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AN ANALYSIS OF FOOD CONSUMPTION PATTERNS IN EGYPT

Dissertation

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ABSTRACT

Food is not only a basic need, but it also has an enormous impact on the economic situation of Egyptian households. It is observed that the major sources of calories and proteins in Egypt are plant products and only small amounts come from animal products. These are a relatively concentrated source of high-quality and highly digestible, essential proteins. It is essential to gain thorough knowledge of the determinants of food demand in order to design comprehensive agricultural, food, and social policy options that improve access to food. Therefore, this study estimates partial and complete food demand systems as a basis for choosing future Egyptian food policies. It presents the estimation of expenditure elasticities for rural and urban areas and for each household size, using an Engel double-log model of household expenditures because of the absence of food data for each household size in each governorate. Due to the specific features of the data, spatial variation in regional prices estimated using household survey data are used as proxies for food prices. The calculated unit values of the aggregated commodities are incorporated into the food demand analysis based on a linear approximate almost ideal demand system (LA/AIDS). Hence own- and cross-price elasticities are estimated. The expenditure and price elasticities of demand for different food groups are used in projections of future food consumption up to the year 2015.

The study depends mainly on both a descriptive and an econometric analysis of the most recent Egyptian Household Income, Expenditure, and Consumption Survey that has been conducted by the Central Agency for Public Mobilisation and Statistics (CAPMAS) of the Government of Egypt.

The descriptive analysis examines the structure of food consumption and expenditure patterns for selected food groups in Egypt, with special emphasis on the difference between rural and urban areas and within rural and urban regions across governorates. This reflects a map of the consumption and expenditure patterns in Egypt identifying disparities in food consumption and expenditures of different food groups by region.

Regarding household specific elasticity estimates, households exhibit increasing consumption of vegetables and meats with higher income. The expenditure elasticities are larger in rural areas compared to urban areas. Also, the expenditures on most food groups increase at a decreasing rate as household size grows. As compared to the estimates of the expenditure elasticities using the Engel relationship only for Egypt, the results of the complete demand system differ in value but are of the same relative order of magnitude. Expenditure and price elasticities for selected food groups are relatively high in Egypt. Expenditure elasticities for

all food groups were positive and less than one, except for fruits, meats, and milk that have been identified as luxuries. Cereals tend to have the lowest expenditure elasticity of demand.
Uncompensated own-price elasticities of demand for all food groups are negative and their absolute amounts are lower than unity i.e. demand reacts inelastically to own price changes, except for meats (elastic). According to the values of the cross-price elasticities and on the level of all selected food commodity groups, only substitution relationships are observed.
Projecting future food consumption up to the year 2015, Egypt is expected to be far from self-sufficient in food especially for livestock products. The high price elasticities of demand for many food items stress the importance of food price changes for households, and their reactions should be taken into account in the development of comprehensive agricultural and food policies in Egypt.

ZUSAMMENFASSUNG

Nahrungsmittel sind nicht nur ein Grundbedürfnis. Sie haben auch einen wesentlichen Einfluss auf die wirtschaftliche Situation ägyptischer Haushalte. Die Energie- und Proteinzufuhr wird in Ägypten hauptsächlich durch pflanzliche Erzeugnisse gewährleistet. Tierische Produkte, die eine konzentrierte Quelle essentieller Proteine mit einer guten Verfügbarkeit darstellen, machen nur einen geringen Prozentsatz aus.

Es ist wichtig die Bestimmungsgründe der Nahrungsmittelnachfrage zu kennen, um eine Grundlage für eine umfassende Agrar-, Ernährungs- und Sozialpolitik, die den Zugang zu Nahrungsmitteln verbessert, zu schaffen. Deshalb schätzt diese Studie partielle und vollständige Nachfragesysteme für Nahrungsmittel. Sie stellt die Schätzung von Ausgabenelastizitäten für ländliche und städtische Haushalte sowie für Haushalte unterschiedlicher Größe unter Verwendung von doppellogarithmischen Engel-Kurven vor. Aufgrund der Eigenschaft der verwendeten Querschnittsdaten wird die spatiale Variabilität der regionalen Preise aus den Haushaltsdaten geschätzt. Diese geschätzten Werte werden als Proxies für Nahrungsmittelpreise in das vollständige Nachfragesystem (LA/AIDS) für Nahrungsmittel eingesetzt, um Eigen- und Kreuzpreiselastizitäten zu schätzen. Die geschätzten Ausgaben- und Preiselastizitäten werden in einer Prognose der Entwicklung des Nahrungsmittelkonsums bis zum Jahr 2015 eingesetzt.

Diese Studie basiert hauptsächlich auf deskriptiven und ökonometrischen Analysen der letzten Einkommens- und Verbrauchsstichprobe privater Haushalte in Ägypten (Central Agency for Public Mobilisation and Statistics – CAPMAS).

Die deskriptive Analyse untersucht die Struktur des Nahrungsmittelverbrauchs und der Ausgaben für ausgewählte Nahrungsmittelgruppen in Ägypten. Dabei werden insbesondere regionale Besonderheiten zwischen ländlichen und städtischen Regionen unterschiedlicher Verwaltungseinheiten betrachtet. Diese spiegeln die geografischen Verbrauchs- und Ausgabenmuster in Ägypten wider und verdeutlichen die Unterschiede im Verbrauch von einzelnen Nahrungsmittelgruppen und der Ausgaben hierfür.

In Bezug auf die Ausgabenelastizitäten zeigen Haushalte mit steigendem Einkommen hohe Zuwächse im Gemüse- und Fleischverzehr. Die Elastizitäten sind in ländlichen Regionen größer als in städtischen Regionen. Auch zeigen die meisten Nahrungsmittelgruppen abnehmende Ausgabenzuwachsraten mit steigender Haushaltsgröße. Die

Ausgabenelastizitäten auf Basis von Engel-Kurven sind mit den Ausgabenelastizitäten, die durch das vollständige Nachfragesystem geschätzt wurden, vergleichbar. Für alle Nahrungsmittelgruppen sind die Ausgabenelastizitäten positiv und kleiner als eins, mit der Ausnahme von Obst, Fleisch, und Milch, die durch die geschätzten Elastizitäten als Luxusgüter beschrieben werden können. Cerealien haben die niedrigste Ausgabenelastizität. Unkompensierte Eigenpreiselastizitäten der Nachfrage aller Nahrungsmittelgruppen sind negativ und ihr absoluter Wert ist kleiner als eins, das heißt, die Nachfrage reagiert unelastisch auf Eigenpreisveränderungen. Die einzige Ausnahme stellt die Nachfrage nach Fleisch dar. Hier wird eine elastische Nachfrage gemessen. Die geschätzten Kreuzpreiselastizitäten zeigen, dass es sich bei allen Nahrungsmittelgruppen um gegenseitige Substitute handelt.

Die Prognose des Nahrungsmittelverbrauchs bis zum Jahr 2015 zeigt, dass eine Selbstversorgung mit wichtigen Nahrungsmitteln in Ägypten weiterhin nicht erreicht werden kann. Dies betrifft insbesondere die Versorgung mit tierischen Produkten. Die hohen Preiselastizitäten der Nachfrage für viele Nahrungsmittel unterstreichen die Sensibilität der Nachfrage in Bezug auf Preisveränderungen, was in der Konzeption einer umfassenden Agrar- und Ernährungspolitik in Ägypten berücksichtigt werden sollte.

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LIST OF ABBREVIATIONS

ADAJ	American Dietetic Association Journal
AEO	African Economic Outlook
AIDS	Almost Ideal Demand System
CAPMAS	Central Agency for Public Mobilisation and Statistics
CBE	Central Bank of Egypt
CCA	Common Country Assessment
CDS	Complete Demand System
EDHS	Egyptian Demographic and Health Survey
EHDR	Egyptian Human Development Report
EHIECS	Egyptian Household Income Expenditure and Consumption Survey
ERSAP	Economic Reform and Structural Adjustment Program
FAO	Food and Agricultural Organisation
FBS	Food Balance Sheet
FNIC	Food and Nutrition Information Centre
FPND	Food Policy and Nutrition Division
g	gram
GDP	Gross Domestic Product
ICTSD	International Centre for Trade and Sustainable Development
IFPRI	International Food Policy Research Institute
ILO	International Labour Organisation
INP	Institute of National Planning
ITS	Indirect Translog System
Kcal	kilocalorie
Kg	kilogram
KJ	kilojoule
LA/AIDS	Linear Approximated Almost Ideal Demand System
LE	100 Piasters (Egyptian Pound)
LES	Linear Expenditure System
MALR	Ministry of Agriculture and Land Reclamation
MISA	Ministry of Insurance and Social Affairs
MOHP	Ministry of Health and Population

MFTS	Ministry of Foreign Trade and Supply
MWRI	Ministry of Water Resources and Irrigation
NPU	Net Protein Utilisation
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
p.	page
pp.	pages
RDA	Recommended Daily Allowance
SFD	Social Fund for Development
SIPSs	Social Insurance Programs
SAP	Structural Adjustment Program
SAPs	Social Assistance Programs
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organisation
UNICEF	United Nations Children's Fund
UNU	United Nations University
USDA	United States Department of Agriculture
USAID	United Status Agency for International Development
WHO	World Health Organisation
%	percent

CHAPTER 1

INTRODUCTION

1.1 Problem Statement

The food problem, the problem of adequate nutrition, is regarded as a major strategic issue that attracts intensive attention at all levels. Its importance stems from important political and socio-economic dimensions. Although Egypt recorded the highest caloric intake at 3,385 per day in 2001 compared to the average in developed countries and developing countries, the Egyptian individual is still suffering from malnutrition and unbalanced essential food elements like energy, protein, and fat content. It is observed that the major sources of calories and proteins in Egypt are plant products with small amounts of nutrients from animal products that are a relatively concentrated source of high-quality and highly-digestible essential proteins. A total of 91.91 % of the total calories and 79.59 % of the total proteins consumed per capita per day in 2001 came from plant products. In addition, the diets in Egypt are low in fat intake, since of all basic foodstuffs, fat is one of the most expensive. Therefore, lack of dietary diversity is a particular problem among the populations in Egypt, because their diets are predominantly based on starchy staples with little animal products and few fresh fruits and vegetables.

Also, there is a marked difference in food consumption patterns between rural and urban areas and within rural and urban regions in Lower Egypt, Middle Egypt, Upper Egypt, and Frontier Egypt across governorates. Food policies, therefore, need to address aspects of consumption by regions.

It is essential to gain thorough knowledge of the determinants of food demand in order to design comprehensive agricultural, food, and social policy options that improve access to food in Egypt. Besides preferences, the economic variables -income and prices - can be seen as the most important factors that determine food consumption (According to demand theory). Predictions of changes in consumer expenditure caused by changes in income and prices are key information for this purpose, and econometric analyses are needed to estimate them empirically.

1.2 Objectives of the Study

The main aim of this study is to econometrically estimate food demand elasticities. The expenditure (or income) and price elasticities of demand can be used for assessing implications of changes in income or prices on food demand that result from economic trends or changes in policies. The following are the specific objectives of the study:

- To identify the development of production and consumption for major food commodities.
- To identify the current state of food security at the macro and micro levels discussing different indicators of food security in Egypt.
- To describe and analyse the structure of consumption and expenditure patterns for the selected food groups in rural and urban regions.
- To estimate the expenditure elasticities, using Engel relationship, for the selected food groups by region and household size.
- To estimate the complete demand functions for the selected food groups to measure own- and cross-price elasticities.
- To forecast future production and consumption of major food commodities, to give food policy recommendations improving dietary consumption patterns in Egypt.

1.3 Data Sources and Methods

This study is mainly based on data of the Egyptian Household Income, Expenditure, and Consumption Survey (EHIECS), which was conducted by the official statistical agency of Egypt, the Central Agency for Public Mobilisation and Statistics (CAPMAS) in 2000. It is also based on data of the Consumption Bulletin issued by CAPMAS; data of the Economic Bulletin supplied by the Ministry of Foreign Trade and Supply; data from the Ministry of Agriculture and Land Reclamation (MALR), the Economic Affairs Sector, the General Department of Agricultural Statistics, Egypt; data of the Food Balance Sheet issued by the FAO; and data from the World Bank, IFPRI, and ILO.

Egypt has conducted Household Income, Expenditure, and Consumption Surveys since 1957/58. It was intended to perform these surveys every five years. But because of wars, these surveys were stopped for some time. These surveys are available for the years 1957/58, 1964/65, 1974/75, 19981/82, 1990/91, 1995/96, and 1999/2000.

Data of the last three surveys of 1990/91, 1995/96, and 1999/2000 were collected on the basis of data from the Population Censuses, Labour Force Sample Surveys, and the Demographic and Health Surveys. The questionnaire design and administration were similar across the three surveys (CAPMAS, HIECS, Various Issues).

The 1995/96 survey was collected from October 1995 to September 1996. It included 14,805 households, of which 6,622 were located in urban and 8,183 in rural areas. The sample frame of the 1995/96 survey was based on an updated frame of the 1986 Population Census of 503 area sampling units that included 276 units in urban and 227 units in rural areas (CAPMAS, HIECS, Volume one, 1996).

The 1999/2000 HIECS was supplemented by the most recent Population Census, conducted in November 1996. The sample frame of this Census is 600 area sampling units distributed between urban and rural areas (360 and 240 units, respectively). The 1995/96 and 1999/2000 surveys are highly comparable in terms of sampling procedure and data collection methodology.

The most recent survey was conducted from October 1999 to September 2000. The results were published in December 2000. This is the largest survey of its kind conducted in Egypt. The total sample included 47,949 households, of which 28,754 reside in urban and 19,195 in rural areas.

According to CAPMAS (2000), the survey used a stratified multistage random sample. The sample is nationally representative and the size of the survey is large enough to allow for inferences at the regional and governorate levels. Using the variance and average total consumption expenditure of the 1995/96 survey, it was estimated that the sampling errors in the 1999/2000 survey were 0.7 % in urban areas and 0.9 % in rural areas, with a confidence level of 95 %.

The total sample is stratified such that urban and rural areas are self-independent strata. Each stratum (urban or rural) is divided into internal layers (being the governorates), with probability proportionate to size of an updated population Census of the closest year. The areas (urban or rural) were systematically selected, using sampling intervals and a random start. Using maps, these areas were subdivided into partitions of about 1500 households where each chunk is chosen randomly from each area. Household lists for the selected chunks were prepared. Finally, 80 households for the 1999/2000 sample were selected randomly from each partition.

Subsequently, the systematic selection of 80 households is randomly divided into four quarters (sub-groups), so that 20 households are covered in each quarter of the surveyed year. Thus, all areas are represented in each quarter; and, no seasonal variations can be detected in any area. In addition, the data do not show any seasonal variation from one month to another, because the monthly data are added together to give the annual consumption and expenditure (CAPMAS, HIECS, Volume one, 2000).

This study will use the survey data in three sets: Firstly, data of five household surveys for the years 1974/75, 1981/82, 1990/91, 1995/96, and 1999/2000; secondly, regional data with price variations; and, thirdly, data for different sizes of households without price variations.

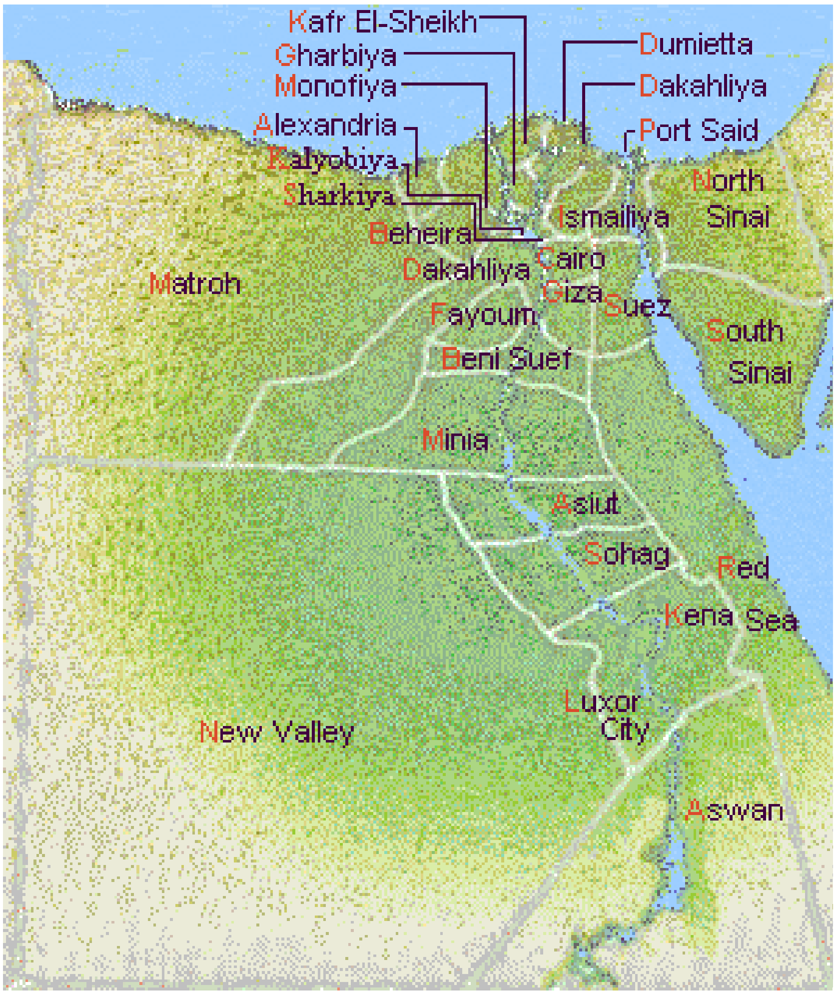
In the first data set, the study will depend on household surveys conducted from 1974/75 to 1999/2000, to measure the inequality in the distribution of Egyptian household consumption expenditures.

The second data set is for Egyptian regions, and here the study has a strong regional focus. Geographically, Egypt is divided into nine regions: Metropolitan, Lower urban and Lower rural, Middle urban and Middle rural, Upper urban and Upper rural, and Frontier urban and Frontier rural. The Metropolitan governorates essentially comprise the four major cities of Cairo, Alexandria, Port-Said, and Suez, all in northern Egypt. Lower Egypt (essentially the region of the Nile Delta) is also in the northern part of Egypt, and Upper Egypt, perhaps counter-intuitively, is the area mostly south of Cairo, with governorates largely following the meandering upper reaches of the Nile. The Frontier areas are the less populated desert areas bordering the Red Sea, the Sinai, and the Matruh and New Vally areas west of the Nile, as shown in a map of Egypt's governorates (of figure 1.1).

Based on the most recent Population Census conducted in November 1996, the Metropolitan cities had about 18.6 % of Egypt's total population, Lower Egypt had 43.5 %, mostly in urban governorates, Middle Egypt had 20.2 %, Upper Egypt had 16.3 %, with more than two-thirds residing in rural areas, and Frontier Egypt had only 1.4 % of the total population (Year Book, 2002).

Specifically, we have data on quantities of food items consumed and on the value of consumption for aggregate food groups (such as cereals, vegetables, fruits, meats, fish, etc.) for Metropolitan governorates and for both the urban and rural areas in another 23 governorates. Therefore, in the second data set, the study will depend on 50 observations each observation belongs to one governorate in Egypt.

The third data set is based on aggregate commodity groups for four types of households according to household size. The first type includes households consisting of one person, the second type of households consists of 2-3 persons, the third type consists of 4-6 persons, and the last type of households consists of seven or more persons. This data will enable us to estimate household size effects on food expenditures in Egypt.



Source: http://www.highway.idsc.gov.eg/govern/gov.map?59,14

Figure 1.1 Map of Egypt's Governorates

The study uses descriptive and statistical inference methods for the data analysis in order to achieve the aims of the study. Using linear trend analysis, growth rates for cultivated area, yield, production, and consumption for major food crops are estimated. Using adjusted coefficients of variation, which were proposed by Cuddy-Della Valle (1978), the instability in agricultural production and consumption is measured. Gini coefficients are used to examine expenditure inequality. Simple linear regression is used to estimate Engel relationship for the selected food groups by region and household size. A double-log specification of the Engel function is chosen in order to estimate the expenditure elasticities. And a linear approximate almost ideal demand system LA/AIDS is chosen to measure own- and cross-price elasticities for the selected food groups.

1.4 Organisation of the Study

This study is to identify food consumption patterns of Egyptian households, through studying different aspects of food consumption. The second chapter provides an overview of the neoclassical theory of consumer demand. It outlines two frequently used ways to present the consumer decision problem including utility maximisation and cost minimisation (Section 2.2). It also presents the properties of demand systems that can serve as a guideline for choosing a suitable functional form for a specific empirical study (Section 2.3). Thereafter, this chapter compares partial versus complete demand systems, discusses specific functional forms of demand, and finally leads to the selection of a specific model for the empirical part of this study (Section 2.4).

The third chapter presents a descriptive analysis of food production and consumption in Egypt. It has been divided into two parts. Part I deals with the development of food production during two periods (Section 3.2). The period 1980 to 2000 is divided into two periods, namely, period I from 1980 to 1986 and period II from 1987 to 2000 as a result of policy change following the structural adjustment (SAP). These may also called before and after agricultural liberalisation reform periods. Part II deals with development of food consumption during these two periods (Section 3.3). To consider the development of food production compound growth rates for cultivated area, yield, and production of various crops during the two periods are presented in Section 3.2.1. The average change in production for various crops between these two periods has been decomposed into different components to study the contribution of area, yield, and interaction between changes in area and yield towards this change in production (Section 3.2.2). In addition, instability in agricultural production is measured in terms of variability in important crops by using adjusted coefficient of variation for production (Section 3.2.3).

Changes in food consumption patterns in any society are an important indicator of development changes, thus, the second section of this chapter is to consider the development of food consumption (Section 3.3) through: (a) Assessing trends in per capita consumption for major food commodities in Egypt during the two periods (Section 3.3.1); (b) Decomposing changes in total food consumption (Section 3.3.2); And (c) Presenting the corrected coefficients of variation in per capita consumption of different food commodities (Section 3.3.3).

The fourth chapter is to identify the current state of food security and nutritional standards in Egypt based on data from food balance sheets for Egypt, for developing countries, and for developed countries. It discusses the theoretical framework of food security and nutritional standard determination (Section 4.2). Section 4.3 provides background information on the food balance sheet that is regularly compiled by the FAO. Section 4.4 examines the current state of food security in Egypt at the macro level in terms of domestic supply, and at the micro level in terms of per capita food supplies, which is expressed in terms of quantity and also in terms of caloric value, protein, and fat content. It also shows Egyptian food intakes in comparison to those of developed countries and developing countries in 2001. Section 4.5 discusses other factors as indicators of food security in Egypt such as dietary diversity, nutritional indicators, income poverty, and the inequality in the distribution of household expenditures (Section 4.4). Finally, this chapter discusses policies aimed at improving food security and at poverty reduction in Egypt such as the food subsidy system (Section 4.6).

Egypt can be divided into several regions according to both the geographical distribution and the approximation of the average per capita expenditure share of each food commodity group based on the household survey data collected by CAPMAS, 2000. To describe and analyse the structure of food consumption and expenditure patterns in Egypt, the consumption and expenditure patterns for selected food groups are considered separately, at the rural and urban levels of Egypt, in the fifth chapter (Sections 5.3 and 5.4, respectively).

