00934	**0.00447*** **	0.00092	**-0.00215** **	0.00089
Water supply (Dummy)	**0.11262*** **	0.03709	**0.10718*** **	0.02199	**0.01886** *	0.01021	**-0.02985*** **	0.00856
Electricity supply (Dummy)	**0.05030** *	0.02914	**0.00638**	0.02748	**0.01909** **	0.00843	**0.04462*** **	0.00678
Common mode of transportation: Taxi/Bus (Dummy)	**0.07572*** **	0.02438	**0.11097*** **	0.02391	**0.01445**	0.00878	**0.00991**	0.00790
Common mode of transportation: Ship/Boat (Dummy)	**0.05821**	0.04389	**-0.05131**	0.04254	**0.01349**	0.01039	**-0.00127**	0.00917
Common mode of transportation: Bullock Cart (Dummy)	**-0.03770**	0.02941	**-0.03089**	0.02311	**-0.03720*** **	0.00828	**0.00431**	0.00730
Common mode of transportation: Horse (Dummy)	**0.01916**	0.03758	**-0.12464*** **	0.02676	**0.04663*** **	0.01116	**0.00109**	0.01208
Nargis affected area (Dummy)			**0.00918**	0.03205			**0.12286*** **	0.01742
Constant	**12.91494*** **	0.26648	**13.76116*** **	0.23185	**13.08685*** **	0.09118	**13.24389*** **	0.08417
Number of Observations		**5,132**		**5,244**		**11,855**		**12,520**
F -statistics		**0.0000**		**0.0021**		**0.0000**		**0.0000**
R2		**0.4210**		**0.3852**		**0.3055**		**0.2918**

Source: Author's estimations; **Notes**: Same as Notes of Table (5.9).

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