The sixth chapter presents an empirical analysis of food expenditures in Egypt in two steps: First, it estimates the expenditure elasticities for the selected food groups for rural and urban areas and for each household size. It considers the simultaneous effect of total expenditure, location and household size, using an Engel model (Section 6.2). Second, it presents the complete analysis of demand system (LA/AIDS) for the Egyptian households to measure own- and cross-price elasticities from spatial variation in regional prices estimated using household survey data (Section 6.3).

Chapter 7 presents forecasts of future food production and consumption. The simple linear trend model that is presented in chapter 3, are used to forecast future production for major of food commodities. The population growth and expected increase in income and prices (the expenditure and price elasticities), i.e. the most important factors influencing the levels of food consumption, are utilized in the projections for future consumption of major food commodities until the year 2015.

Finally, the eighth chapter presents a summary, conclusions, and recommendations to achieve a better pattern of food consumption by implementing a number of development and fiscal policies.

CHAPTER 2

DEMAND THEORY

2.1 Introduction

In consumer behaviour theory, demand functions are derived by assuming that the consumer maximises his/her utility subject to a budget constraint. In this chapter, the essentials of economic theory of consumer behaviour are discussed. They provide the theoretical framework for modelling consumer demand and form the basis of the empirical analyses in this study. In the basic application of consumer theory, the economic variables, income and prices, along with consumer preferences can be seen as the most important factors that determine food consumption.

This chapter provides an overview of neoclassical theory of consumer demand. It outlines two frequently used approaches to presenting the consumer decision problem including utility maximisation (primal) and expenditure minimisation (dual) (Section 2.2). It also presents the properties of demand systems that can give guidance in choosing a suitable functional form for a specific empirical study (Section 2.3). Thereafter, this chapter compares partial versus complete demand systems, discusses specific functional forms of demand functions, and finally leads to the selection of a specific model for the empirical part of this study (Section 2.4).

2.2 The Consumer Decision Problem

2.2.1 The Utility Maximisation Problem (Primal)

Consumer analysis assumes that a consumer makes consumption decision so as to maximise his/her utility subject to a budget constraint. The consumer[1] then has to allocate the budget among the commodities consumed such that the maximum satisfaction is achieved. Under the axioms of completeness, reflexivity, and transitivity, the consumer decision problem can be presented mathematically using a utility function (Deaton and Muellbauer, 1980a, pp. 37-42; Varian, 1992, pp. 98-102; and Nicholson, 2005, pp. 95-101):

$$u = u(\mathbf{q}) \tag{2.1}$$

[1] Consumer and household are used synonymously in this study.

where $\mathbf{q}$ is a vector of quantities[2] $\mathbf{q} = q_1,..,q_n$ of goods $1,...,n$, among which the consumer can choose, subject to the budget constraint

$$\sum_{i=1}^{n} p_i \, q_i \leq x, \tag{2.2}$$

where p_i is the price of good i, q_i is the quantity demanded of good i, and x denotes the available budget for purchasing goods[3]. This is a standard constrained maximisation problem, which can be analysed using the Lagrangian function (Hands, 2004, pp. 297-298). The Lagrangian results as:

$$L = u(\mathbf{q}) + \lambda \, (x - \sum_{k=1}^{n} p_k \, q_k). \tag{2.3}$$

where λ denotes the Lagrange multiplier corresponding to the budget constraint $(x - \sum_{k=1}^{n} p_k \, q_k = 0)$. Assuming that L is twice continuously differentiable with respect to q_k and λ and setting the derivatives equal to zero provides the necessary first-order conditions for a local maximum:

$$\frac{\partial L}{\partial q_k} = \frac{\partial u}{\partial q_k} - \lambda \, p_k = 0 \quad \forall \, k = 1,...,n \tag{2.4}$$

$$\frac{\partial L}{\partial \lambda} = x - \sum_{k=1}^{n} p_k \, q_k = 0 \tag{2.5}$$

The simultaneous solution of equations (2.4) and (2.5) yields the Marshallian demand functions,

$$q_k = m_k \, (x, \mathbf{p}). \tag{2.6}$$

From (2. 3) one obtains

$$\frac{\partial u}{\partial q_k} = \lambda \, p_k \tag{2.7}$$

and solving for λ gives

$$\frac{\partial u / \partial q_k}{p_k} = \lambda \quad \forall \, k = 1,...,n. \tag{2.8}$$

It results that

[2] Vector or matrices are written in bold letters.
[3] In the following, the notion "budget" or "expenditure" relates to the amount available to be spent on goods. It can differ from "income" due to saving decisions of the household. In this study, these are ignored and it is assumed that the household spends its entire income on the purchase of goods. Therefore, also the notion "income" is used synonymously.

$$MRS_{kj} = \frac{\partial u / \partial q_k}{\partial u / \partial q_j} = \frac{p_k}{p_j} \quad , \quad \forall k \neq j \tag{2.9}$$

indicating that at the maximising solution, the marginal rates of substitution, must equal the price ratio or the rate at which the goods can be traded in the market $p_k / p_j, \forall k \neq j$.

Given a quasi-concave utility function[4], substituting the Marshallian demand functions into the direct utility function $u = u(\mathbf{q})$ one obtains the indirect utility function

$$u^* = u(m(x, \mathbf{p})) = v = v(\mathbf{p}, x) \tag{2.10}$$

It relates utility directly to income and prices assuming optimising behaviour. Thus, the indirect utility function is the solution to the primal optimisation problem.

2.2.2 The Cost Minimisation Problem (Dual)

The problem dual to that of utility maximisation is that of expenditure minimisation[5]. The consumer seeks to minimise the total expenditure of achieving a given utility level (Deaton and Muellbauer, 1980a, p. 41):

$$\text{Minimise } \mathbf{p}\,\mathbf{q} = x \text{ subject to the constraint } u = v(\mathbf{q}) \tag{2.11}$$

The solution to this problem can be found by setting up a Lagrangian function and analysing the system of first order conditions, providing the Hicksian or compensated demand functions

$$q_k = h_k(u, \mathbf{p}), \tag{2.12}$$

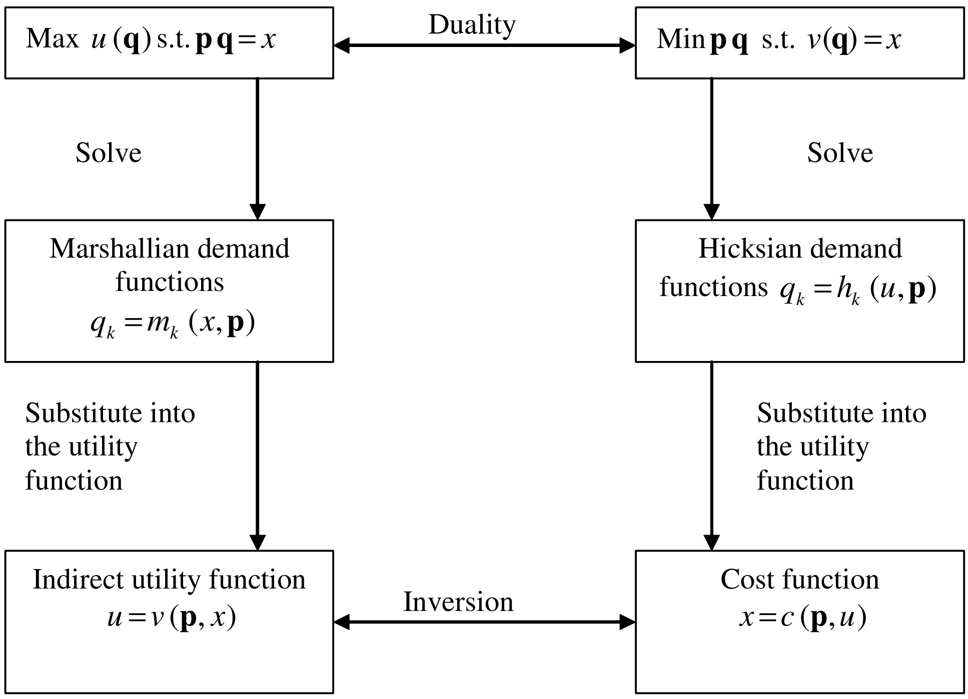
Substituting the Hicksian demand functions into the objective function $\sum_{k=1}^{n} p_k\, q_k = x$, gives (as shown in Figure 2.1) the expenditure (cost) function

$$x = c(\mathbf{p}, u) \tag{2.13}$$

The indirect utility function and the expenditure function are inverses of each other. The expenditure function $x = c(\mathbf{p}, u)$ can be inverted to obtain $v = v(\mathbf{p}, x)$, the indirect utility function.

4 The second-order conditions for a local optimum in a constraint optimisation problem require that the bordered Hessian matrix is negative semi-definite. These second-order conditions present necessary and the sufficient conditions for the local maximum. They are met of the utility function is quasi-concave.

5 See Grings (1993, pp. 42-45) for a full presentation of two alternative ways of describing the optimisation problems.



Note: $k = 1,\ldots,n$

Source: Deaton and Muellbauer (1980a, p. 38).

Figure 2.1 The Primal and Dual Optimisation Problems: Utility Maximisation and Cost Minimisation

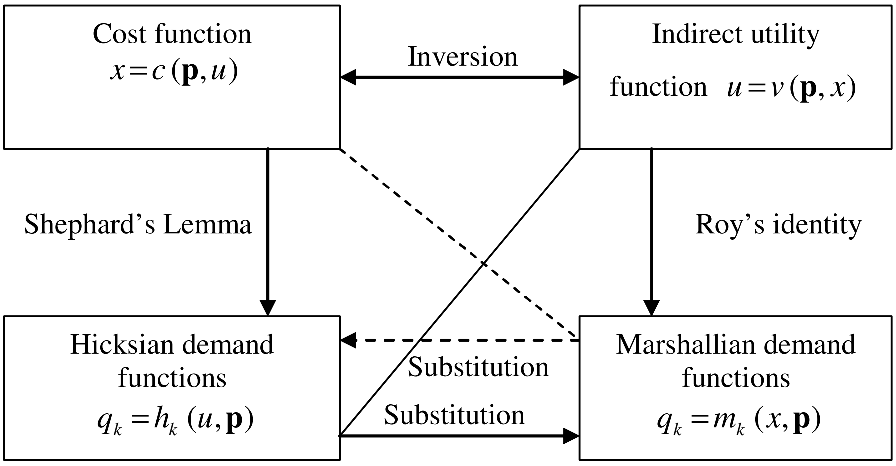
Using Roy's identity, one obtains the Marshallian demand function (see, Figure 2.2):

$$q_k^* = -\frac{\partial v / \partial p_k}{\partial v / \partial x} = m_k(x, \mathbf{p}) \quad \forall k = 1,\ldots,n \tag{2.14}$$

By using the expenditure function $x = c(\mathbf{p}, u)$, Hicksian demand functions can be obtained through Shephard's Lemma:

$$q_k^* = \frac{\partial c}{\partial p_k} = h_k(u, \mathbf{p}) \quad \forall k = 1,\ldots,n \tag{2.15}$$

Because utility maximisation and expenditure minimisation give the same solution, the Marshallian demand functions and the Hicksian demand functions are closely related. To go from Marshallian demand functions to Hicksian demand functions, given the direct utility function $u = u(\mathbf{q})$ one can obtain Marshallian demand functions $q_k = m_k(x, \mathbf{p})$ through constrained optimisation, then substituting the Marshallian demand functions into the direct utility function to obtain the indirect utility function $u = v(\mathbf{p}, x)$. Inverting the indirect utility function yields the expenditure function $x = c(\mathbf{p}, u)$.



Note: $k = 1, ..., n$

Source: Deaton and Muellbauer (1980a, p. 41).

Figure 2.2 Demand, Cost, and Indirect Utility Functions

The expenditure function can be substituted back into the Marshallian demand functions to obtain Hicksian demand functions $q_k = h_k(u, \mathbf{p})$. Similarly, one can begin with Hicksian demand functions obtained through expenditure minimisation, substituting them into the objective function $\sum_{k=1}^{n} p_k\, q_k = x$ to obtain the expenditure function. The expenditure function can be inverted to obtain the indirect utility function. Finally, substituting the indirect utility function into the Hicksian demand functions yields the Marshallian demand functions.

2.3 Properties of Demand Systems

Microeconomic theory imposes a number of regularity conditions that demand functions should meet. A demand function is considered *regular* at a particular price-income argument if the model satisfies the usual theoretical restrictions: *(i)* adding up, *(ii)* homogeneity, *(iii)* symmetry, and *(iv)* negativity (Deaton and Muellbauer, 1980a, pp. 15-16 and 43-46, and Rauniker and Huang, 1987, pp. 6-10). These conditions are derived in the following.

Adding up

Demand functions must respect the budget constraint

$$\sum_{k=1}^{n} p_k\, q_k = x = \sum_{k=1}^{n} p_k\, q_k(x, \mathbf{p}). \tag{2.16}$$

This implies that the sum of quantities demanded, evaluated at their respective prices, equals the available total expenditure x. Differentiating the budget constraint with respect to x, and p gives:

$$\sum_{k=1}^{n} p_k \frac{\partial q_k(x,\mathbf{p})}{\partial x} = 1 \quad \text{and,} \tag{2.17}$$

$$\sum_{k=1}^{n} p_k \frac{\partial q_k(x,\mathbf{p})}{\partial p_j} + q_j = 0 \quad \forall\, j = 1,\dots,n. \tag{2.18}$$

These two equations are the "adding-up" or aggregation restrictions, which must be satisfied for the budget constraint to always be binding. Equation (2.17) is called the "Engel aggregation restriction", and Equation (2.18) is called "Cournot aggregation restriction".

The Engel aggregation restriction can alternatively be expressed in terms of demand elasticities by defining the k budget share as

$$w_k = \frac{p_k\, q_k}{x} \quad \text{and} \tag{2.19}$$

the income (or expenditure) elasticity for the k goods as

$$\varepsilon_k = \frac{x}{q_k} \frac{\partial q_k}{\partial x} \tag{2.20}$$

so that the sum of expenditure elasticities weighted with their respective budget shares equals unity:

$$\sum w_k\, \varepsilon_k = 1 \quad \text{(Engel aggregation restriction).} \tag{2.21}$$

Similarly, and by defining the Marshallian price elasticity of good k with respect to price p_j as

$$\frac{\partial q_k}{\partial p_j} \frac{p_j}{q_k} = \varepsilon_{jk}\,, \tag{2. 22}$$

The Cournot aggregation restriction can be expressed as

$$\sum_{k \neq j}^{n} w_k\, \varepsilon_{jk} + w_j = 0 \quad \text{or} \tag{2.23}$$

$$\sum_{k \neq j}^{n} w_k\, \varepsilon_{jk} = -\, w_j\,. \tag{2.24}$$

The sum of uncompensated own- and cross-price elasticities of good k weighted with their respective budget shares equals the negative value of the budget share of good j.

Homogeneity

The homogeneity condition considers a proportional change in all prices and income. Hicksian demand functions are homogenous of degree zero in prices, and Marshallian demand functions are homogenous of degree zero in both expenditure and prices, denoting that "money illusion" is absent so that

$$h_i(u, \theta \mathbf{p}) = h_i(u, \mathbf{p}) \tag{2.25}$$

$$m_k(\theta x, \theta \mathbf{p}) = m_k(x, \mathbf{p}) \tag{2.26}$$

Given a Marshallian demand function $q_i = m_i(\mathbf{p}, x)$, which is homogeneous of degree zero, and applying Euler's theorem, total differentiation of the Marshallian demand function yields (Chiang, 1984, p. 417):

$$\sum_{j=1}^{n} p_j \frac{\partial q_i}{\partial p_j} + x \frac{\partial q_i}{\partial x} = 0 \tag{2.27}$$

Hence homogeneity can be presented in elasticity form as

$$\sum_{j=1}^{n} \varepsilon_{ij} + \varepsilon_i = 0 \quad \forall i = 1, ..., n \tag{2.28}$$

where ε_{ij} is the Marshallian price elasticity of good i with respect to p_j, $\forall i \neq j$. Thus, the sum of all the uncompensated price elasticities of the i^{th} good and its income elasticity must equal zero. As a result, only n price and expenditure elasticities are independent out of the total $(n+1)$. In the case of Hicksian demand functions only $(n-1)$ of the total n price elasticities are independent.

Symmetry

Symmetry derives from the existence of consistent preferences, assuming that any cost function representing consistent preference is twice continuously differentiable. By Young's theorem (Chiang, 1984, p. 313), symmetry states that the order of differentiation of the demand function with respect to any two arguments does not change the value of the derivative so that

$$\frac{\partial^2 c(\mathbf{p}, u)}{\partial p_i \partial p_j} = \frac{\partial^2 c(\mathbf{p}, u)}{\partial p_j \partial p_i} \tag{2.29}$$

Because

$$h_i(\mathbf{p}, u) = \frac{\partial c(\mathbf{p}, u)}{\partial p_i} \quad \text{and} \tag{2.30}$$

$$h_j(\mathbf{p}, u) = \frac{\partial c(\mathbf{p}, u)}{\partial p_j} \tag{2.31}$$

The cross-price derivatives of the Hicksian demand functions are symmetric, *i.e.,*

$$\frac{\partial h_i(\mathbf{p}, u)}{\partial p_j} = \frac{\partial^2 c(\mathbf{p}, u)}{\partial p_i \partial p_j} = \frac{\partial^2 c(\mathbf{p}, u)}{\partial p_j \partial p_i} = \frac{\partial h_j(\mathbf{p}, u)}{\partial p_i} \tag{2.32}$$

This guarantees that the consumer's choice is consistent.

Negativity:

Denote

$$s_{ij} = \frac{\partial h_i(u, \mathbf{p})}{\partial p_j} \tag{2.33}$$

The $n \; x \; n$ matrix (Slutsky, or substitution, matrix) of compensated price responses formed by the s_{ij} elements is negative semi-definite. Concavity of the cost function implies that the Slutsky matrix is negative semi-definite. This is the negativity condition. A necessary condition for negativity is that all diagonal elements of the substitution matrix are non-positive $s_{ii} \leq 0$, meaning that, if p_i changes, holding utility constant, demand for good i must fall or at least remain unchanged. This is the "law of demand", which relates to the Hicksian demand functions.

The requirements of theoretical consistency can serve as a guideline for choosing a specific demand system for empirical study. Nonetheless, the chosen functional form should be sufficiently "flexible" and sufficiently "simple" (Diewert, 1974, p. 119 and Lau, 1986, pp. 1520-1521).

To yield the required flexibility, the estimated preference function may have enough free parameters (no restrictions on its free parameters) to be able to approximate any arbitrary, twice-continuously-differentiable preference function to the second order (Diewert, 1971 and 1988, p. 285 and p. 303, respectively). On the other hand, it is possible for simplicity that the functional form is linear in parameters and that the number of the parameters is limited in order to increase the degrees of freedom available in the estimation procedure. Furthermore, it is advised that the functional form describes any substitutive and complementary relationships between goods, and allows for the description of demand for luxuries, necessities, and inferior goods.

2.4 Partial and Complete Demand Systems

Partial demand models, which focus on one specific good, have been and still are estimated in empirical research to describe consumer behaviour due to the ease of estimation and interpretation of results. A major advantage of single equation models is that the number of parameters to be estimated is limited, enabling estimation with a smaller number of observations than that required for estimation of complete demand systems. However, this should only be done under special circumstances such as given by theoretical considerations and data and time constraints. Most studies concentrate on the estimation of complete demand system (CDS). Among the advantages that are linked to the use of complete demand systems in empirical estimation are the following reasons (Raunikar and Huang, 1987, pp. 23-25):

- Empirical estimation of a complete demand system usually generates expenditure elasticities and own- and cross-price elasticities (compensated and uncompensated).
- The substitutive or complementary relationships between goods can be described because of simultaneously taking into account existing interdependencies between demand for specific goods.
- Some system specifications also provide welfare indicators, e.g. the marginal propensity to consume and the subsistence levels of consumption or expenditure for specific goods.
- In addition, the complete demand system provides information for testing hypotheses about restrictions derived from demand theory.

Besides these advantages, there are difficulties in empirical estimations linked to the use of demand systems:

- A sufficiently large data set is necessary to estimate the number of independent reaction parameters. Therefore, restrictions on parameters or separability assumptions are frequently introduced to reduce the number of parameters to be estimated simultaneously.

- Theoretical problems exist in applying demand systems derived from the theory of neoclassical demand (Prais and Houthakker, 1971, pp. 8-20 and Raunikar and Huang, 1987, pp. 25-28) such as the "aggregation problem over individuals". The consumption decisions in neoclassical demand theory are taken by individuals. If empirical estimates are derived from average consumption and expenditure data, it is implicitly and restrictively assumed that all individuals have identical utility functions. If empirical estimations are based on household data, the households take consumption decisions, not the individuals. This assumes identical utility functions for a number of consumers or for all households and household members. The "aggregating over different commodities" is another problem needing assumptions on the structure of preferences and the use of index theory to construct aggregates of goods and to choose suitable values for prices and quantities for these aggregates.

According to the specification of demand systems, they are categorised into three subgroups: First, demand systems specified directly like the Rotterdam System. Second, demand systems based on a direct or indirect utility, or cost function, for example, the Linear Expenditure System (LES). Third, demand systems are derived from a flexible functional form like the Indirect Translog System (ITS) and Almost Ideal Demand System (AIDS).

2.4.1 Partial Demand Models – Analysis of Engel Curves

There are several possible functional forms of Engel curves. The choice of a suitable functional form for Engel curves becomes important when the total expenditure elasticities are estimated. The general functional types, which are used to estimate Engel curves are linear, semi-logarithmic, double-logarithmic and the working-Leser model (Houthakker, 1957, pp. 532-551 and Leser, 1963, pp. 694-703).

A common functional form in demand estimation using cross-sectional data is an Engel equation, which expresses the expenditure on a good as some linear function of income, as follows:

$$w_j = \alpha_j + \beta_j y + \eta_j \tag{2.34}$$

where w_j is the average annual per capita expenditure share for food group j, α_j, and β_j are the coefficients to be estimated, y is the average annual total per capita income calculated as the average annual total per capita expenditure, and the last term of equation (η_j) is the disturbance term. It is assumed to capture all other factors that might affect consumption, and may refer to traditions, habit, etc.

An Engel curve of the functional form given by the above equation is derived by the constrained optimisation of an additive utility function, on the assumption that all prices are constant. The demand equation is theoretically plausible; all theoretical restrictions related to cross-price derivatives disappear and the only remaining restriction is the adding-up condition (Engel Aggregation), which is satisfied by the linear functional form of the Engel curve.

A problem with linear Engel equations is that a positive intercept of the regression equation implies an income (expenditure) elasticity of less than one (i.e., the good is necessary), whereas, a negative intercept implies an income elasticity of greater than one (i.e., the good is a luxury). The implications of linearity in terms of these income elasticities are that, as income increases, the income elasticity of necessity goods increases, while the opposite is true for a luxury good. This is a conceptual problem, because logically one would expect the reverse situation. The statistical fit of linear Engel equations is often poor, because the data may not satisfy the linearity restrictions.

Generally, the used functional forms that are most widely used in the literature and their corresponding elasticities are:

$$w_j = \alpha_j + \beta_j\, y + \eta_j \qquad \varepsilon_j = \beta_j\,(y / w_j) \tag{2.35}$$

$$w_j = \alpha_j + \beta_j \ln y + \eta_j \qquad \varepsilon_j = \beta_j\,(1 / w_j) \tag{2.36}$$

$$w_j = \alpha_j - \beta_j\, 1/ y + \eta_j \qquad \varepsilon_j = \beta_j\,(1 / y\, w_j) \tag{2.37}$$

$$\ln w_j = \alpha_j + \beta_j\, y + \eta_j \qquad \varepsilon_j = \beta_j\, y \tag{2.38}$$

$$\ln w_j = \alpha_j + \beta_j \ln y + \eta_j \qquad \varepsilon_j = \beta_j \tag{2.39}$$

$$\ln w_j = \alpha_j - \beta_j\, 1/ y + \eta_j \qquad \varepsilon_j = \beta_j\,(1 / y) \tag{2.40}$$

$$w_j / y = \alpha_j + \beta_j\, y + \eta_j \qquad \varepsilon_j = 1 + \beta_j\, y\,(y / w_j) \tag{2.41}$$

$$w_j / y = \alpha_j + \beta_j \ln y + \eta_j \qquad \varepsilon_j = 1 + \beta_j\,(y / w_j) \tag{2.42}$$

$$w_j / y = \alpha_j - \beta_j\, 1/ y + \eta_j \qquad \varepsilon_j = \alpha_j\,(y / w_j) \tag{2.43}$$

2.4.2 Complete Demand Systems

Demand functions that constitute a complete demand system specify the allocation of total expenditures among all goods contained in a consumer's budget set. The following section presents a description of the selected demand systems including the Rotterdam System, the Linear Expenditure System (LES), the Indirect Translog System (ITS) and the Almost Ideal Demand System (AIDS). It is shown how they are derived and in how far they are consistent with theoretical conditions.

2.4.2.1 The Linear Expenditure System (LES)

In an effort to begin with as simple expenditure model, the Linear Expenditure system was developed by Stone in 1954 (Stone, 1954, pp. 511-527); for other applications, see, e.g., Deaton and Muellbauer, 1980a, pp. 64-67; Houthakker, 1985, pp. 15-16; Goldberger, 1987, pp. 43-68; Rauniker and Huang, 1987, pp. 92-96; and Selvanathan and Clements, 1995, pp. 9-11 and 33-34). The LES is derived from the Stone-Geary utility function, which has previously been considered by Klein-Rubin (1948). The Stone-Geary utility function is given as:

$$\bar{u} = \prod (q_k - \gamma_k)^{\beta_k} \tag{2.44}$$

This equation is frequently transformed to its monotone transform

$$\ln \bar{u} = \sum_{k=1}^{n} \beta_k \ln (q_k - \gamma_k) \tag{2.45}$$

where β_k and γ_k are parameters.

The adding-up property can be imposed by the following parameter restrictions as:

$$\sum_{k=1}^{n} \beta_k = 1 \quad 0 < \beta_k < 1 \tag{2.46}$$

The coefficient β_k that is interpreted as the marginal share in the Stone-Geary function must be positive, indicating that the LES does not allow for inferior goods. Also γ_k must be smaller than the corresponding q_k, since the marginal utility for each good $\beta_k (q_k - \gamma_k)$ must be positive.

The above utility function is strongly separable or additive indicating that the total expenditure of several goods is the sum of the individual expenditures for these goods. In addition, the marginal utility of each good i $\ln \partial u / \partial q_i = \beta_i / (q_i - \gamma_i)$ is independent of the level of consumption of all other goods.

Subject to the restriction of a linear budget constraint, maximising the Stone-Geary utility function yields the expenditure on good i as

$$p_i q_i = p_i \gamma_i + \beta_i \left(x - \sum_{k=1}^{n} p_k \gamma_k \right) \quad \forall i = 1, ..., n \tag{2.47}$$

and this leads to the demand functions

$$q_i = \gamma_i + \left(\frac{\beta_i}{p_i} \right) \left(x - \sum_{k=1}^{n} p_k \gamma_k \right). \tag{2.48}$$

If all γ_i are positive, the expenditure function on good i is interpreted as follows: the consumer purchases first the quantity γ_i at a cost of $p_i \gamma_i$ for good i representing the level of subsistence consumption of good i . The total subsistence consumption of all goods is $\sum_{k=1}^{n} p_k \gamma_k$, leaving a residual "supernumerary expenditure" $x - \sum_{k=1}^{n} p_k \gamma_k$, which is allocated between the goods in the fixed proportions β_i.

The cost function for the above equation is

$$c(u, \mathbf{p}) = \sum_{k=1}^{n} p_k \gamma_k + u \prod p_k^{\beta_k} \tag{2.49}$$

The cost function is concave if all β_i are non-negative and x is no less than $\sum_{k=1}^{n} p_k \gamma_k$ (or $x \geq \sum_{k=1}^{n} p_k \gamma_k$), so that $q_i \geq \gamma_i$ for all i. If the cost function is not concave, the LES is not consistent with utility maximising behaviour.

The features of the LES can be summarised as follows:

- This system satisfies the properties of demand functions: the adding-up, homogeneity, and Slutsky symmetry restrictions.
- Although the LES is linear in the variables, it is not linear in the parameters β_i and γ_i , thus, the LES cannot be complemented using linear estimation methods.
- The coefficients β_k are assumed to be positive $(0 < \beta_k < 1)$ indicating that the LES does not allow for the description of demand for inferior goods.
- The expenditure elasticity of good i is defined as $\varepsilon_i = \beta_i / w_i$
- The property of a strongly separable utility function implies that no two goods may be substitutes. This is only justifiable for large aggregates of goods.
- The additive utility function implies a proportional relationship between the price and expenditure elasticities, but this restrictive assumption cannot be justified.
- In some empirical applications, for positive γ_i, the own-price elasticities $(\varepsilon_{ii} = -1 + (1 - \beta_i)\, \gamma_i / q_i)$ of all goods range between zero and minus one, indicating that under LES all goods are price-inelastic, and all cross-price elasticities $\varepsilon_{ij} = -\beta_i\, (p_j\, \gamma_j / p_i\, q_i)$ are negative, meaning that all pairs of goods are complements.
- The compensated own-price elasticities $\varepsilon^*_{ii} = \varepsilon_{ii} + \beta_i$ are positive, also the cross-price elasticities $\varepsilon^*_{ij} = \varepsilon_{ij} + \beta_i\, (p_j\, q_j / p_i\, q_i)$ are positive, indicating that every good must be a substitute for every other good and no two goods may be complements.

2.4.2.2 The Rotterdam System

The Rotterdam system was introduced by Theil (1965) and Barten (1966). It is similar to Stone's LES system (1954), but it works in differentials instead of levels of logarithms (Theil, 1975, pp. 67-87; Deaton and Muellbauer, 1980, pp. 67-74; Philips, 1983, pp. 122-127; Johnson *et al.*, 1984, pp. 68-72; and Peterson and Cotterill, 1998, pp. 6-8):

The demand function results as:

$$d \ln q_i = \varepsilon_i\, d \ln x + \sum_{j=1}^{n} \varepsilon_{ij}\, d \ln p_j \qquad (2.50)$$

where ε_i is the expenditure elasticity of demand for good i. And ε_{ij} is the cross-price elasticity (the elasticity of demand for good i with respect to changes in the price of good j.

Compensated cross-price elasticities ε_{ij}^* can be written as $\varepsilon_{ij}^* = \varepsilon_{ij} - \varepsilon_i\, w_j$ (Slutsky decomposition), so that:

$$d \ln q_i = \varepsilon_i \left(d \ln x - \sum_{j=1}^{n} w_j \, d \ln p_j \right) + \sum_{j=1}^{n} \varepsilon_{ij}^* \, d \ln p_j \qquad (2.51)$$

Multiplying by the budget share yields

$$w_i \, d \ln q_i = b_i \, d \ln \bar{x} + \sum_{j=1}^{n} c_{ij} \, d \ln p_j \qquad (2.52)$$

with

$$d \ln \bar{x} = d \ln x - \sum_{j=1}^{n} w_j \, d \ln p_j = \sum_{j=1}^{n} w_j \, d \ln q_j \qquad (2.53)$$

where the second equality follows from the budget constraint.

The variable b_i is the marginal propensity to spend on good i, and

c_{ij} is the compensated cross-price elasticity weighted by the budget share

such that

$$b_i = w_i \, \varepsilon_i = p_i \frac{\partial q_i}{\partial x} \qquad (2.54)$$

$$c_{ij} = w_i \, \varepsilon_{ij}^* = \frac{p_i \, p_j \, s_{ij}}{x} \qquad (2.55)$$

where s_{ij} is the i, j the term of the Slutsky substitution matrix.

Theoretical consistency

The parameters of the Rotterdam system can easily be related to the theoretical restrictions. *Adding-up* requires that the marginal propensities to spend on all goods k add up to unity and that the net effect of a price change on the budget equals zero;

$$\sum_k b_k = 1 \quad \text{and} \quad \sum_k c_{kj} = 0 \qquad (2.56)$$

Homogeneity will be satisfied for all goods if

$$\sum_k c_{jk} = 0 \qquad (2.57)$$

Symmetry requires that the matrix of the coefficients c_{ij} is symmetric; that is, for all i and j:

$$c_{ij} = c_{ji} \tag{2.58}$$

Negativity: the substitution matrix will be negative semi-definite if and only if the Slutsky matrix is also negative semi-definite.

The Rotterdam System is linear in its parameters and not complex to estimate, but the model is not derived from any explicit utility or cost function. Income elasticities can be calculated using the marginal budget shares b_i (2.54) and the budget share w_i (2.55), allowing for a conclusion on whether a good is a necessity or a luxury. All complementary or substitutive relations between goods can be described.

2.4.2.3 The Indirect Translog System

The indirect translog system was introduced by Christensen, Jorgenson, and Lau (1975). It is derived from a flexible indirect utility function by taking a logarithmic second-order Taylor series approximation[6]. The indirect utility function is written as:

$$\ln v = f(\ln p_1, \ln p_2, ..., \ln p_n, \ln x) \tag{2.59}$$

Approximating the logarithm of the indirect utility function by a quadratic function in the logarithms of the ratios of prices and total expenditure yields the translog utility function:

$$\ln v = \alpha_0 + \sum_{i=1}^{n} \gamma_i \ln\left(\frac{p_i}{x}\right) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \beta_{ij} \ln\left(\frac{p_i}{x}\right)\ln\left(\frac{p_j}{x}\right) \tag{2.60}$$

α_0, γ_i and β_{ij} are the parameters to be estimated under the restrictions implied by symmetry $\beta_{ij} = \beta_{ji}$. The imposition of homogeneity and symmetry leaves a total of $\frac{1}{2}(n+1)(n+2)$ independent parameters to be estimated.

Applying Roy's identity leads to the following system of demand equations in budget share form:

$$-\frac{\partial \ln u / \partial \ln p_j}{\partial \ln u / \partial \ln x} = \frac{p_j q_j}{x} = w_j \frac{\gamma_j + \sum_{i=1}^{n} \beta_{ji} \ln\left(\frac{p_i}{x}\right)}{\sum_{k=1}^{n} \gamma_k + \sum_{k=1}^{n}\sum_{i=1}^{n} \beta_{ki} \ln\left(\frac{p_i}{x}\right)} \tag{2.61}$$

To insure that the indirect utility function is non-decreasing in expenditures, the following normalization is needed:

[6] A full mathematical treatment appears in several works, see, e.g., Christensen, Jorgenson, and Lau, 1975, pp. 367-383 and Selvanathan and Clements, 1995, pp. 36-39.

$$\sum_{j=1}^{n}\gamma_j=-1 \tag{2.62}$$

and in addition,

$$\sum_{j=1}^{n}\sum_{k=1}^{n}\beta_{jk}=0 \tag{2.63}$$

The translog utility functions yields demand functions that are highly non-linear. As noted above, a large number of independent parameters need to be estimated. The demand system becomes very complex if many goods are included in one system causing difficulties in the estimation. In addition, the translog system is non-linear in its parameters, thus this may also yield problems in empirical estimation.

All complementary or substitutive relations between goods can be depicted. It is also possible to describe demand for inferior, necessary, and luxury goods.

2.4.2.4 The Almost Ideal Demand System (AIDS)

The AIDS was introduced by Deaton and Muellbauer (1980b). It is derived from a flexible expenditure function that is extremely useful for estimating a demand system with many desirable properties. The AIDS model automatically satisfies the aggregation restriction and with simple parametric restrictions, homogeneity and symmetry can be imposed. In addition, the AIDS has the ability to depict non-linear Engel curves. It has a functional form that is consistent with known household-budget data. Owing to its simplicity, the linear approximate almost ideal demand system (LA/AIDS) is popular for empirical studies (Deaton and Muellbauer, 1980a and 1980b, pp. 75-78 and pp. 312-326, respectively; Philips, 1983, pp. 136-138; Alston, 1990 and 1994, pp. 442-445 and pp. 351-356, respectively; and Peterson and Cotterill, 1998, pp. 3-5).

The AIDS is derived from the cost function of the form:

$$\ln c(u,\mathbf{p})=a(\mathbf{p})+u\,b(\mathbf{p}) \tag{2.64}$$

$a(p)$ and $b(p)$ are functions of prices such that

$$a(p)=\alpha_0+\sum_{k=1}^{n}\alpha_k\ln p_k+\frac{1}{2}\sum_{k=1}^{n}\sum_{i=1}^{n}\gamma_{ki}^{*}\ln p_k\ln p_i \quad \text{and;} \tag{2.65}$$

$$b(p)=\beta_0\prod_{k=1}^{n}p_k^{\beta k} \tag{2.66}$$

α_k, β_k, and γ_{ki}^{*} are the parameters to be estimated. The expenditure function takes the form

$$\ln c(u,\mathbf{p}) = \alpha_0 \sum_{k=1}^{n} \alpha_k \ln p_k + \frac{1}{2}\sum_{k=1}^{n}\sum_{i=1}^{n} \gamma_{ki}^{*} \ln p_k \ln p_i + u\,\beta_0 \prod_{k=1}^{n} p_k^{\beta k} \tag{2.67}$$

Applying Shephard's Lemma results in the Hicksian demand functions. Inverting the cost function yields the indirect utility function, describing the utility level u depending on prices and total expenditure. Substituting the indirect utility function into the Hicksian demand functions leads to the Marshallian demand functions in budget share form; these are the AIDS demand functions:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln(x/P) \tag{2.68}$$

where α_i, β_i , and γ_{ij} are the parameters that need to be estimated. w_i is the budget share of good i , p_j is the price of good j and x is the total expenditure. P is the aggregate price index that is defined by

$$\ln P = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \ln p_i \ln p_j \tag{2.69}$$

where $\gamma_{ij} = \frac{1}{2}(\gamma_{ij}^{*} + \gamma_{ji}^{*}) = \gamma_{ji}$ for any two goods i and j. (2.70)

α_0 and α_i are the parameters to be estimated.

Simplicity of estimation

By using the above price index (2.69), the relationship between the price index and the prices of foods is non-linear, which results in a complicated non-linear system. To linearise the relationship, Deaton and Muellbauer (1980b) suggested replacing the price index (P) with Stone's price index (P^*) of the form:

$$\ln P^* = \sum_j w_j \ln P_j \tag{2.71}$$

The model that uses Stone's price index is called the linear approximate AIDS "LA/AIDS". Its estimation is much simpler because linear estimation procedures can be used[7].

Theoretical Consistency*:*

The following restrictions can be imposed on the parameters in the AIDS model:

Adding-up implies the following parameter restrictions

$$\sum_{i=1}^{n} \alpha_i = 1 \qquad \sum_{i=1}^{n} \beta_i = 0 \qquad \sum_{i=1}^{n} \gamma_{ij} = 0 \tag{2.72}$$

[7] For a discussion on the relationship between the Almost Ideal Demand System and its linear approximation, see Alston *et al.* (1994) and Green and Alston (1990, 1991).

Homogeneity requires that, $\sum_{i=1}^{n} \gamma_{ij} = 0$ (2.73)

Symmetry is satisfied if $\gamma_{ij} = \gamma_{ji}$ for any two goods i and j. (2.74)

Negativity is not automatically introduced, but by estimating all the compensated own-price elasticities one can test for their negativity.

The β_i parameter of the AIDS determines the effect of a change in real expenditure on the budget share of good i and whether this good is a luxury, a necessity or an inferior good. For a luxury $\beta_i > 0$ and the expenditure elasticity is larger than unity $(\varepsilon_i > 1)$, and w_i increases with rising total expenditure (x). For a necessary good, $\beta_i < 0$ and the expenditure elasticity lies between zero and unity $(0 < \varepsilon_i < 1)$. w_i decreases with increasing x. And, for an inferior good $\beta_i < -1$ and the expenditure elasticity is smaller than zero $(\varepsilon_i < 0)$.

In addition, it is possible to examine all complementary and substitutive relations between pairs of goods by estimating the compensated price elasticities.

2.4.3 The Choice of a Specific Demand System for the Empirical Study

The previous section presented a number of different complete demand systems developed in the economic literature. According to the comparative assessment of the selected demand systems, the LES does not describe consumer demand behaviour according to Engel's law. Inferior goods tend to become luxuries with increasing expenditures, which is not plausible. Thus, the LES is not appropriate for an analysis of food demand. The Rotterdam system is not consistent with utility maximising behaviour even if it is flexible and corresponds to generally accepted empirical facts (such as the description of demand for inferior, necessary, and luxury goods, and the complementary and substitutive relations between pairs of goods). The theoretical properties of demand functions can be imposed by parameters restrictions given by the Indirect Translog System and the AIDS, and these two systems are derived from a flexible functional form that depicts generally accepted empirical facts. However, the Indirect Translog System has a relatively high number of independent parameters to be estimated and this may cause difficulties in the estimation. The LA/AIDS demand functions are linear in parameters and its estimation is much simpler. Therefore, the LA/AIDS has been chosen as the basic model for the empirical application of this study.

CHAPTER 3

THE DEVELOPMENT OF THE FOOD SITUATION IN EGYPT

3.1 Introduction

Agriculture is central to the welfare of any country. Improved agricultural growth has the potential to play an important role in most developing countries. It does so by increasing foreign exchange earnings through export of high-value agricultural products, reducing the burden of importing food, and generating employment through direct and indirect effects.

The Government of Egypt places great importance on the agricultural sector. Agriculture, especially its food sub-sector, still has an important role in the national economy by enhancing the needs of the increasing population. It accounts for 16.7 % of Egypt's GDP and almost 29.11 % of the labour force in 2000 (CBE). Agriculture provides the domestic industry with agricultural raw materials and promotes industrial development through expanding the market for industrial goods such as chemical fertilizers and pesticides. It also helps in financing economic and social development through the net capital outflow from agriculture to other sectors in the economy.

Egypt's Government interventions in the agricultural sector have important implications at the micro level, such as nutritional and real income effects, and at the macro level, such as employment effects and foreign exchange impacts. The Egyptian economy was subject to a structural adjustment and liberalisation programme in 1987. The political change process can be divided into before and after liberalisation as follows (MALR, 2002):

- Before the reform (-1986): During the sixties and seventies, agricultural policy favoured an increasing contribution of agriculture to financing industrial sector, and supporting other sectors of the national economy. This period was characterised by heavy government interventions in production, trade, and prices, with the aim of mobilising surpluses into other sectors of the national economy.
- After the reform (1987-): In the year 1987, the Government of Egypt had taken different measures in the agricultural sector, with respect to price, marketing and delivering quota for main crops, reducing subsidies on inputs and encouraging private sector investments. The reform included several phases:

The first phase of agricultural policy reform (1987-89): The Government of Egypt began to promote the long-term goals of reform in the agricultural sector and strengthen market-based incentives. Agricultural markets and cropping patterns were liberalised, except for those of cotton, rice, and sugarcane. During this period, the Government retained its control over cotton and sugarcane production and marketing, but rice was partially liberalised by reducing the size of the compulsory delivery quota and by allowing rice producers to sell more of their output to private dealers.

The second phase of agricultural reform policy (1990-95): Egypt's Government used privatisation as a tool of resource reallocation to achieve the goal of economic efficiency. Rice production and marketing were liberalised, but the cotton market was only liberalised by permitting private sector traders to buy seed cotton from farmers and sell lint cotton to textile holding companies.

The third phase of the reform (1996-99): The Government of Egypt continued its policy reform program covering five policy areas. These are: 1) price, markets, and trade; 2) private investment and privatisation in agribusiness; 3) agricultural land and water resource investment in utilisation and sustainability; 4) agricultural sector support services; and 5) food security and poverty alleviation.

The fourth phase of the reform (2000-02): Egypt's Government continued its reform program, focusing on three policy areas: 1) agricultural land and water resource investment in utilisation and sustainability; 2) agricultural sector support services; and 3) food security and poverty alleviation. In this phase the program helped in improving policies for food security in Egypt.

This chapter analyses the food security situation in Egypt over time. It is based on data from the Ministry of Agriculture and Land Reclamation (MALR), the Economic Affairs Sector, the General Department of Agricultural Statistics, and data from the Consumption Bulletin conducted by CAPMAS. Simple linear trend analysis is used to estimate growth rates for cultivated area, yield, production, and consumption for major food crops. The decomposition analysis is used to estimate the components of production and consumption changes. By using adjusted coefficients of variation, as proposed by Cuddy-Della Valle (1978), the instability in agricultural production and consumption for major food commodities is measured.

This chapter is divided into two sections. Section 3.2 looks at the development of food production during two periods. The period from 1980 to 2000 is divided into two periods as a result of policy change (SAP), namely, period I from 1980 to 1986 and period II from

1987 to 2000. These may also called before and after the agricultural liberalisation reform periods. Section 3.3 looks at the development of food consumption during the two periods.

3.2 Development of Food Production

This section includes three parts. In part 3.2.1, compound growth rates for cultivated area, yield, and production for major food crops during the two periods are presented in Tables 3.1, 3.2, and 3.3, respectively. In part 3.2.2, average change in production for these food crops between the two periods has been decomposed into different components to study the contribution of area, yield, and interaction between changes in area and yield towards this change in production (Table 3.4). In part 3.2.3, instability in agricultural production is measured in terms of variability of production in important crops by using adjusted coefficient of variation for production (Table 3.5).

3.2.1 Growth Performance of Egyptian Agriculture

Wheat

Cultivated area under wheat crop declined during period I by an annual 1.31 %. However, in period II, it grew at a significant annual rate of 3.59 %. Yield recorded highly significant growth rates of 4.52 % and 2.19 % during period I and period II, respectively. Under the combined effect of cultivated area and yield, the growth rate of production showed a significant increase in period II, where it grew by 5.97 %, while it remained stagnant in period I. Although the growth rate in yield was significant in period I, it could not offset the declining trend of area which resulted in stagnancy of production during this period.

Maize

During period I, cultivated area under this crop declined by an annual 1.86 %, but its yield grew at a significant rate of 2.19 %. The combined effect of area and yield resulted in stagnancy of production. The cultivated area remained stagnant during period II, while yield grew at a significant rate of 3.35 %. Under the rising impact of yield, the production registered a significant growth rate of 2.75 %. It is observed that yield was the main component in growth of maize production during period II.

Table 3.1 Growth Rate of Cultivated Area for Major Food Crops in Egypt, 1980-2000

Commodity	1980-1986					1987-2000				
	Constant	b	R^2	F	Growth rate	Constant	b	R^2	F	Growth rate
Wheat	1,368.33***	-16.96	0.19	1.38	-1.31	1,623.05***	77.81***	0.74	30.69***	3.59
Maize	2,018.45***	-34.66	0.28	2.32	-1.86	2,001.40***	0.69	0.01	0.03	0.03
Rice	983.46***	0.04	0.00	0.00	0.01	892.71***	54.41***	0.82	50.33***	4.27
Potatoes	146.81***	3.59	0.27	2.22	2.20	189.16***	1.84	0.02	0.24	0.91
Broad bean	244.75***	5.56**	0.51	6.15**	2.06	333.10***	-1.02	0.01	0.11	-0.31
Lentils	9.75***	1.61***	0.80	24.02***	9.46	21.05***	-1.17***	0.74	30.95***	-9.07
Garlic	13.64***	-0.18	0.02	0.10	-1.40	11.15***	0.95***	0.46	9.48***	5.33
Onions	47.47***	-1.22	0.35	3.22	-2.91	31.16***	3.41***	0.67	22.43***	6.19
Tomatoes	297.21***	10.71**	0.62	9.97**	3.09	352.21***	5.71*	0.28	4.24*	1.46
Squash	57.25***	0.31	0.10	0.67	0.53	39.69***	3.75***	0.85	60.19***	5.69
Eggplant	28.90***	1.33	0.29	2.50	3.81	29.65***	3.58***	0.86	68.31***	6.55
Cucumber	45.51***	-0.36	0.29	2.42	-0.82	31.27***	2.12***	0.84	56.59***	4.60
Citrus	145.40***	6.48***	0.95	108.97***	3.71	204.73***	10.75***	0.90	103.35***	3.84
Dates	4,540.61***	209.71**	0.65	11.20**	3.82	5,473.72***	260.64***	0.86	68.84***	3.57
Grapes	35.83***	4.58***	0.87	41.17***	8.12	79.31***	4.24***	0.81	48.13***	3.89
Banana	9.91***	1.61***	0.94	85.68***	9.39	27.36***	1.25***	0.78	38.94***	3.46

Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.

*** Indicates significant at one percent level of significance.

** Indicates significant at five percent level of significance.

* Indicates significant at ten percent level of significance.

Table 3.2 Growth Rate of Yield for Major Food Crops in Egypt, 1980-2000

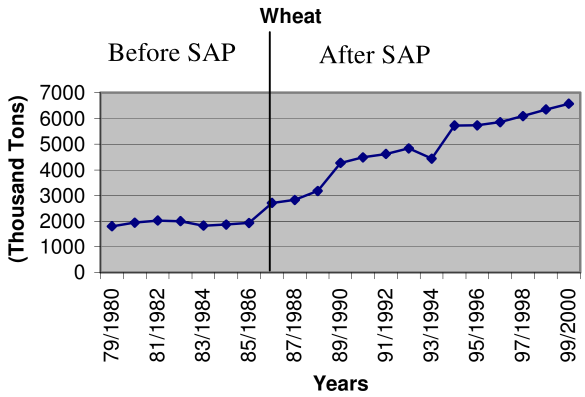
Commodity	1980-1986					1987-2000				
	Constant	b	R^2	F	Growth rate	Constant	b	R^2	F	Growth rate
Wheat	1.24***	0.07***	0.77	19.57***	4.52	1.91***	0.05***	0.85	61.59***	2.19
Maize	1.63***	0.04***	0.94	87.09***	2.19	2.04***	0.09***	0.92	123.55***	3.35
Rice	2.37***	0.01	0.07	0.42	0.33	2.65***	0.09***	0.94	170.33***	2.73
Potatoes	6.92***	0.26***	0.87	38.93***	3.21	8.44***	0.07	0.19	2.60	0.78
Broad bean	0.83***	0.04***	0.91	57.77***	4.04	0.97***	0.02	0.12	1.53	1.79
Lentils	0.34***	0.05***	0.94	99.11***	8.79	0.78***	-0.01	0.18	2.49	-1.25
Garlic	7.53***	0.13***	0.80	24.67***	1.60	8.62***	0.18***	0.86	64.86***	1.82
Onions	8.35***	-0.06	0.09	0.61	-0.74	9.02***	0.04	0.08	0.91	0.43
Tomatoes	6.24***	0.71***	0.97	181.98***	7.54	10.35***	0.38***	0.73	30.26***	2.92
Squash	8.26***	-0.06	0.15	1.08	-0.75	7.35***	-0.01	0.01	0.10	-0.08
Eggplant	8.60***	0.06	0.03	0.18	0.68	8.92***	0.02	0.06	0.64	0.22
Cucumber	6.20***	0.17***	0.78	21.25***	2.45	6.87***	0.08**	0.36	6.05**	1.08
Citrus	6.58***	0.25***	0.81	26.08***	3.25	8.91***	-0.15**	0.39	7.16**	-1.91
Dates	86.29***	-0.07	0.00	0.01	-0.08	85.67***	1.30***	0.76	34.93***	1.37
Grapes	6.55***	0.01	0.01	0.01	0.06	6.10***	0.13**	0.42	7.96**	1.86
Banana	10.67***	0.09	0.20	1.47	0.81	10.84***	0.45***	0.91	106.35***	3.22

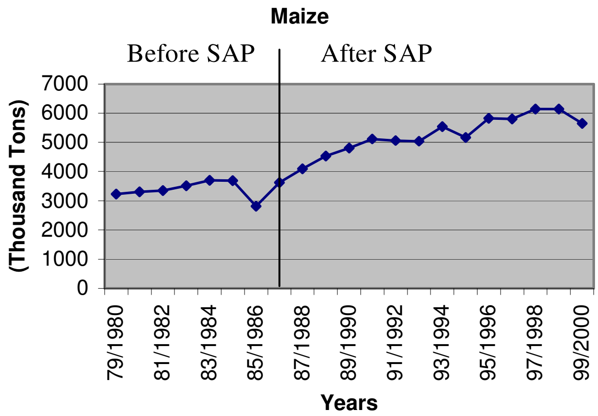
Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.
*** Indicates significant at one percent level of significance.
** Indicates significant at five percent level of significance.
* Indicates significant at ten percent level of significance.

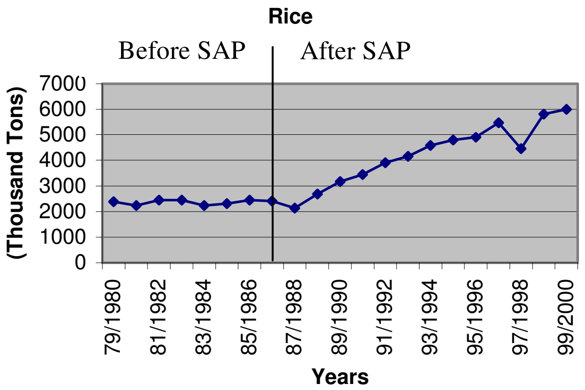
Table 3.3 Growth Rate of Production for Major Food Crops in Egypt, 1980-2000

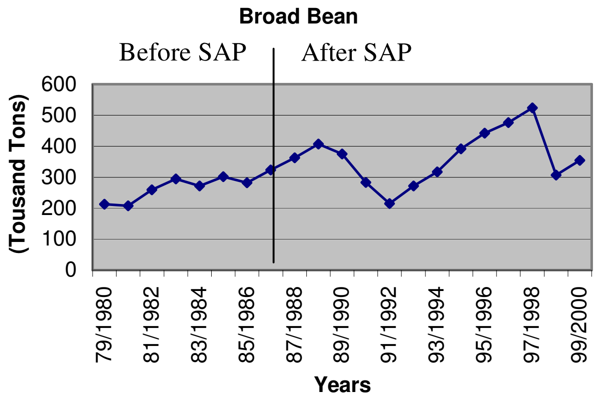
Commodity	1980-1986					1987-2000				
	Constant	b	R^2	F	Growth rate	Constant	b	R^2	F	Growth rate
Wheat	1,699.28***	69.21	0.32	2.88	3.44	2,971.19***	289.51***	0.92	134.43***	5.79
Maize	3,324.64***	16.92	0.02	0.12	0.50	4,282.52***	145.89***	0.84	56.18***	2.75
Rice	2,330.51***	7.15	0.04	0.24	0.30	2,241.30***	289.92***	0.91	112.08***	6.79
Potatoes	987.75***	74.58**	0.61	9.47**	5.63	1,602.79***	29.02	0.07	0.78	1.61
Broad bean	202.23***	14.88***	0.78	21.60***	5.53	317.54***	6.57	0.09	1.06	1.81
Lentils	1.84***	1.84***	0.88	45.64***	18.20	15.72***	-0.94***	0.84	56.66***	-10.30
Onions	360.59***	-4.70	0.10	0.59	-1.38	241.11***	44.58***	0.78	38.10***	8.06
Garlic	112.77***	-1.77	0.02	0.12	-1.69	101.04***	9.34***	0.45	8.98***	5.61
Tomatoes	1,687.20***	358.00***	0.88	42.17***	10.85	3,493.60***	230.82***	0.90	97.45***	4.52
Squash	443.83***	3.90	0.18	1.27	0.85	290.73***	27.36***	0.79	41.99***	5.67
Eggplant	243.22***	15.58	0.23	1.79	4.97	258.20***	34.35***	0.80	44.16***	6.89
Cucumber	282.52***	4.91*	0.42	4.40*	1.61	207.48***	19.69***	0.79	42.37***	5.70
Citrus	931.28***	92.98***	0.93	79.53***	6.89	1,868.34***	43.53**	0.40	7.19**	2.00
Dates	388.99***	17.54***	0.71	14.90***	3.75	448.68***	35.27***	0.89	89.39***	5.07
Grapes	234.53***	30.12***	0.90	55.62***	8.14	453.65***	44.80***	0.90	98.80***	5.84
Banana	100.21***	19.55***	0.93	79.60***	10.39	271.49***	34.42***	0.90	100.72***	6.72
Red meat	250.50***	28.19***	0.92	69.18***	7.47	500.26***	9.94	0.22	3.08	1.74
Poultry	21.08	28.57***	0.85	33.36***	19.09	374.90***	18.87**	0.41	7.77**	3.72
Fish	122.41***	9.80**	0.57	7.97**	5.88	194.66***	23.95***	0.80	38.82***	6.61
Milk	1,864.36***	35.31***	0.97	193.29***	1.75	1,513.81***	142.32***	0.45	9.00***	5.67
Eggs	77.61***	14.2***	0.96	135.53***	10.03	183.24***	-2.97	0.16	2.13	-1.83
Sugar	538.14***	33.27***	0.78	20.99***	4.84	741.61***	18.83	0.04	0.50	2.16
Oils & Fats	346.32***	-6.57	0.21	1.80	-2.07	270.89***	19.65***	0.43	8.45***	4.81

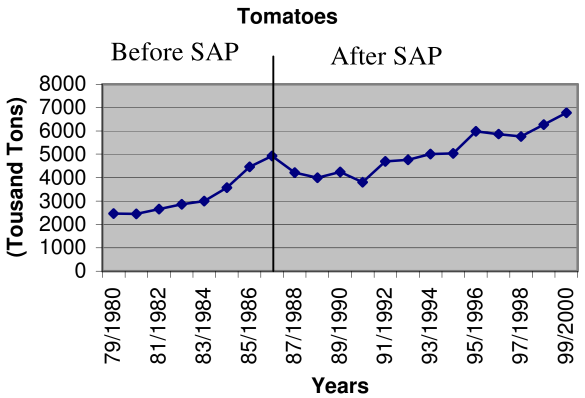
Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.
*** Indicates significant at one percent level of significance.
** Indicates significant at five percent level of significance.
* Indicates significant at ten percent level of significance.

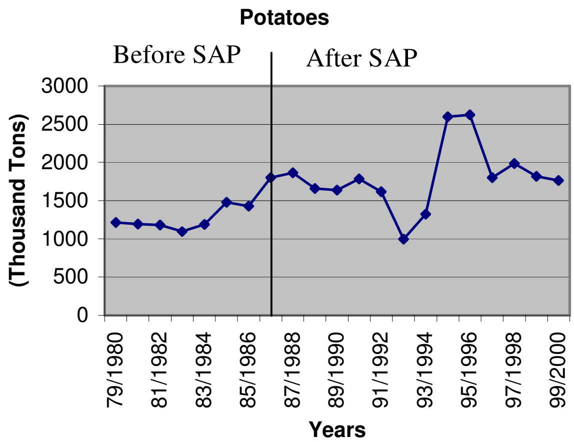

Wheat
Before SAP
After SAP
(Thousand Tons)
7000
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Maize
Before SAP
After SAP
(Thousand Tons)
7000
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years

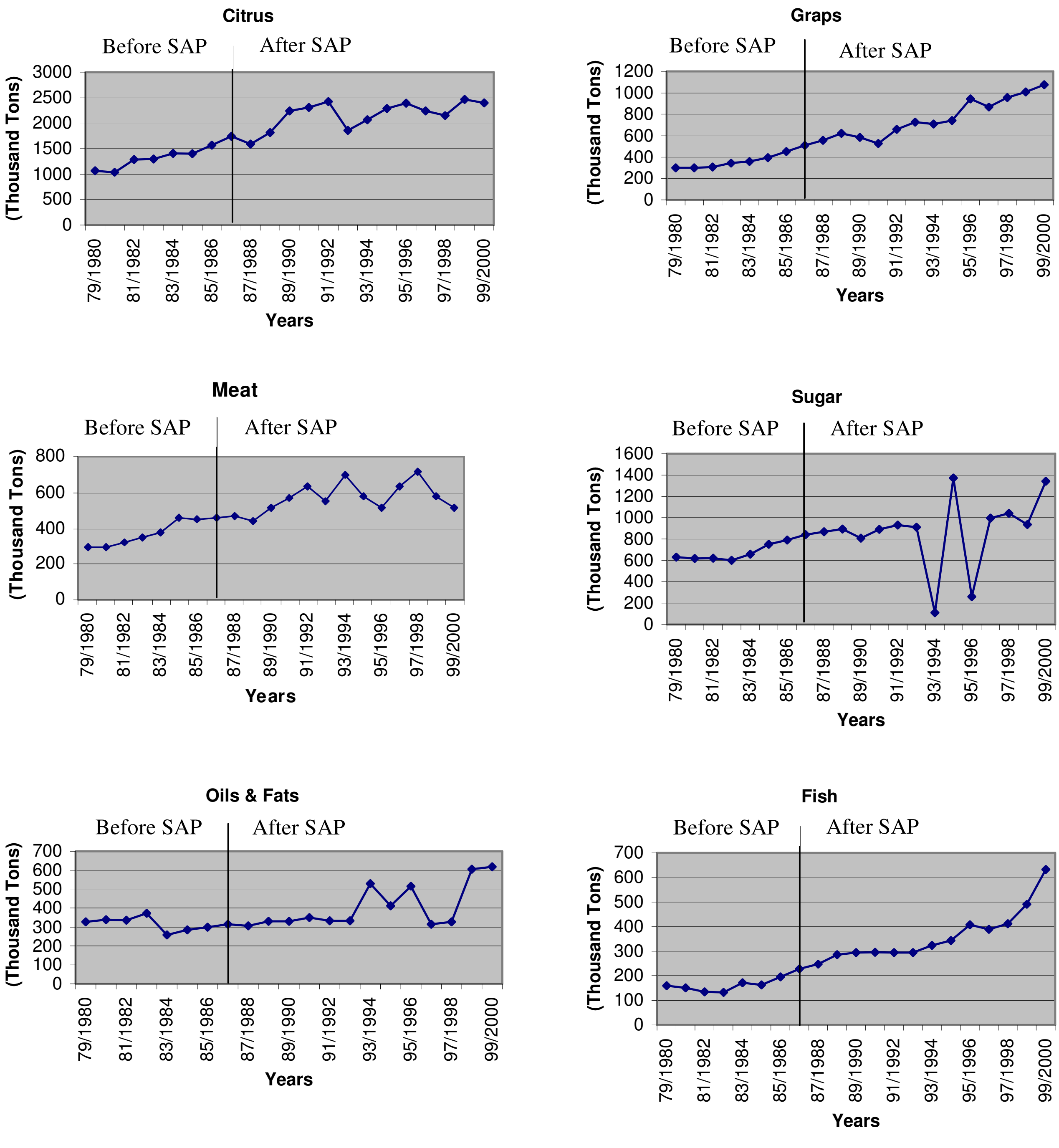

Rice
Before SAP
After SAP
(Thousand Tons)
7000
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Broad Bean
Before SAP
After SAP
(Tousand Tons)
600
500
400
300
200
100
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Tomatoes
Before SAP
After SAP
(Tousand Tons)
8000
7000
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Potatoes
Before SAP
After SAP
(Thousand Tons)
3000
2500
2000
1500
1000
500
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years

Continued Figure 3.1



Source: CAPMAS and MALR, Various Issues.

Figure 3.1 Trends in Production for Major Food Crops

Rice

Cultivated area under this crop showed a stagnant position during period I, its yield also remained stagnant resulting in stagnancy in rice production. During period II, the cultivated area was highly significant with an annual growth rate of 4.27 %. Under the impact of modern technology and agricultural reform policy, yield of this crop recorded a significant annual growth rate of 2.73 %. Resulting from the combined effect of both the forces, the production also grew at a significant annual rate of 6.79 %. Although area and yield contributed significantly to an increase in production levels in period II, they resulted in stagnancy in rice production in period I.

Potatoes

In both periods cultivated area under potatoes remained stagnant. During period I, yield grew at a significant annual rate of 3.21 % and production also showed a significant annual growth rate of 5.63 % where the yield contributed significantly to an increase of the production level in this period offsetting the stagnancy trend of area. During period II, production of potatoes remained stagnant; it may be due to the fact that productivity was lowest and cultivated area remained stagnant.

Tomatoes

During period I, cultivated area under tomatoes grew at a significant annual rate of 3.09 %; its yield also registered a significant annual growth at 7.54 %. Resulting from the impact of high-yielding varieties area and yield, production recorded a significant annual growth rate of 10.85 % during this period. During period II, a similar trend has been observed; the area under this crop grew at a significant annual rate of 1.46 %. Its yield also increased recording a significant annual growth rate at 2.92 %. Under the combined effect of area and yield, the annual growth rate of production showed a significant increase at 4.52 % where the yield contributed more than the area to growth in tomatoes production.

Broad Bean

Cultivated area under this crop grew at a significant annual rate of 2.06 % during period I. Its yield also recorded a significant annual rate of 4.04 %. Under the combined effect of high-yielding varieties of area and yield, the annual growth rate of production showed a significant increase at 5.53 %, yield contributed more than area in increasing production. The cultivated area under this crop showed a stagnant position during period II. Its yield also remained stagnant resulting in stagnancy in production.

Citrus

During period I, cultivated area under citrus crop grew at a significant annual rate of 3.71 %, the yield growth rate was also highly significant at 3.25 %. Under the combined effect of both forces, the annual growth rate of production showed a significant increase at 6.89 % during this period. It has been observed during period II, that the growth rate for the cultivated area under citrus was highly significant at 3.84 %, while its yield declined at a significant annual rate of 1.91 %. Under the combined effect of area and yield, the production of citrus grew at a significant annual rate of 2 %, where the annual growth rate in cultivated area could offset the declining trend of yield, which resulted in a significant annual growth in production during period II. The annual growth rate in citrus production in period I was much higher than in period II.

Grapes

For grapes, cultivated area under this crop grew at a significant annual rate of 8.12 % during period I, while its yield showed a stagnant position. Production of this crop registered a significant annual growth rate of 8.14 % resulting from the rising impact of cultivated area, which could offset the stagnancy effect of yield. During period II, cultivated area of grapes recorded a significant annual growth rate of 3.89 %; its yield also grew at a significant annual rate of 1.86 %. Under the impact of high-yielding varieties area and yield, the production recorded a significant annual growth rate of 5.84 %. The area under this crop was the main source of increase in the production during period I, while area and yield were the factors responsible for increase in the production during period II.

Red Meat

A simple linear trend shows that red meat production, during period I, increased by a significant annual growth rate of 7.47 %. The time trend variable is significant at the 0.01 probability level and it explains 92 % of the variation in production of this commodity. During period II, the results of the simple trend analysis show that the production of red meat increased at an annual growth rate of 1.74 %. The time trend variable is not significant. Only 22 % of the variation in the red meat production is explained by the time trend factor.

Sugar

An increasing trend has been observed for production of sugar during period I under consideration. It increased significantly at an annual growth rate of 4.84 %. The R^2 value shows that 78 % of the variation in the sugar production is explained by the time factor. During period II, the production of this food commodity also increased by an annual growth rate of 2.16 %. The time trend variable is not significant and explains only 4 % of the variation in production of this crop.

Oils & Fats

The results of simple linear trend show that the production of oils & fats declined by an annual rate of 2.07 % during period I, but the time trend variable is not significant. During period II, it increased significantly by an annual growth rate of 4.81 %. The time trend variable explains 43 % of the variation in oils & fats production.

Fish

Aquaculture has played an important role in improving the supplies of fish, rising from just 35,000 tons in 1992 (10 % of supplies) to 340,000 tons in 2000 (47 % of supplies to market) (MALR, 2001). A simple linear trend shows that fish production during period I increased by an annual growth rate of 5.88 %. The time trend variable is significant at the 0.05 probability level and it explains 57 % of the variation in fish production. During period II, production of fish increased by a significant annual growth rate of 6.61 %. And 80 % of the variation in fish production is explained by the time factor.

3.2.2 Decomposition of Changes in Crop Production

In this section, decomposition analysis is used to estimate the components of production changes. The change in mean production of different crops between two periods - before and after the reform - has been divided into three components; cultivated area, yield, and interactions changes. Thus, this section sheds light on the contribution of different components in the growth of production for different crops.

The analysis uses averages of production and cultivated area while it uses the weighted average of yield for each crop, to decompose the difference in the changes in mean production between the two periods of policy changes. Decomposition analysis is a mathematical method that disaggregates a difference in an observable quantitative variable into its components. This approach is applied for decomposing changes in the production into (1) changes due to the cultivated area effect (2) changes due to the yield effect, and (3) changes due to the interaction effect between area and yield.

Mean production for a crop can be expressed in two components as follows:

$$P = A.Y \tag{3.1}$$

where A denotes the cultivated area, Y is the yield, and P is the level of production. Using equation (3.1), a change in production between a base period P_0 and a comparison period P_1 is stated as:

$$\Delta P = P_1 - P_0 \quad (3.2)$$

$$= A_1 Y_1 - Y_0 A_0 \quad (3.3)$$

$$= A_1 Y_0 - A_0 Y_0 + Y_1 A_0 - Y_0 A_0 + A_1 Y_1 - A_0 Y_1 - A_1 Y_0 + A_0 Y_0 \quad (3.4)$$

$$= (A_1 - A_0) Y_0 + (Y_1 - Y_0) A_0 + (A_1 - A_0)(Y_1 - Y_0) \quad (3.5)$$

$$\Delta P = \Delta A . Y_0 + \Delta Y . A_0 + \Delta A . \Delta Y \quad (3.6)$$

where ΔP denotes the change in average production, ΔA presents the change in cultivated area, ΔY is the change in weighted average of the yield with the area.

The first term on the right hand side of equation (3.6), denotes the change in cultivated area with fixed yield (the cultivated area effect), the second term is the change in yield (the yield effect) with fixed area, and the third is the interaction of two sources. The values in Table 3.4 confirm the area effect, yield effect, and interaction effect for each food commodity.

Wheat

Table 3.4 presents the change in average production and the percentage contribution of different factors to this change. It would be seen from the Table that average production of wheat increased from 2,005.51 thousand tons in period I to 4,998.02 thousand tons in period II, with a percentage increase of 149.21 % between the two periods. The main contributor to this increase in wheat production was cultivated area, its share was 45.42 % and share of change in mean yield was 32.53 %. While change in area-yield interaction accounted for 22.05 % in the change. Thus, simultaneous movement of mean area and mean yield during period II had also contributed much to increasing wheat production.

Maize

Average production of this crop had increased by 58.85 % between the two periods. Mean yield was the main component to the change in average maize production in Egypt; it contributed 80 % towards the change in average production. While change in mean area accounted for only 13.11 % to the change in production between the two periods. Contribution of interaction between changes in mean area and mean yield ranked last in terms of contribution to the average change in production between the two periods, it had contributed to the extent of 6.22 %.

Table 3.4 Average Annual Crop Production and Components of Change in Production in Egypt in Period I (1980-1986) and Period II (1987-2000)

Crop	Average production (Thousand tons)		Component of change (in percent)			
	Period I	Period II	Change in mean area	Change in mean yield	Interaction between changes in mean area and mean yield	Total
Wheat	2,005.51	4,998.02 (149.21)*	45.42	32.53	22.05	100.00
Maize	3,401.23	5,402.72 (58.85)	13.11	80.66	6.22	100.00
Rice	2,362.46	4,270.63 (80.77)	36.49	49.05	14.46	100.00
Potatoes	1,323.78	1,805.13 (36.36)	65.93	27.48	6.59	100.00
Broad bean	269.07	363.53 (35.10)	59.37	33.62	7.01	100.00
Lentils	10.14	28.60 (2,155.08)	84.32	0.82	14.87	100.00
Garlic	104.82	166.40 (58.75)	65.81	24.68	9.52	100.00
Onions	339.45	553.17 (62.96)	49.51	38.48	12.01	100.00
Tomatoes	3,298.68	5,109.44 (54.89)	24.69	66.33	8.99	100.00
Squash	468.30	482.12 (2.95)	421.17	- 285.65	- 35.52	100.00
Eggplant	313.34	98.70 (59.16)	95.99	2.56	1.45	100.00
Cucumber	304.60	345.33 (13.37)	37.12	59.91	2.97	100.00
Citrus	1,349.72	2,173.02 (61.00)	99.05	0.59	0.36	100.00
Dates	469,439.75	696,465.99 (48.36)	68.39	23.75	7.86	100.00
Grapes	370.08	766.40 (107.09)	86.90	6.78	6.31	100.00
Banana	190.69	512.47 (168.74)	65.64	16.30	18.06	100.00

Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.

* Percentage Change in Production in parentheses.

Rice

Rice is one of the most important cereal crops in Egypt in period I and period II. Its average production increased from 2,362.46 thousand tons in period I to 4,270.63 thousand tons in period II. It increased by 80.77 % between the two periods. Change in mean yield had contributed more than the change in mean area towards increasing rice production in Egypt between the two periods. Yield accounted for 49.05 % while the increase in mean area had contributed to the extent of 36.49 % towards the production change over the two periods. Change in area-yield interaction accounted for 14.46 % in the change in production, this indicated that a simultaneous increase in mean area and mean yield had also contributed much to increasing rice production.

Potatoes

Production of potatoes is very high, as it is the most important root crop in Egypt. It increased from an average of 1,323.78 thousand tons in period I to an average of 1,805.13 thousand tons in period II, i.e., an increase of 36.36 %.

The change in mean area was the main component responsible for enhancing the average potato production in Egypt over the two periods. It contributed 65.93 % towards the change in production. In this analysis, the effect of yield was 27.48 %, it may be due to the fact that yield levels in this crop in period I were not very low as compared to period II. The interaction term contributed 6.59 % to the change in average production over the two periods.

Tomatoes

Tomatoes are the most important vegetable crops in Egypt, offering a high net return. The average production of tomatoes increased from 3,298.68 thousand tons in period I to 5,109.44 thousand tons in period II, with a percentage increase of 54.89 % between the two periods. Mean yield was the main factor of change in average tomato production. It contributed 66.33 % towards the increase in production, while change in mean area accounted for 24.69 % to the change in production between the two periods. Contribution of interaction changes in mean area and mean yield accounted for 8.99 % of the change.

Broad Bean

For this crop, average production between the two periods showed an increase of 35.10 %, it increased from 269.07 thousand tons in period I to 363.53 thousand tons in period II. The share of change in mean cultivated area in the increase in average production between the two periods was 59.37 %, while change in mean yield came to be 33.62 %. The interaction term between change in mean area and mean yield contributed 7.01 % towards change in average production between the two periods.

Citrus

Citrus are the most important fruit crops in Egypt, they are items exported. The production of citrus fruits registered a sharp rise between the two periods from 1,349.72 thousand tons in period I to 2,173.02 thousand tons in period II, i.e., an increase of 61 %. The dominant factor towards the increase in production was the change in average area of this crop between the two periods whose share in the total change was 99.05 %. Contribution of the change in mean yield registered only 0.59 % to the total change in production. The share of the change in interaction term between changes in mean area and mean yield is very small as compared to the area contribution and it was only 0.36 % to the increase in production.

Grapes

Average production of this crop doubled between the two periods in Egypt. It increased from 370.08 thousand tons in period I to 7,66.40 thousand tons in period II, with a percentage increase of 107.09. The contribution of change in mean area was more than the contribution made by the change in mean yield to the change in average production due to substantial increase in cultivated area of this crop between the two periods. Area contributed 86.90 % to the change while yield contribution was only 6.78 %. Change in interaction term helped to increase grape production; its contribution was 6.31 % towards change in production of this crop.

2.2.3 Instability Analysis of Crop Production

This section is to measure the extent of variability in the time series of production of different crops. The index of instability proposed by Cuddy-Della Valle (1978) has been selected, further on referred to as CD-Index. It is defined as follows (Cuddy and Della Valle, 1978, pp. 79-85):

$$I_X = CV \sqrt{1 - \overline{R}^2}$$

where I_X is the index of instability, CV is the coefficient of variation of the time series and $\overline{R}^2$ is the adjusted coefficient of determination of the linear trend function.

The index (I_X) has been calculated by selecting the trend function at a significant level of at least 5 %. When the trend function is not significant, the coefficient of variation (CV) is chosen.

The advantages of this index are derived from its combination of the coefficient of variation with the coefficient of determination to adjust the observations to the respective trend value. Otherwise the fluctuations around the trend line would easily be overestimated.

This index is computed to examine the magnitude of instabilities of selected food commodities. The analysis restricted to production variability in the two time periods, namely, 1980 to 1986 and 1987 to 2000. The time period from 1980 to 1986 referred to the pre-reform period and the period from 1987 to 2000 referred to post-reform period.

Table 3.5 Instability Indices of Production for Major Food Commodities in Egypt, 1980-2000

Commodity	1980-1986			1987-2000			Δ % In instability
	Mean	St. deviation	Instability indices (I_X)	Mean	St. deviation	Instability indices (I_X)	
Wheat	2,010.73	297.86	14.81	4,997.78	1,172.71	6.57	-55.64
Maize	3,400.76	297.96	8.97	5,303.77	621.31	4.92	-45.15
Rice	2,362.69	89.42	3.78	4,270.70	1,183.16	8.86	134.39
Potatoes	1,323.34	233.48	26.33	1,805.90	439,014.00	24.32	-7.63
Broad bean	269.17	41.19	7.65	363.56	86.32	23.74	210.33
Lentils	10.11	4.79	17.53	9.13	4.00	18.40	4.96
Onions	339.45	38.51	11.34	553.17	97.09	17.46	53.97
Garlic	104.82	30.75	29.34	166.40	54.24	25.10	-14.45
Tomatoes	3,298.21	937.23	10.52	5,109.37	948.31	6.12	-41.83
Squash	461.37	22.82	4.95	482.24	119.69	11.91	140.61
Eggplant	313.33	79.65	25.42	498.62	149.50	14.09	-44.57
Cucumber	304.63	18.49	6.07	345.29	86.05	11.71	92.92
Citrus	1,349.69	236.19	4.90	2,173.04	269.65	10.05	105.10
Dates	467.93	50.89	6.19	695.55	145.55	7.32	18.26
Grapes	370.05	77.65	6.92	767.22	183.91	7.90	14.16
Banana	188.18	49.66	7.39	512.44	141.18	9.09	23.00
Red meat	377.39	71.99	5.72	569.87	2.81	14.53	154.02
Poultry	149.65	76.02	21.34	506.98	114.23	18.02	-15.56
Fish	166.53	31.79	14.13	362.34	105.68	14.29	1.13
Milk	2,023.25	87.82	0.74	2,510.08	826.21	25.34	3,324.32
Eggs	141.50	35.54	5.53	162.44	28.76	17.70	220.07
Sugar	687.88	92.42	6.31	873.44	351.30	40.22	537.40
Oils & Fats	316.75	35.19	11.11	408.43	116.10	22.46	102.16

Source: Calculated Based on Data from CAPMAS and MALAR, Various Issues.

Table 3.5 presents instability indices of production for different food commodities. It shows that the variability in production changed between the two periods. The highest increase in the variability is observed for milk and dairy products, where the variability in terms of the corrected coefficient of variation in the production for this commodity has increased by 3,324.32 % as compared to period I. The variability in period II is much higher than the variability in period I for the commodities: sugar (537.4 %), eggs (220.07 %), broad bean (210.33 %), red meat (154.02 %), and citrus (105.1 %). The smallest increase in the corrected coefficient of variation is observed in the production of fish, where its variability has increased by 1.13 % from its period I level. In addition variability in production declined for maize, potatoes, eggplant, poultry, garlic, and tomatoes.

3.3 Development of Food Consumption

Changes in food consumption patterns in any society are an important indicator of development changes. Such changes are mostly an outcome of changed income, which in turn has important implications for the agribusiness sector, especially, in terms of production, processing and trade. In addition, food consumption patterns in any country are governed by the food habits of societies within a country. Thus, this section proposes to assess trends in per capita consumption for major food commodities in Egypt during the two periods (Table 3.6).

3.3.1 Trends in Food Consumption

Egypt has achieved considerable progress towards an equilibrated supply and consumption of major food crops. The local production of food items such as rice, vegetables, fruits, poultry, and eggs has been sufficient to meet the domestic demand with some surplus for export.

Wheat

During period I, it is observed that per capita consumption of wheat increased from 146.5 kg/year in 1980 to 161.8 kg/year in 1986. A simple linear trend analysis shows that per capita wheat consumption increased by 1.99 kg/year, with an annual growth rate of 1.27 %. The time trend variable is significant at the 0.01 probability level and it explains 72 % of the variation in the change of the consumption pattern. While during period II, per capita wheat consumption declined from 164.4 kg/year in 1987 to 145.8 kg/year in 2000. The trend analysis also reveals that it declined by 1.55 kg/year, with an annual decrease rate of 0.88 %. This may be due to increasing size of the population from about 48,816 million in 1987 to 63,976 million in 2000. The time trend variable is insignificant and it explains only 14 % of the total variation in consumption change.

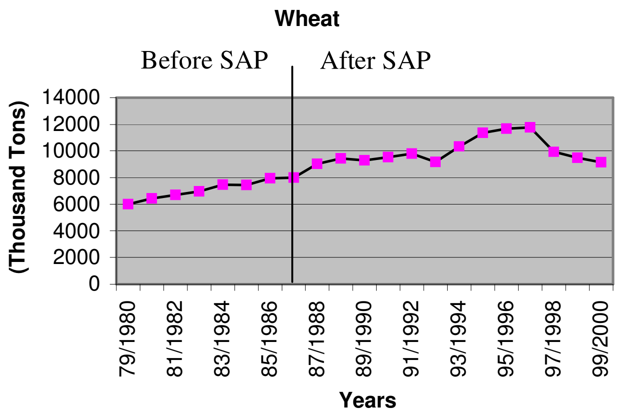
Maize

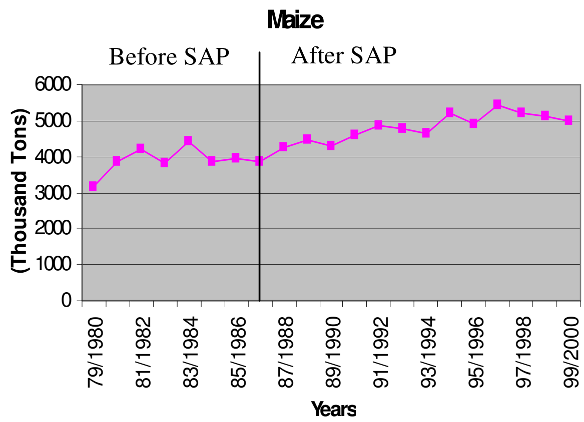
Per capita consumption of maize has decreased during period I from 91 kg/year in 1981 to 80.3 kg/year in 1986. The trend analysis shows that maize consumption declined by 0.83 kg/year, decreasing at an annual rate of 0.97 %. But the time trend variable is insignificant. During period II, the per capita consumption of maize dropped from 91.56 kg/year in 1997 to 79.41 kg/year. The time trend analysis shows that maize consumption has decreased by 0.23 kg/year, at an insignificant annual rate of -0.27 %.

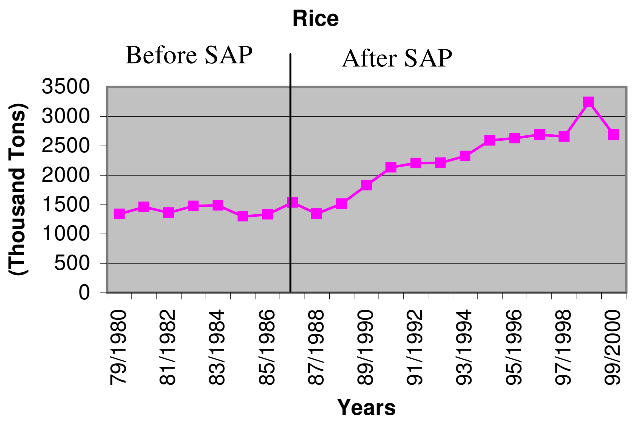
Table 3.6 Growth Rate of Per Capita Consumption for Major Food crops in Egypt, 1980-2000

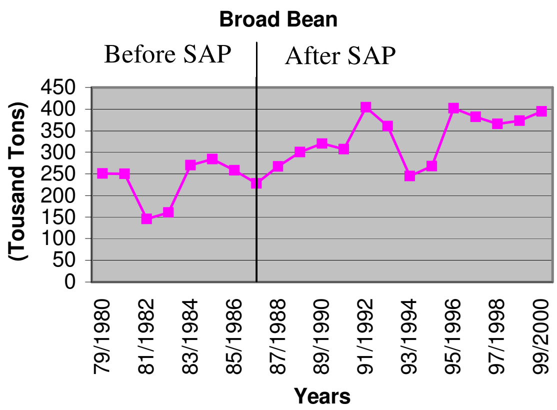
Commodity	1980-1986					1987-2000				
	Constant	b	R^2	F	Growth rate	Constant	b	R^2	F	Growth rate
Wheat	147.41***	1.99***	0.72	15.13***	1.27	186.69***	-1.55	0.14	1.83	-0.88
Maize	89.12***	-0.83	0.08	0.52	-0.97	86.90***	-0.23	0.06	0.72	-0.27
Rice	34.10***	-0.67*	0.39	3.85*	-2.15	29.59***	1.52***	0.77	36.62***	3.78
Potatoes	14.69***	1.53***	0.79	22.69***	7.08	26.74***	-0.73	0.22	3.18	-3.37
Broad bean	5.28***	-0.04	0.01	0.04	-0.78	5.69***	0.03	0.02	0.26	0.51
Lentils	1.54***	-0.07	0.13	0.92	-5.65	1.28***	-0.03**	0.34	5.56**	-2.75
Onions	14.03***	0.13	0.09	0.92	-5.65	15.27***	0.12	0.03	0.36	0.75
Garlic	2.81***	-0.04	0.02	0.09	-1.50	2.95***	0.03	0.03	0.39	0.94
Tomatoes	43.53***	6.11***	0.82	27.13***	8.60	80.79***	-0.54	0.17	2.29	-0.70
Squash	10.35***	0.19**	0.61	9.35**	-2.00	5.96***	0.14	0.22	3.14	2.01
Eggplant	5.95***	0.17	0.19	1.36	2.54	5.45***	0.25***	0.43	8.42***	3.47
Cucumber	6.62***	-0.01	0.01	0.05	-0.15	5.01***	0.10***	0.44	8.49***	1.75
Citrus	17.93***	0.59	0.21	1.56	2.87	24.82***	-0.07	0.01	0.09	-0.29
Dates	8.52***	0.12	0.31	2.66	1.32	10.28***	-0.21	0.21	2.92	-0.24
Grapes	4.97***	0.51***	0.91	57.47***	7.01	10.13***	0.25***	0.58	15.10***	2.10
Banana	1.93***	0.23***	0.85	33.13***	7.77	4.66***	0.17***	0.66	21.78***	2.91
Red meat	9.05***	0.18***	0.66	11.84***	1.85	9.84***	0.32**	0.36	6.22**	2.65
Poultry	2.83***	0.42***	0.76	18.50***	8.92	9.50***	-0.02	0.01	0.05	-0.21
Fish	3.78***	0.34***	0.83	29.86***	6.34	6.14***	0.36***	0.57	14.40***	4.17
Milk	26.36***	2.52**	0.62	9.79**	6.68	31.60***	2.33*	0.27	4.03*	4.87
Eggs	1.47***	0.17***	0.91	58.14***	7.47	2.48***	-0.06*	0.26	3.79*	-2.90
Sugar	26.14***	0.40**	0.49	5.82**	1.43	21.65***	1.27***	0.54	12.80***	4.16
Oils & Fats	14.86***	-0.65**	0.55	7.20**	-5.44	6.70***	0.69***	0.75	33.24***	6.00

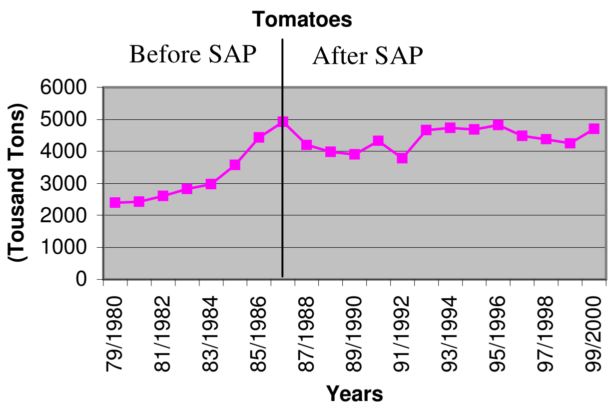
Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.
*** Indicates significant at one percent level of significance.
** Indicates significant at five percent level of significance.
* Indicates significant at ten percent level of significance.

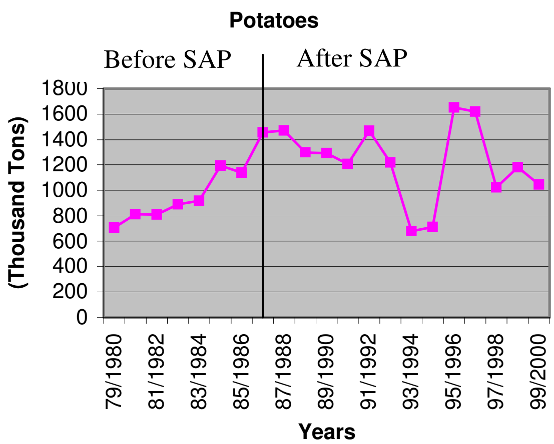

Wheat
Before SAP
After SAP
(Thousand Tons)
14000
12000
10000
8000
6000
4000
2000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Maize
Before SAP
After SAP
(Thousand Tons)
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years

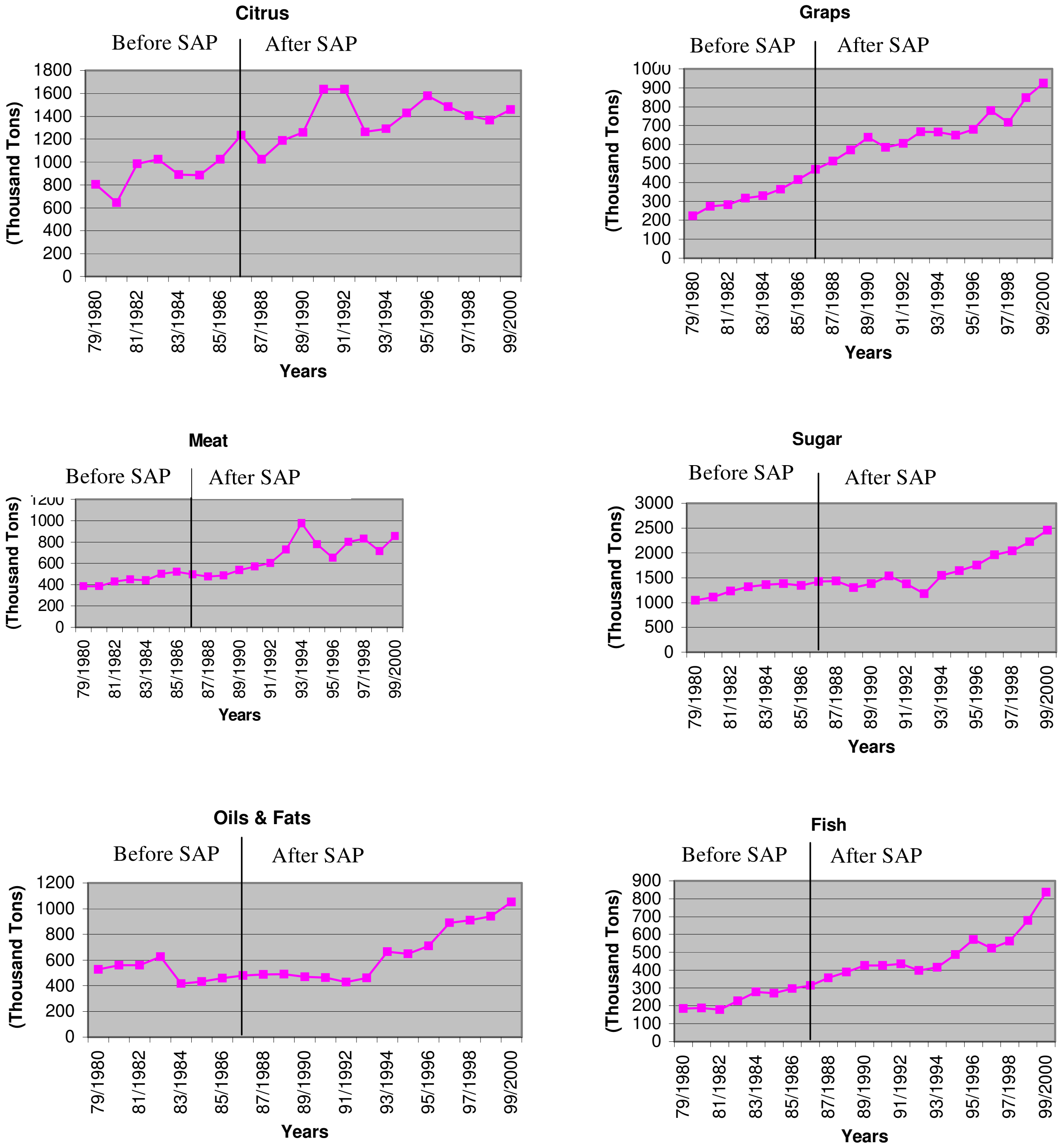

Rice
Before SAP
After SAP
(Thousand Tons)
3500
3000
2500
2000
1500
1000
500
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Broad Bean
Before SAP
After SAP
(Tousand Tons)
450
400
350
300
250
200
150
100
50
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Tomatoes
Before SAP
After SAP
(Tousand Tons)
6000
5000
4000
3000
2000
1000
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years


Potatoes
Before SAP
After SAP
(Thousand Tons)
1800
1600
1400
1200
1000
800
600
400
200
0
79/1980
81/1982
83/1984
85/1986
87/1988
89/1990
91/1992
93/1994
95/1996
97/1998
99/2000
Years

Continued Figure 3.2



Source: CAPMAS and MALR, Various Issues.

Figure 3.2 Trends in Per Capita Consumption for Major Food Crops

Rice

Rice is the predominant staple food for Egypt and mainly produced and consumed locally. In addition to being a rich source of energy, rice is a good source of thiamine, riboflavin and niacin. Rice consumption in Egypt is always taken with other food items, such as vegetables, fish or meat for lunch and in many instances, for dinner too. People also eat rice in other forms like “milk rice”.

During period I, and over the years, rice consumption shows a gradual decline, but in 1981, the consumption has increased to 34.5 kg/year, which contributes to a marginal declining trend. The trend analysis reveals that rice consumption declined by 2.15 kg/year, only 39 % of the variation in the consumption patterns of rice is explained by the time trend factor. However, during period II, per capita consumption of rice has varied from a low of 27.2 kg/year in 1988 to a high of 52.9 kg/year in 1999, clearly reflecting a change in the pattern of consumption for this commodity. A simple linear analysis shows that rice consumption increased by 1.52 kg/year, with an annual growth rate of 3.78 %. The trend variable is significant at the 0.01 probability level and it also explains 77 % of the variation in consumption pattern change.

A definite conclusion emerging from the pattern of change in consumption of these cereals is that wheat is consumed with a declining trend during the period under consideration, and it has been, over the years, replaced mainly by rice. Rice has gradually become the most important cereal food item in the country and now holds a predominant position. The reason for this, the increase in productivity per unit area and the increase in the area cultivated to rice crop because of a high net return to unit area for this crop.

Despite the ease of wheat preparations compared to rice, it is imported because of the substitution by clover crops, which are mainly used as an animal feed and where a high net return to unit area can be achieved.

Potatoes

Potatoes are always consumed in Egypt together with rice as main dish for lunch or with bread for dinner especially for the poor. Therefore, consumption of potatoes can be used as an indicator of development change, where a declining use of potatoes can be linked to an increased standard of living. During period I, per capita potato consumption increased from 17.3 kg/year in 1980 to 23.2 kg/year in 1986. The results of the simple trend analysis show that per capita potato consumption has increased by 1.53 kg/year, with a highly significant annual growth rate of 7.08 %. The time trend variable is significant at the 0.01 probability level and explains 79 % of the variation in potatoes consumption. During period II, a declining trend is found for potatoes consumption; it declined by 0.73 kg/year. The results of the trend analysis do not show a significant relationship with the time factor.

Tomatoes

Tomatoes registered an increase in per capita consumption during period I. It increased from 58.5 kg/year in 1980 to 90.5 kg/year in 1986. The trend analysis shows that per capita tomato consumption increased by 6.11 kg/year, with an annual growth rate of 8.6 %. The trend variable is significant at the 0.01 probability level. The R^2 value shows that 82 % of the variation in consumption is explained by the time factor. During period II, the simple trend analysis shows that per capita tomato consumption increased by only 0.54 kg/year, but it does not show a significant relationship with the time variable.

Broad Bean

Broad bean has been always consumed in Egypt in two forms; dry broad bean, which is consumed with bread for breakfast, and green broad bean, which is used as a vegetable and consumed with rice for lunch. Generally, beans are mainly consumed by the poor in Egypt.

During period I, per capita broad bean consumption decreased from 6.13 kg/year in 1980 to 5.3 kg/year in 1986. The time trend shows that its consumption decreased by 0.04 kg/year, but the time trend variable is insignificant. During period II, per capita consumption increased from 4.7 kg/year in 1987 to 6.3 kg/year in 2000. But also this time trend variable is not significant where the trend analysis reveals that per capita broad bean consumption increased only by 0.03 kg/year.

Citrus

It is observed that per capita citrus consumption increased from 19.7 kg/year in 1980 to 20.8 kg/year in 1986 during period I. The trend analysis shows that its consumption increased by 0.59 kg/year, with an annual growth rate of 2.87 %, but the trend variable is insignificant. During period II, a simple trend analysis shows that per capita citrus consumption declined by 0.07 kg/year.

Grapes

An increasing trend is observed in per capita grape consumption. During period I, it increased from 5.5 kg/year in 1980 to 8.5 kg/year in 1986. From the results of trend analysis, per capita consumption of grape increased by 0.52 kg/year, with an annual rate of 7.01 %. The time trend variable is significant at the 0.01 probability level and 91 % of the variation in its consumption pattern is explained by the time trend. During period II, per capita consumption of grape increased from 10.3 kg/year in 1988 to 14.76 kg/year in 2000. The trend analysis shows that per capita grape consumption increased by 0.25 kg/year, with an annual growth rate of 2.1 %. The trend variable is significant at 0.01 probability level and it explains 59 % of the variation in grape consumption.

Red Meat

Per capita red meat consumption increased during the two periods under consideration. During period I, a simple linear trend analysis shows that per capita consumption of red meat has increased only by 0.18 kg/year, with an annual growth rate of 1.85 %. The time trend is significant at the 0.01 probability level. The R^2 value shows that 66 % of the variation in red meat consumption is explained by the time factor. During period II, per capita consumption of red meat also increased by 0.32 kg/year, with a significant annual growth rate of 2.65 %. The time trend explains 66 % of the variation in red meat consumption.

Fish

The increase in fish consumption has been provided by aquaculture, with the balance supplied by capture fisheries (Mediterranean Sea, Red Sea, and the Northern Lakes) and imports. The resulting trends in per capita fish consumption are shown in Table 3.6. An increasing trend has been observed in per capita fish consumption. Annual per capita consumption of fish has increased from 6.5 kg/capita in 1986 to an estimated 13.68 kg/capita in 2000. A simple linear trend shows also that its per capita consumption during period I increased by 0.34 kg/year, with an annual growth rate of 6.34 %. The time trend variable is significant at the 0.01 probability level and explains 83 % of the variation in fish consumption. During period II, the per capita consumption of fish has increased by 0.36 kg/year, with a significant annual growth rate of 4.17 %. Only 57 % of the variation in fish consumption is explained by the time factor.

Sugar

During period I, per capita consumption of sugar has increased by 0.4 kg/year, with an annual growth rate of 1.43 %. The time trend variable is significant at the 0.05 probability level and it explains 49 % of the variation in sugar consumption. During period II, it increased by 1.27 kg/year, with a significant growth rate of 4.16 %. Only 54 % of the variation in sugar consumption is explained by the time factor.

Oils & Fats

The results of trend analysis show that per capita consumption of this food group has decreased by 0.65 kg/year, with a decline annual rate of 5.44 % during period I. The time trend is significant at the 0.05 probability level. The R^2 value shows that 55 % of the variation in oils & fats consumption is explained by the time factor. During period II, per capita consumption of these commodities increased by 0.69 kg/year, with a significant annual growth rate of 6 %. The time trend explains 75 % of the variation in the consumption.

3.3.2 Decomposition of Changes in Food Consumption

The decomposition analysis is applied for decomposing changes in total consumption of the food crop into: (i) the change in mean per capita consumption (ii) the change in mean population number; and (iii) the change in interaction effect of mean per capita consumption and mean population number.

Mean consumption for a crop can be written as:

$$C = c.P \tag{3.7}$$

where C is the total consumption for a crop, c is the per capita consumption, and P is the population number. Using equation (3.7) a change in mean total consumption between a base period C_0 and a comparison period C_1 is stated as:

$$\Delta C = C_1 - C_0 \tag{3.8}$$

$$= c_1 P_1 - c_0 P_0 \tag{3.9}$$

$$= (c_1 - c_0) P_0 + (P_1 - P_0) c_0 + (c_1 - c_0)(P_1 - P_0) \tag{3.10}$$

$$\Delta C = \Delta c . P_0 + \Delta P . c_0 + \Delta c . \Delta P \tag{3.11}$$

where ΔC denotes the change in average total consumption. Δc presents the change in per capita consumption. ΔP is the change in mean population number. Decomposition of change in average total consumption of various food crops between two periods in Egypt and the contribution of different components in the change of total consumption are presented in Table 3.7 and discussed below.

Wheat

Average total consumption of this crop has increased from 7,118.59 thousand tons in period I to 9,991.67 thousand tons in period II, with a percentage increase of 42.38 %. Change in mean population was the main component to the change in average total wheat consumption in the country. It contributed 62.82 % while change in mean per capita consumption accounted for 29.36 % to the change in total consumption of this crop. The share of interaction term between changes in mean per capita consumption and mean population number contributed 7.82 % to the change in average total wheat consumption.

Table 3.7 Average Annual Food Consumption and Components for Change in Consumption in Egypt in Period I (1980-1986) and Period II (1987-2000)

Crop	Average consumption (Thousand tons)		Component of change (in percent)			
	Period I	Period II	Change in mean per capita consumption	Change in mean population	Interaction between changes in mean per capita consumption and mean population	Total
Wheat	7,118.59	9,991.67 (42.38)	29.36	62.82	7.82	100.00
Maize	3,885.44	4,827.79 (26.44)	-0.53	100.67	-0.14	100.00
Rice	1,413.38	2,314.09 (63.82)	46.03	41.71	12.25	100.00
Potatoes	990.79	1,220.72 (27.09)	1.38	98.25	0.37	100.00
Broad bean	230.88	337.76 (46.48)	33.75	57.27	8.98	100.00
Lentils	53.00	61.82 (11.76)	-99.73	226.28	-26.55	100.00
Garlic	120.20	182.13 (39.08)	25.23	68.05	6.72	100.00
Onions	634.34	901.54 (53.00)	39.31	50.23	10.46	100.00
Tomatoes	3,272.64	4,377.60 (37.30)	22.62	71.36	6.02	100.00
Squash	430.80	397.66 (-7.29)	367.54	-365.38	97.84	100.00
Eggplant	306.61	412.64 (36.10)	20.74	73.74	5.52	100.00
Cucumber	300.49	326.36 (10.14)	-128.32	262.48	-34.16	100.00
Citrus	935.66	1,386.08 (49.87)	36.82	53.38	9.80	100.00
Dates	413.91	497.66 (23.01)	-12.41	115.71	-3.30	100.00
Grapes	333.59	680.46 (106.93)	59.32	24.89	15.79	100.00
Banana	134.54	334.70 (149.80)	64.94	17.77	17.29	100.00
Red meat	451.80	694.49 (55.12)	40.83	48.30	10.87	100.00
Poultry	213.13	530.21 (151.67)	65.12	17.55	17.33	100.00
Fish	242.14	500.61 (106.63)	59.26	24.97	15.77	100.00
Milk	1,708.25	2,754.36 (60.78)	44.39	43.79	11.82	100.00
Eggs	100.93	117.12 (18.46)	-34.88	144.17	-9.29	100.00
Sugar	1,277.00	1,678.73 (38.25)	24.02	69.59	6.39	100.00
Oils	507.75	662.75 (22.05)	-16.38	120.74	-4.36	100.00

Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.

Maize

Average total consumption of maize crop has increased by 26.44 % between the two periods. The highest contributor to this change was change in mean population, which contributed 100.67 % to the change. Per capita consumption contribution was negative to the increase in consumption and the effect of interaction term between changes in mean per capita consumption and mean population was also negative to the change in consumption.

Rice

Rice consumption increased by 63.82 % from 1,413.38 thousand tons in period I to 2,314.09 thousand tons in period II. Change in mean per capita consumption had contributed more than the change in mean population towards the increase in rice consumption between the two periods. Change in mean per capita consumption contributed to the extent of 46.03 % while change in mean population's contribution was 41.71 %. Effect of change in the interaction term accounted for 12.25 % to the change in mean total rice consumption.

Potatoes

For this crop, average total consumption increased from 990.79 thousand tons in period I to 1,220.72 thousand tons in period II, i.e., an increase of 27.09 %. The dominant factor towards the increase in potato consumption was change in mean population whose share in the total change was 98.25 %. Change in mean per capita consumption contributed only 1.38 % to the total change in potato consumption. The change in the interaction term between changes in mean per capita consumption and mean population between the two periods was very low accounting for only 0.37 % towards the total change in potato consumption.

Tomatoes

It is observed that average consumption of tomatoes increased to 4,377.60 thousand tons in period II, with a percentage increase of 37.30 % over the average consumption in period I. Change in mean population number was the main factor responsible for increasing the average total consumption over the two periods. It contributed 71.36 % while change in mean per capita consumption accounted for 22.62 % in the change. The contribution of the interaction term was 6.02 % towards the increase in mean consumption of this crop.

Broad Bean

Average total consumption of this crop has increased by 46.48 % over the two periods. The share of change in the mean population was greater than share of a changing per capita consumption between the two periods. It contributed 57.27 % to the change while contribution of mean per capita consumption accounted for 33.75 %.

The contribution of the interaction between changes in mean per capita consumption and mean population number was 8.98 %.

Citrus

A high increase in total citrus consumption was registered between the two periods. It increased from 935.66 thousand tons in period I to 1,386.08 thousand tons in period II, with a percentage increase of 49.87 %. The share of change in mean population number in the increase in average citrus consumption between the two periods was 53.38 %. Change in mean per capita consumption contributed 36.82 % to the change. The share of change in interaction term between changes in mean per capita consumption and mean population number helped to increase the consumption where its contribution was 9.80 %.

Grapes

Average total consumption of this fruit doubled between the two periods in Egypt. It increased from 333.59 thousand tons in period I to 680.46 thousand tons in period II, with a percentage increase of 106.93 %. Change in mean per capita consumption contributed more than the change in mean population towards the increase in grapes consumption between the two periods. It contributed to the extent of 59.32 % while change in mean population contributed 24.89 %. The contribution of change in the interaction term was 12.25 % to the change in mean consumption, indicating simultaneous change in mean per capita consumption and mean population.

Red Meat

It is observed that average total consumption of red meat commodity increased substantially between the two periods. It increased from 451.80 thousand tons in period I to 694.49 thousand tons in period II, with a percentage increase of 55.12 %. The increase in mean population during period II resulted in an increase of red meat consumption. The share of change in mean population was 48.30 %, while change in mean per capita consumption contributed 40.83 % towards the increase in consumption of red meat. The share of interaction between changes in mean per capita consumption and mean population number was 10.87 % to the change in mean red meat consumption.

Fish

Average total consumption of fish between the two periods has doubled in the country. It increased from 242.14 thousand tons in period I to 500.61 thousand tons in period II, with a percentage increase of 106.63 %. The highest share in the increase in fish consumption was taken by the increase in the mean per capita consumption between the two periods; it was 59.26 %. The share of the change in mean population came to 24.97 %. Change in the interaction term contributed 15.77 % towards change in average total consumption between the two periods. A higher level of interaction indicated that a simultaneous increase in mean per capita consumption and mean population had also contributed much to increasing the fish consumption in the country.

Sugar

For average consumption of sugar, it increased from 1,277 thousand tons in period I to 1,678.73 thousand tons in period II, i.e., an increase of 38.25 %. Change in mean per capita consumption had contributed more than change in mean population towards the increase in sugar consumption between the two periods. It contributed to the extent of 69.59 % while the change in mean population number contributed 24.02 %. The effect of change in the interaction term accounted for 6.39 % to the change in mean consumption of sugar.

Oils & Fats

Average total oils & fats consumption has increased by 22.05 % between the two periods. The main contributor to this change was the change in mean population number, which contributed 120.74 % to the change. The per capita consumption contribution was negative to the increase in consumption and the effect of interaction term between changes in mean per capita consumption and mean population was also negative to the change in average oils & fats consumption.

3.3.3 Instability Analysis of Per Capita Food Consumption

Table 3.8 presents the corrected coefficients of variation in per capita consumption of major food commodities and discussed as below:

In general, there was a change in per capita consumption variability of all commodities between the two periods. Change in the corrected coefficient of variation in per capita consumption was the highest for red meat, with an increase of 388.7 % from its period I level. Variability of per capita consumption has increased more than twice between the two periods for the commodities; wheat (333.33 %), sugar (303.61 %), squash (298 %), dates (247 %), and eggs (246 %). The lowest increase in the variability of per capita consumption is observed for rice, with an increase of 0.12 % from its period I level. On the other hand, the variability in period II was less than the variability in period I for maize, broad bean, lentils, garlic, tomatoes, citrus, and poultry.

Table 3.8 Instability Indices of Per Capita Consumption for Major Food Commodities, 1980-2000

Commodity	1980-1986			1987-2000			Δ % In instability
	Mean	St. deviation	Instability indices	Mean	St. deviation	Instability indices	
Wheat	156.37	5.77	2.10	175.83	16.00	9.10	333.33
Maize	85.39	7.20	8.43	85.27	3.66	4.29	-49.11
Rice	31.10	2.61	8.39	40.24	6.76	8.40	0.12
Potatoes	21.59	4.22	9.58	21.67	5.96	27.50	187.06
Broad bean	5.12	1.10	21.48	5.92	0.84	14.19	-33.94
Lentils	1.24	0.46	37.16	1.09	0.18	14.03	-62.24
Onions	14.63	1.07	7.30	16.07	2.51	15.62	113.97
Garlic	2.64	0.79	29.92	3.19	0.72	22.57	-24.57
Tomatoes	71.01	16.53	10.71	77.00	5.07	6.58	-38.56
Squash	9.50	0.59	4.22	6.96	1.17	16.81	298.34
Eggplant	6.70	0.95	14.18	7.20	1.48	16.24	14.53
Cucumber	6.56	0.36	5.49	5.71	0.59	8.16	48.63
Citrus	20.57	3.17	15.41	24.35	2.88	11.83	-23.23
Dates	9.06	0.53	5.85	8.80	1.79	20.34	247.69
Grapes	7.28	1.31	5.94	11.89	1.29	7.38	24.24
Banana	2.96	0.61	8.66	5.84	0.81	8.46	-2.31
Red meat	9.87	0.55	3.45	12.09	2.08	16.86	388.70
Poultry	4.71	1.18	13.53	9.36	1.23	13.14	-2.88
Fish	5.28	0.90	7.51	8.63	1.84	14.70	95.74
Milk	37.71	7.85	13.74	47.88	17.49	36.53	165.87
Eggs	2.21	0.43	6.42	2.07	0.49	22.22	246.11
Sugar	27.95	1.41	3.88	30.51	6.73	15.66	303.61
Oils & Fats	11.95	2.15	13.13	11.52	3.09	13.95	6.25

Source: Calculated Based on Data from CAPMAS and MALR, Various Issues.

3.4 Conclusion

Food Production

From the previous analysis it can be concluded that cereal production (mainly rice and wheat) has increased. Wheat production increased at a much faster rate of 5.97 %, this was mainly due to the increase in cultivated area under wheat along with significant growth in productivity. Despite the increase of wheat production, wheat is imported because of the growing number of population.

Phenomenal growth rate of rice production was the result of research and agricultural extension efforts to improve rice productivity and expand its cultivated area because of a high net return to unit area of this crop on the one hand. On the other hand, as a result of salinity problem especially in Nile delta region, rice cultivation plays an important role in water-land degradation against sea water intrusion in the northern delta regions. Rice is a suitable crop for leashing requirements.

In the case of broad bean, production grew at the rate of 5.53 % in the first period through the sharp increases in yield coupled with increases in area. In the second period, there was stagnancy in production.

Onions production increased significantly under the combined effect of both cultivated area and yield. However, garlic production grew under significant improvement in cultivated area of this crop offsetting the stagnancy trend of its yield.

For potatoes crop, yield contributed significantly to increase production in the first period offsetting the stagnancy trend of area, while its production remained stagnant in the later period. Tomato production has increased under the combined effect of area and yield. Squash production registered significant growth rates through the improvement in the planted area to this crop. Also area changes were the main factor responsible for increasing eggplant production.

In the case of fruits, citrus production has increased, mainly through area expansion. Dates, grapes, and banana show similar trends. Growth rates of production were higher resulting from the combined effect of both area and yield.

Food Consumption

In Egypt, the cereals, compared to other foods, are consumed at a high level. Within this category, wheat consumption exhibits a declining trend being replaced, over the years, by rice that shows an increasing trend. Rice has gradually become the most important cereal food item in the country. It is a staple food, mainly produced and consumed locally.

As cereals increase in importance as items of consumption, there has been a commensurate decline in the consumption of potatoes. Potatoes are a typical food of the poor. This implies, as indicated earlier, a transition from one growth stage to another.

With the acceleration of the development process, fruit and vegetable consumption should show an increasing trend. But vegetable consumption, except for tomatoes, exhibits an opposite pattern to what is expected. This could be, as already mentioned, due to the increased population number and the limited supply of vegetables. Fruits consumption, especially grapes and banana, has improved in the period under the study.

Consumption of animal products especially meat, fish, and milk is another area governed by the pace of development. It increases with increasing income levels. Economies that go through a rapid development process have always shown significant increases in their red meat consumption. Increased health concerns could be a factor influencing these trends. But it is true that an increased awareness about health is also a function of more development. Although Egyptian red meat consumption levels have, traditionally, been very low, an increasing trend has been observed in per capita red meat consumption during the two periods under study.

Per capita fish consumption has improved in Egypt. Aquaculture has had a significant impact on improving the supplies of fish for human consumption, rising from just 35,000 tons in 1992 (10 % of supplies) to 340,000 tons in 2000 (47 % of supplies to market) (MALR, 2001). Since 1992 about half of the increase in consumption and in per capita consumption has been provided by aquaculture, with the balance supplied by capture fisheries (Mediterranean Sea, Red Sea and the northern Lakes) and imports. Egyptian people presently eat about twice as much fish now than they did 10 years ago, and about half of the increase is due to improved supplies from aquaculture.

Change in the food consumption pattern is an important source that could influence agribusiness planning for the future. The nature of demand for food should be carefully analysed before both production and import or export decisions for agricultural commodities are made. Changes in consumption patterns also have implications on the processing side of the agribusiness sector.

This study has, for example, revealed that rice consumption will continue to be at high levels for some time. Consequently, there will be sufficient opportunity for more initiative and innovation in agribusinesses relating to rice consumption.

CHAPTER 4

FOOD SECURITY AND NUTRITIONAL STANDARD IN EGYPT

4.1 Introduction

Food is a human right precisely because it is a necessary input for human development. In general, food may be defined as anything eaten or drunk that can be absorbed by the body and used as a source of energy. In short, food is the raw material from which our bodies are made (Sumati *et al.*, 1996, p. 2).

The food insecurity problem in developing countries is generally caused by a combination of factors, which include a high share of food in total expenditures and a high-income elasticity for food (Deaton, 1998), in addition to a high rate of population growth.

Adequately feeding a growing population with limited land and water resources is the most important challenge for Egyptian agriculture. Through the optimal allocation of agricultural resources, the agricultural sector can enhance food security by increasing the availability of food for a growing population.

The general objective of this chapter is to examine the state of food security in Egypt in terms of supply, demand and consumption, and to discuss policies aimed at improving it. The per capita food supplies are expressed in terms of quantity and by applying appropriate food composition factors for all primary and processed products in terms of caloric value, protein, and fat content. These data, together with other elements such as income elasticity coefficients serve as a major element for the projection of food demand.

The situation of food consumption of any nation can be assessed by Food Balance Sheets such as those are issued by the Food and Agriculture Organisation of the United Nations (FAO). Thus, this chapter will proceed as follows:

Section 4.2 discusses the theoretical framework of food security and nutritional standard determination. Section 4.3 provides background information on food balance sheets compiled by the FAO. Section 4.4 is based on data from food balance sheets for Egypt, developing countries, and developed countries and examines the current state of food security in Egypt. This is done at the macro level in terms of domestic supply, and at the micro level in terms of per capita food supplies, which are expressed in terms of quantity and also in terms of caloric value, protein, and fat content. It also shows food intakes in Egypt in comparison to those of developed countries and developing countries in 2001. Section 4.5 discusses indicators of food security in Egypt such as dietary diversity, nutritional indicators, income poverty, and the inequality in the distribution of expenditure. Section 4.6 discusses policies aimed at improving food security and reducing poverty in Egypt, with emphasis on the food subsidy system in Egypt. Section 4.7 presents the chapter conclusions.

4.2 Theoretical Framework

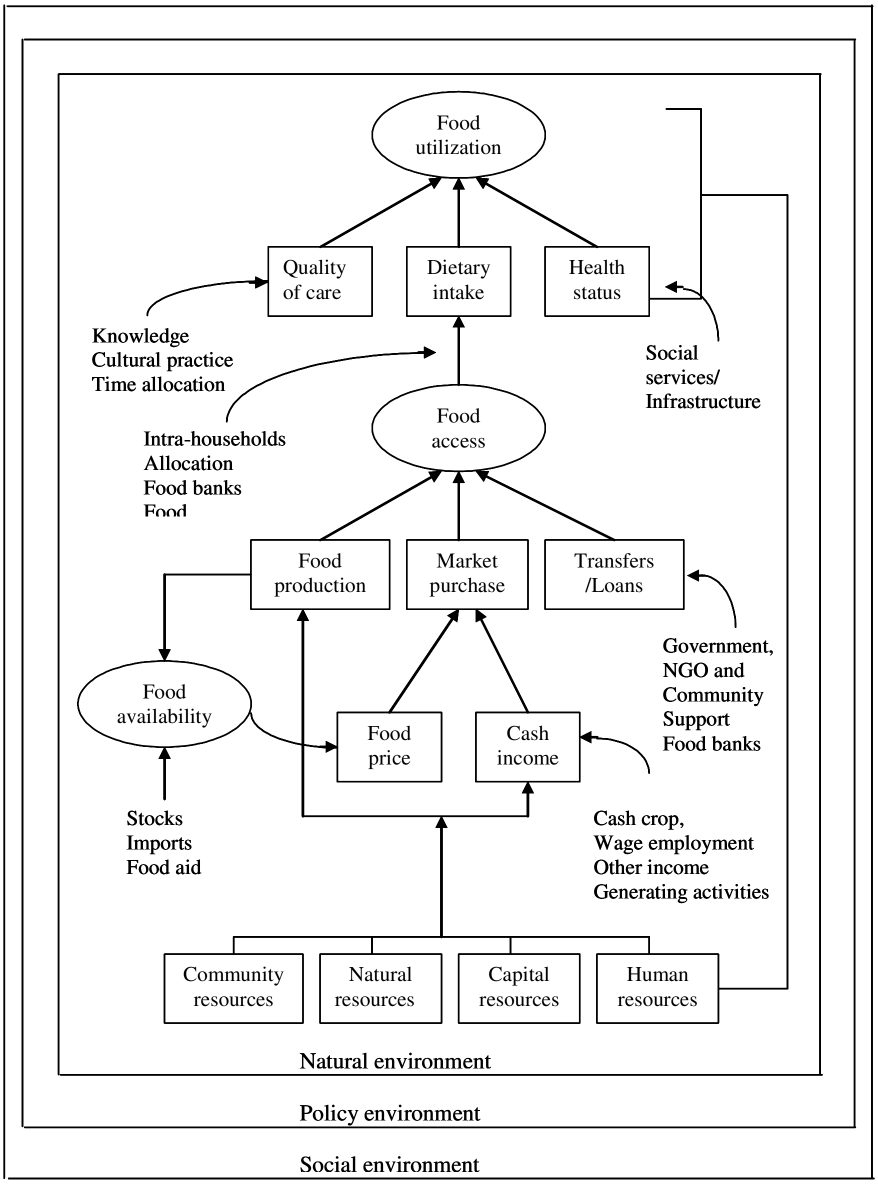
4.2.1 Definition of Food Security

Food security is defined by USAID (2002) as a situation "when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life". This definition also highlights that "three distinct variables are central to the attainment of food security: availability, access, and utilisation".

Food availability means that sufficient food should be available for all people to meet consumption needs. This could be through domestic production and/or external sources from imports and food aid. *Food access* occurs when individuals within a household have the necessary income or other means to obtain adequate food. *Food utilisation* concentrates on the biological use of food for energy and other food nutrients.

Figure 4.1 outlines the USAID food security framework, highlighting the three variables of availability, access, and utilisation, and their relationship to one another, as well as a brief description of their determinants. As indicated in the diagram, food availability is a function of the combination of food stock, imports, food aid, and domestic food production, as well as the underlying determinants of each of these factors. Food access is influenced by food availability through the latter's impact on supplies in the food market and on market prices. Figure 4.1 indicates that food access is determined by households' ability to obtain food from their own production, stocks, imports and from other sources. These factors are, in turn, determined by the resource endowment of the household, which includes the set of productive activities they can pursue in meeting their income and food security objectives.

Food access also is a function of the natural environment, social environment, and policy environment that determine how effectively households are able to utilise their resources to meet their food security objectives.



Source: Riely, F. *et al.*, USAID, 1999, p. 13.

Figure 4.1 Food Security Conceptual Framework

Food utilisation, which is reflected in the nutritional status of an individual, is determined by the quality of care and quantity of dietary intake along with health status and its determinants. Poor infant care and feeding practices, inadequate access to, or the poor quality of, health services are also major determinants of poor health and nutrition. Improved food utilisation has feedback effects, through its impact on the health and nutrition of household members, and therefore on labour productivity and household income-earning potential.

Food security is also defined by the FAO (2000) at different conceptual levels, for the world as a whole, or for individual nations, regions or households with purchasing power as indicator. At the national level, two concepts are considered: Food self-sufficiency, which implies meeting food needs, as far as possible, from domestic supplies and minimising dependence on trade. Food self-reliance on the other hand takes into account the possibilities of international trade. This concept includes maintaining some level of domestic food production plus generating the capacity to import from the world market as needed. However, reliance on trade may also bring some risks including uncertainty of supplies and world market prices (FAO, 2000).

Generally, there is food insecurity when there is not enough food supplied or when individuals are unable to obtain their basic food requirements. People are vulnerable to food insecurity because of income poverty, unemployment, and unequal distribution of income. Under these circumstances, the Government has an important role in resolving or alleviating the problems of food shortages. Policies and programs such as food subsidy programs were implemented to improve food security in Egypt.

4.2.2 Nutritional Standard

Nutritional status is often defined as the pool of nutrients in the body that is or can become available to metabolism (Bos *et al*., 1993, p. 4). An adequate food intake is a prerequisite for good nutrition. Nutrient adequacy refers to a diet that meets requirements for energy and all essential nutrients (Ruel, 2002). Intake of the right kind and amount of food can ensure good health, which may be reflected in an individual's appearance, efficiency and emotional well-being (Sumati *et al*., 1996, p. 2). An imbalance or deficiency of nutrients can cause malnutrition that is probably the most distressing manifestation of under-development. It exhibits a wide variety of effects; on health, work productivity, and the returns to human investment. These effects, in turn, are likely to have a detrimental effect on a population's productivity and its response to educational and family planning campaigns thus slowing down the pace of economic development (Kobbe, 1986, p. 405). Malnutrition can come from not eating enough healthy food (under nutrition), or from not getting enough of a particular nutrient (specific deficiency), or from getting too many calories or the wrong types of calories such as from saturated fats or highly processed sugar, which creates a stress in the bodily function (over nutrition). A deficiency of protein is more frequent in some countries, as a result of relying too heavily on a single staple food. Just as when people are fed watery cereal- a diet that provides enough calories but not enough protein.

The three leading causes of malnutrition are: an unbalanced diet, disease, and poverty. Figure 4.2 outlines a framework highlighting these factors, as well as a brief description of their determinants. As indicated in Figure 4.2, an unbalanced diet is a function of the combination of lack of nutrition knowledge, insufficient food in the household, and a lack of food variety, as well as the underlying determinants of each of these factors. In addition to a food shortage in the market, unequal distribution of resources at family, community, and national levels also contributes to malnutrition. Diseases are determined by poor health services, and this factor is, in turn, determined by low household income. Poverty, which is typically reflected in the malnutrition status of an individual, is determined by unemployment and/or lacking access to land.

Generally, in the light of the conceptual framework described in Figure 4.2, it is apparent that malnutrition is a reflection of, and can be caused by, a wide range of factors. Many of these factors are directly or indirectly influenced by government action, while many others reflect the traditional knowledge, attitudes and practices of individuals, households, and communities.

4.2.3 The Main Dietary Components

Improvement in the diet depends on a knowledgeable selection of foods that complement one another in nutrients and a good knowledge of nutritional requirements. The keys to good nutrition are balance, variety, and moderation. The body needs an adequate supply of food to maintain all body functions and to ensure a healthy life. Food needs can be expressed both in terms of energy (calories) and major nutrients including proteins, fats, vitamins, and minerals.

Energy

The energy stored in food is measured in terms of calories[8], which is needed for vital functions like movement, thought, and growth. Carbohydrates and fats are the main nutrients, which can be used by the body to produce different amounts of energy (about 85 to 90 %). A small part of energy need, about 10 %, is met by proteins (Sumati *et al.*, 1996, p. 41). Most foods rich in carbohydrates are inexpensive. Carbohydrates naturally are readily available in sugars, starchy roots, vegetables, and cereals while fats occur mainly in oils and animal products. Sugars are digested and absorbed quickly whereas cereals, starchy roots, and some vegetables contain complex carbohydrates.

[8] One calorie is the amount of heat required to raise the temperature of one kilogram of water from 15 degrees to 16 degrees Celsius.

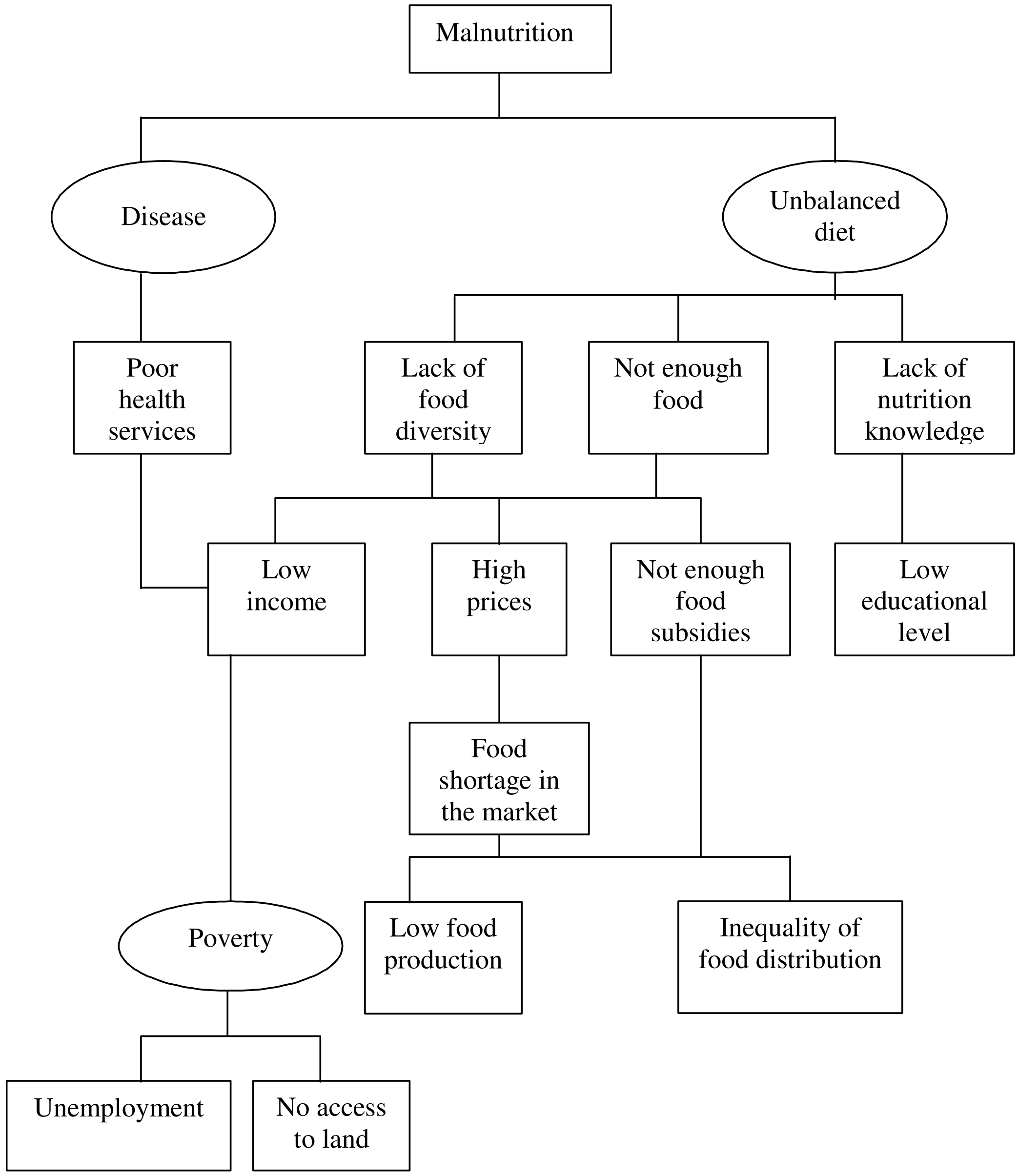


Figure 4.2 Causes of Malnutrition in Egypt

A fat calorie has the same amount of energy as a protein calorie by definition, but the amount of calories from one-gram sugar or starchy roots or protein amounts to 4 kcal (17 KJ)[9]/gram, while the amount of calories from one gram fat reaches 9 kcal (37.7 KJ)/gram (FAO/WHO, 1994b and FAO/WHO/UNU, 1991). The amount of calories in a diet refers to how much energy the diet can provide to the body. A well-balanced diet is one that delivers an adequate amount of calories while providing the maximum of nutrients. The body stores the energy it does not need in fat cells for future use. The process of breaking down food for use as energy is called metabolism. Increased activity results in increased metabolism, as the body needs

[9] One joule is equal to the energy expended when one kilogram is moved through one meter by a force of one new ton (N). 1 kilocalorie = 4.184 kilojoules.

more fuel. The opposite is also true; with decreased activity the body continues to store energy in fat cells and does not use it up. Finally, diets high in carbohydrates as compared to those high in fat reduce the likelihood of developing obesity and its co-morbid conditions. An optimal diet should consist of at least 55 % of total energy coming from carbohydrate obtained from a variety of food sources (FAO/WHO, 1998).

Generally, the effects of insufficient energy supply vary with age and with the extent of insufficiency. For adults, it may affect their capacity to work, for children it affects their growth and activity. If the energy supply is very short of what is needed, body storages of fat may be used, followed by muscle tissue, to meet the need for a minimal functioning of the body.

Protein

Protein is necessary for good health. It is involved in building new tissue and in maintaining and repairing of that already built. Regulatory and protective substances such as muscles, blood, skin, hormones, enzymes, and internal organs are formed from food proteins. When the diet is not sufficient in fats and carbohydrates, protein consumed will become a source of energy. Protein, when taken in excess of the body's need, is converted to carbohydrates and fats and stored. Proteins are complex organic compounds and the basic structure of protein is a chain of amino acids. Amino acids are described as essential and non-essential amino acids. The body can make only 13 of the amino acids that are known as the non-essential amino acids. The body can produce these and does not need them to be supplied in the diet. There are 9 essential amino acids that are obtained only from food, and that can not be made in the body. If the protein in a food supplies enough of the essential amino acids, it is called a complete protein. All meat and other animal products are sources of complete proteins containing all essential amino acids. These include red meat products, poultry, fish, eggs, and milk and its products. Protein in foods such as grains, fruits, and vegetables are either low in complete protein or lack one of the essential amino acids, for example, cereals are low in lysine and most of the pulses contain a small amount of methionine. Plant proteins can be combined to include all essential amino acids and form a complete protein. Examples of combined complete plant proteins are rice and beans or corn and beans.

A value accepted for the safe level of intake is 0.75 g/kg/day for adults, in terms of proteins with the digestibility of milk or eggs (FAO/WHO, 1991).

Fats

Fats are the most concentrated source of energy in foods. They provide 9 kcal (37.7 KJ)/gram, more than twice the amount provided by carbohydrates or proteins. Fats belong to a group of substances called lipids. All fats are combinations of saturated (solid form) and unsaturated (liquid form) fatty acids. The role of dietary fats and oils in human nutrition is one of the most important areas of concern and of investigation in the field of nutritional science (FAO/WHO, 1994b). The findings of these investigations have wide-ranging implications for consumers, nutrition educators and health-care, as well as food producers, processors and distributors. Fats are essential for the proper functioning of the body. They provide the essential fatty acids, which can not be made by the body and must be obtained from food. Fatty acids provide the raw materials that help in the control of blood pressure and maintaining healthy skin and hair. They help in the absorption, and transport through the blood stream of the fat-soluble vitamins A, D, E, and K.

Adequate amounts of dietary fat are essential for health. In addition to their contribution to meeting energy needs, intakes of dietary fat must be sufficient to meet requirements for essential fatty acids and fat soluble vitamins. The minimum intake consistent with health varies throughout a person’s life and among individuals. For most adults, dietary fat should supply at least 15 % of their energy intake. Women of reproductive age should consume at least 20 % of their energy from fat. Concerted efforts should be made to ensure adequate consumption of dietary fat among populations where less than 15 % of the dietary energy supply is from fat (FAO/WHO, 1994b). Excessive dietary fat intake has been linked to increased risk of obesity, coronary heart disease and certain types of cancer. Sedentary individuals should not consume more than 30 % of their energy from fat, particularly if it is high in saturated fatty acids which are primarily derived from animal products (FAO/WHO, 1994b).

Vitamins

Vitamins are a group of substances essential for normal metabolism, growth and development, and the regulation of cell functions. They work together with enzymes, co-factors (substances that assist enzymes), and other substances necessary for healthy life. Each vitamin has specific functions. If the level of a particular vitamin is inadequate, a deficiency disease will result. There are 13 vitamins essential for bodily functions: vitamin A, C, D, E, K, and B vitamins including thiamine, riboflavin, niacin, pantothenic acid, biotin, vitamin B6, vitamin B12, and folate. They all can be obtained from food, and vitamin D and vitamin K can be synthesized by the body. The best way to get the daily requirement of essential vitamins is to eat a balanced diet that contains a variety of foods (FAO/WHO, 2002).

Minerals

Minerals are inorganic substances that are essential for the metabolic processes in the body. They act as catalysts for the major body processes, and their actions are interrelated. The major minerals include molybdenum, zinc, cobalt, calcium, and manganese. Minerals are necessary for body-building, for building of bones, teeth and structural parts of soft tissues. They also play a role in the regulation of processes in the body, e.g. muscle contraction (Sumati *et al.*, 1996, p. 7). If the body does not get enough minerals, it can create a deficiency and become ill. Minerals such as iron and zinc are low in cereal and tuber-based diets, but the addition of legumes can slightly improve the iron content of those diets (FAO/WHO, 2002).

Generally, fish, poultry, and small animals are excellent sources of highly bio-available essential micronutrients such as vitamin A, iron, and zinc. To achieve dietary adequacy of vitamin A, vitamin C, folate, iron, and zinc by using food-based approaches, food preparation and dietary practices, for example, it is important to recommend vegetables rich in vitamin C, folate, and other water-solute or heat-labile vitamins be minimally coked in a small amount of water.

4.3 Food Balance Sheet

A food balance sheet presents a comprehensive picture of the pattern of a country's food supply and utilisation during a specific reference period. The food balance sheet shows for each primary food item and a number of processed commodities available for human consumption the sources of supply and its utilisation. The total quantity of foodstuffs produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period gives the supply available during the period. On the utilisation side, a distinction is made between the quantities exported, fed to livestock, used for seed, put into the manufacturing sector for food use and other uses, losses during storage and transportation, and food supplies available for human consumption. The per capita supply of each food item available for human consumption is obtained by dividing the respective food quantity by the number of population actually partaking of it. Data on per capita food supplies are expressed in terms of quantity per head and by applying appropriate food composition factors for all primary and processed products also in terms of caloric value, protein, and fat content.

Annual food balance sheets compiled regularly over a period of time show trends in national food availability. They disclose changes that may have taken place in the types of food consumed, i.e. the dietary pattern, and reveal the extent to which the food supply of the country, as a whole, is adequate in relation to nutritional requirements of the population.

A food balance sheet can also serve in examining the food and agricultural situation of a country. The level of self-sufficiency for food intake can be obtained by dividing production by total food supply. A comparison of the quantities of food available for human consumption with those imported will indicate to what extent a country depends upon imports (import dependency ratio).

It is important to note that the quantities of food available for human consumption, as estimated in the food balance sheet, relate simply to the quantities of food reaching the consumer. However, the amount of food actually consumed may be lower than the quantity shown in the food balance sheet, depending on the degree of losses of edible food and nutrients in private households. Losses may occur during storage, preparation and cooking (which affect vitamins and minerals to a greater extend than they do calories, protein and fat) or simply be thrown away.

Food balance sheets do not give any indication as to the difference that may exist in the diet consumed by different population groups, e.g. different socio-economics groups and geographical areas within a country. To obtain a complete picture, food consumption surveys showing the distribution of the national food supply at various geographical areas and among different groups of the population will be used in the next chapters.

4.4 Food Balance Sheet for Egypt

Egypt has a comparative advantage in some key food commodities, which face a strong domestic and external demand such as fruits, vegetables, and rice. Despite impressive gains in the production of strategic food crops, Egypt remains a food importer[10]. It is far from being self-sufficient in food, importing wheat, lentils, sugar, meat, and oils.

Without increases in domestic food production, the increasing cost of food imports could contribute to an increasing foreign account deficit. The need to reduce the dependency on food imports and to meet the gap between consumption and production is crucial for a country with a high rate of population growth. Increased food supplies are needed not only to meet nutritional needs of the population, but also to enhance the food sufficiency and security position of the nation.

[10] The food import dependency ratio accounted for 23.8 (EHDR, 2003).

4.4.1 Domestic Food Supply and Level of Self-Sufficiency

Detailed food balance sheets for Egypt for the years 1995 and 2001 is given in the Appendix A. Table 4.1 provides information on the supply side of the food balance sheet for the year 2001. The total production of cereals was 17,569 thousand metric tons and total import added 9,295 thousand metric tons. The total export in the same year was 665 thousand metric tons, while stock or inventory increased by 942 thousand metric tons. The total supply of cereals available for domestic utilisation or consumption equals 27,141 thousand metric tons, using the formula below:

Supply for domestic utilisation = production + imports – exports + changes in stocks (decrease or increase)

Out of the total domestic supply of cereals, the major uses were food for human consumption (16,300 thousand metric tons) and animal feed (7,967 thousand metric tons). The major food items among cereals were rice, wheat, and maize.

The production of rice was 3,486 thousand metric tons and 639 thousand metric tons were exported in 2001. The total domestic supply of rice was 3,178 thousand metric tons and most of this (2,693 thousand metric tons) was used for food while the rest was used for animal feed (133 thousand metric tons), waste (207 thousand metric tons) and others.

On the other hand, Egypt's production of wheat was only 6,255 thousand metric tons and imports were 4,444 thousand metric tons. Most of the wheat available was used as food for human consumption, i.e., 8,948 thousand metric tons, and the rest was for animal feed and other uses.

The production of starchy roots amounted to 2,266 thousand metric tons in 2001. Total domestic supply in the same year was 2,092 thousand metric tons after 212 thousand metric tons had been exported. Most starchy roots were used for human food (1,644 thousand metric tons). Among the starchy roots the most important items were potatoes. In 2001, Egypt produced 1,903 thousand metric tons and exported 206 thousand metric tons of potatoes. Most of the potatoes were used as food for human consumption.

As for sugar, Egypt produced 1,564 thousand metric tons and imported 637 thousand metric tons, making the total domestic supply of 2,433 thousand metric tons. All sugar was used for food.

For vegetable oils, imports oils were 558 thousand metric tons and exceeded local production by far, which was only 170 thousand metric tons. Egypt exported 23 thousand metric tons and total domestic supply was 824 thousand metric tons. Most of the vegetables oils were used for food (451 thousand metric tons) and other uses.

Table 4.1 Domestic Supply and Utilization of Major Food Commodities and Level of Self-Sufficiency, Egypt, 2001

Products	Domestic supply (1000 metric tons)					Self-sufficiency (%)	Domestic utilization				
	Production	Imports	Stock changes	Exports	Total		Food	Feed	Seed	Processing	Waste
Cereals	17,569	9,295	942	665	27,141	64.73	16,300	7,967	255	174	1,957
Wheat	6,255	4,444	750	23	11,425	54.75	8,948	1,398	167	0	662
Rice	3,486	3	328	639	3,178	109.69	2,693	133	47	0	207
Maize	6,842	4,838	-180	2	11,498	59.51	4,303	5,893	32	123	1,006
Starchy roots	2,266	38	0	212	2,092	108.32	1,644	0	238	0	230
Potatoes	1,903	36	0	206	1,733	109.81	1,326	0	232	0	194
Sweeteners	1,564	637	272	39	2,433	64.28	2,031	0	0	0	0
Sugar (raw E.)	1,476	631	272	35	2,344	62.97	1,941	0	0	0	0
Oil crops	929	493	34	19	1,436	64.69	519	0	32	825	25
Vegetable oils	170	558	119	23	824	20.63	451	0	0	0	0
Vegetables	13,851	10	6	281	13,587	101.94	12,210	1	0	0	1,377
Tomatoes	6,329	5	4	28	6,309	100.32	5,676	0	0	0	633
Onions	628	0	0	166	462	135.93	399	0	0	0	63
Fruit	7,355	132	0	343	7,144	102.95	6,402	0	0	6	736
Oranges	2,261	1	0	258	2,004	112.82	1,778	0	0	0	226
Grapes	1,079	44	0	5	1,118	96.51	1,002	0	0	6	110
Meat	1,435	299	0	1	1,734	82.76	1,734	0	0	0	0
Beef & Veal	550	293	0	0	842	65.32	842	0	0	0	0
Mutton & Goat	108	2	0	0	110	98.18	110	0	0	0	0
Poultry & Meat	630	4	0	0	634	99.37	634	0	0	0	0
Animal fats	117	52	9	0	178	65.73	167	0	0	0	0
Milk exc. butter	4,029	304	0	22	4,311	93.46	3,526	597	0	-15	201
Fish, seafood	771	553	0	2	1,322	58.32	1,055	267	0	0	0

Source: FAO, Food Balance Sheet for Egypt Country, 2001.

As for vegetables, total production was 13,851 thousand metric tons. Egypt exported 281 thousand metric tons of vegetables leaving a total domestic supply of 13,587 thousand metric tons. Most of the vegetables were used for food.

Egypt produced 7,355 thousand metric tons of fruits, imported 132 thousand metric tons, and exported 281 thousand metric tons, making the total domestic supply of 13,587 thousand metric tons. Just as in the case of vegetables, most of the fruits were used for food.

For meats group, Egypt produced 1,435 thousand metric tons and imported 299 thousand metric tons. The total supply of meat was 1,734 thousand metric tons. The meat was used for human food. Looking at the items under meat, Egypt produced most of poultry, mutton and pig meat however, large proportions of beef and veal were imported.

As for milk, total production was 4,029 thousand metric tons and total imports were only 304 thousand metric tons. The total domestic supply of milk was 4,311 thousand metric tons in 2001 and most of it was used for food.

And for fish, Egypt produced 771 thousand metric tons, imported 553 thousand metric tons resulting in a total domestic supply of 1,322 thousand metric tons. Most fish was used for food.

Level of Self-Sufficiency

Table 4.1 also indicates the level of self-sufficiency for each food item. In 2001, Egypt produced more than sufficient quantities of several food items namely; rice, potatoes, beans, vegetables, and fruits. The staple foods for Egypt are rice and wheat. Egypt is self-sufficient in the production of rice. However, Egypt achieved only 54.75 % self-sufficiency in wheat production in 2001. Egypt has to import the rest of wheat needed for domestic consumption.

As for starchy roots, Egypt is self-sufficient in the production of potatoes (109.81 %) and 101.69 % self-sufficient in the production of sweet potatoes. Another important food item in the Egyptian diet is sugar. Egypt is only able to produce 62.97 % of its domestic consumption.

Further analysis of each of the other food crop items, however, revealed that Egypt’s favourable position in the fruits and vegetables in the year under study was largely due to oranges (112.82 % self-sufficiency) and onions (135.93 % self-sufficiency).This more than outweighed the deficiency in the production of vegetable oils. In 2001, Egypt was only 20.63 % self-sufficient in the production of vegetable oils.

Table 4.1 also shows that Egypt almost achieved self-sufficiency in the production of poultry, mutton & goat meat, and other meat. It was below the level of self-sufficiency in the production of other livestock products in particular beef & veal, milk, fish, and animal fats. 1n

2001, Egypt was 65.32 % self-sufficient in the production of beef and veal, 93.36 % self-sufficient in the production of milk and 58.32 % self-sufficient in the production of fish.

4.4.2 Determination of the Nutritional Standard

A balanced diet that includes a variety of naturally nutrient-rich foods from each food group including grains, fruits, vegetables, milk, legumes, fish, and poultry or lean meat, is the key to provide the daily requirement of essential nutrients. Therefore, understanding food consumption patterns is important. This section provides information on the amount of per capita food supply in terms of calories, protein, and fat intake per day as contributed by various food groups in Egypt as compared to other countries.

Based on food balance sheets, there is a marked difference in attitudes towards food consumption and nutritional standards between the people of Egypt and of other countries at the present time.

Table 4.2 shows the food intakes in terms of calories, proteins, and fats as compared to developed countries and developing countries in 2001. Based on this Table, Egypt recorded the highest calories intake at 3,385 followed by developed countries at 3,285. However, developed countries recorded the highest protein intake at 99.4 gram/day and this is followed by Egypt at 96.5 gram/day. But, it is observed that the major sources of calories and proteins in Egypt are plant-based products, with small amounts coming from animal products. However, these are a relatively concentrated source of essential proteins that are of high quality and highly digestible. The highest fat intake was also registered by the developed countries (121.2 gram/day) followed by the developing countries (64 gram/day). Egypt recorded the lowest fat intake at 62.2 gram/day.

Table 4.2 Calories, Proteins, and Fats Intake by Country, 2001

Country	Calories	Proteins (grams)	Fats (grams)
Developed Countries			
Grand total	3,285	99.4	121.1
Vegetable products	2,428	43.6	59.6
Animal products	856	55.8	61.5
Developing Countries			
Grand total	2,675	69.6	64.0
Vegetable products	2,325	49.1	37.4
Animal products	350	20.5	26.5
Egypt			
Grand total	3,385	96.5	62.2
Vegetable products	3,111	76.8	42.4
Animal products	273	19.7	19.9

Source: FAO, Food Balance Sheets, 2001.

This shows that the diets in developed countries are high in total calories, proteins, and in fats compared to those of developing countries. It is important to note that the rise in per capita caloric intake in the diet in Egypt is mainly due to increases in cereal consumption, and does not necessarily reflect improvements in overall nutritional intake.

Table 4.3 shows the amount of per capita food supply (per day) in terms of calories, proteins, and fats in Egypt for the period 1990-2001. The observed changes in the nutritional status of individuals are important, not only because they are associated with changes in welfare, but also because they have important consequences for health and morbidity, and because better nutrition is associated with improved labour productivity. This Table indicates an increase in the intake of calories and proteins over the entire period. This is perhaps due to the improvement in the standard of living among the population.

Table 4.3 Calories, Proteins, and Fats Intake in Egypt, 1990-2001

Year	Per capita supply/per day		
	Calories	Proteins (grams)	Fats (grams)
1990	3,175	84.0	57.6
1991	3,174	83.7	57.2
1992	3,173	84.3	55.6
1993	3,192	85.9	56.9
1994	3,230	88.6	56.0
1995	3,285	90.1	58.2
1996	3,340	91.7	57.9
1997	3,338	92.7	56.8
1998	3,321	93.0	57.3
1999	3,336	93.7	58.4
2000	3,376	96.2	62.5
2001	3,385	96.5	62.2

Source: FAO, Food Balance Sheets, 1990-2001.

Figure 4.3 shows the level of calorie intake while Figure 4.4 shows the amount of proteins, and Figure 4.5 shows the amount of fat intake from 1990 to 2001.

Table 4.4 shows the total amounts of calories, protein, and fat intake per day as contributed by various food groups. It also shows their total annual intake (kg/year).

According to Table 4.4, the components of the Egyptian food have been improved throughout the period of study. There was a great increase in the consumption of energy and healthy foods (meat, milk, fish, vegetables, and fruits) in comparison to the relative constancy of the consumption of cereals, beans, starchy roots, and oils. For instance, the amount of meat intake has increased from 24.1 kg/year in 1995 to 29.4 kg/year in 2001. Fish intake almost doubled from 8.4 kg/year in 1995 to 15.3 kg per/year in 2001.

There is also an increase in the intake of milk and its products, vegetables, fruits, and sugar from 40.0, 145.8, 84.9, and 53.7 kg/year in 1995 to 51.0, 176.7, 92.7, and 70.7 kg/year in 2001, respectively. The amount of per capita cereal consumption is 243.7 in 1995 and 236.0 kg/year in 2001.

It may be noted here that the average individual's cereal consumption reveals some consumption loss. In developing countries, the average individual consumption of cereals reaches 170 kg/capita annually, while in developed countries this average does not exceed 132 kg/capita annually (Food Balance Sheets, FAO).

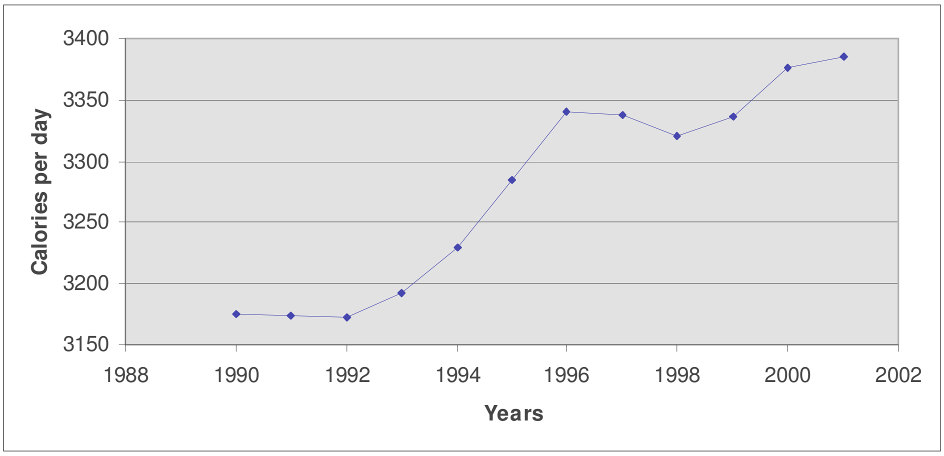


Figure 4.3 Food Intake in Egypt: Calories, 1990-2001

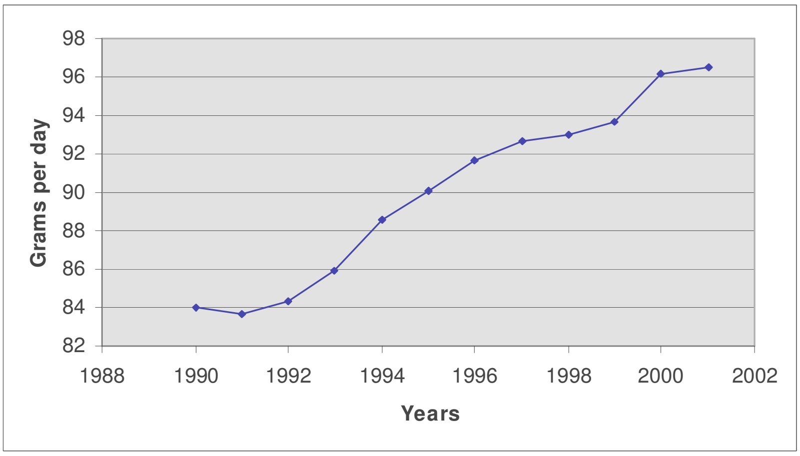


Figure 4.4 Food Intake in Egypt: Proteins, 1990-2001

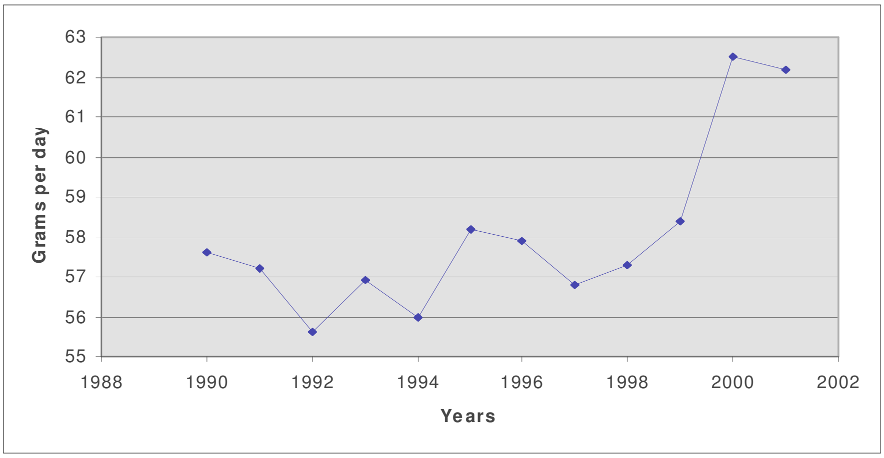


Figure 4.5 Food Intake in Egypt: Fats, 1990-2001

Source: FAO, Food Balance Sheets, Egypt Country, 1990-2001.

The increase in cereal consumption in Egypt may be due to the wide use of cereals in producing animal fodder in light of the increase in prices of animal products.

On the other hand, although the consumption of other food groups has relatively improved, it is still below the defined averages in developed countries. The low level of consumption of meat and its products is due to the low return of resources devoted to animal production, which, in turn, depends on the low purchasing power of the vast majority of the population.

As a whole, there was an increase in the intake of calories from 3,285 in 1995 to 3,385 in 2001. The amount of protein intake also increased from 90.1 gram/day in 1995 to 96.5 gram/day in 2001, so did the intake of fat, which increased from 58.2 gram/day to 62.2 gram/day over the period.

Currently, the major sources of calories are plant-based products, representing over 92 % of the total calories consumed per capita per day in 2001. Cereals, with the highest calorie share, contribute to 66.42 % and 63.04 % of the total calorie availability in 1995 and 2001, respectively. This indicates that cereals are relatively inexpensive sources of calories.

Non-staple plant foods account for 26.91 % and 28.87 % of the total calorie availability in the two years, respectively. Animal and fish products make up only 6.67 % and 8.06 % of the total calorie availability in 1995 and 2001, respectively, indicating that animal and fish products are relatively expensive sources of calories.

Table 4.4 Estimated Consumption of the Commodities in Egypt, 1995 and 2001

Products	Per capita supply/day 1995							Per capita supply/day 2001						
	Kg/year	Calories	%	Protein (grams)	%	Fat (grams)	%	Kg/year	Calories	%	Protein (grams)	%	Fat (grams)	%
Grand total		3,285	100.00	90.10	100.00	58.20	100.00		3,385	100.00	96.50	100.00	62.20	100.00
Vegetable products		3,066	93.33	75.50	83.80	41.60	71.48		3,111	91.91	76.80	79.59	42.40	68.17
Cereals	243.70	2,182	66.42	60.70	67.37	15.40	26.46	236.00	2,134	63.04	59.10	61.24	15.80	25.40
Beans & Starchy	32.50	127	3.87	6.50	7.21	0.40	0.69	32.90	139	4.11	7.30	7.56	0.50	0.80
Sugar & Sweeteners	53.70	306	9.32	0.20	0.22	0.10	0.17	70.70	334	9.87	0.40	0.41	0.10	0.16
Oils	13.00	222	6.76	1.40	1.55	24.00	41.24	14.00	220	6.50	2.00	2.07	23.50	37.78
Vegetables	145.80	86	2.62	4.20	4.66	0.70	1.20	176.70	108	3.19	5.20	5.39	0.80	1.29
Fruits	84.90	132	4.02	1.70	1.89	0.70	1.20	92.70	160	4.73	2.00	2.07	0.80	1.29
Others	2.50	10	0.30	0.70	0.78	0.30	0.52	2.60	15	0.44	0.80	0.83	0.90	1.45
Alcohol	0.60	1	0.03	0.10	0.11	0.00	0.00	1.00	1	0.03	0.00	0.00	0.00	0.00
Animal products		219	6.67	14.50	16.09	16.60	28.52		273	8.06	19.70	20.41	19.90	31.99
Red meat & Poultry	24.10	140	4.26	8.00	8.88	11.60	19.93	29.40	163	4.82	10.30	10.67	13.30	21.38
Fish	8.40	15	0.46	2.40	2.66	0.70	1.03	15.30	27	0.80	4.30	4.46	1.10	1.77
Eggs	2.20	8	0.24	0.70	0.78	0.60	1.03	2.30	9	0.27	0.70	0.73	0.60	0.96
Milk & its products	40.00	56	1.70	3.40	3.77	3.70	6.36	51.00	74	2.19	4.40	4.56	4.90	7.88

Source: FAO, Food Balance Sheets for Egypt Country, 1995 and 2001.

The amount of protein intake is 96.5 gram/capita/day in 2001. But, as a percent of protein, plant-based products are the major source of this component constituting 76.8 % of the total protein availability in 2001. The amount of protein from meat available per capita per day is only 10.3 grams. This is very low in comparison to its share in other countries and due to the high cost of meat as source of protein.

Fat is an expensive commodity. The amount of fat intake derived from meat and its products is only 13.3 gram/capita/day.

Consumption of too little quantities of animal products affects the health of adults and children. *Iron deficiency anaemia* is the most serious micronutrient deficiency in Egypt. The Egyptian Demographic and Health Survey (EDHS) 2000 (the first in the EDHS series to measure haemoglobin levels) reports anaemia prevalence rates of 45 % among pregnant women, 32 % among lactating women, and 26 % among non-pregnant, non lactating women of childbearing age. Almost 30 % of preschool children are anaemic, a figure that rises to 38 % in rural Upper Egypt. High prevalence rates suggest the need for expanding the scope of iron supplementation, nutrition awareness, and iron fortification programs. At present, most iron supplementation efforts are focused on pregnant/lactating women and preschool children.

Stunting still affects almost one in five children under the age of five years and there are significant regional variations in its extent. For example, while stunting affects only 8.5 % of children in urban governorates, the prevalence is 27.2 % in rural Upper Egypt (CCA, 2001, p. 29).

The incidence of low birth weight is a proxy indicator of maternal nutrition, which has a significant influence on a child's future health, development, and growth. A national study conducted by the Ministry of Health and Population (MOHP) shows that the incidence rate of low birth weight was 12.9 % in 1997 and the Egyptian Demographic and Health Survey (EDHS) reported this rate as 10.1 % in 2000.

4.5 Indicators of Food Security in Egypt

This section discusses indicators of food security in Egypt such as dietary diversity, nutritional indicators, income poverty, and the inequality in income distribution.

4.5.1 Dietary Diversity

Dietary diversity is generally recognized as a key component of high-quality diets. It can be defined as the number of different foods or food groups consumed over a given reference period (Drewnowski, 1997, p. 268; Bernstein *et al.*, 2002; and Thiele and Weiss, 2003, pp. 99-115). Consuming a wide variety of foods is often promoted to enhance the chances of achieving an adequate diet, lessen the risks of developing a deficiency or excess in any one nutrient, ensure an appropriate balance of micronutrients as well as energy from fat, and reduce the likelihood of exposure to excessive amounts of contaminants. Food variety can also be important in protecting against chronic diseases (Randall *et al.*, 1985, pp. 830-836; Krebs-Smith *et al.*, 1987, pp. 897-903; and Hatloy *et al.*, 1998, pp. 891-898). Therefore, increasing the variety of foods is recommended by most nutritionists and dietary guidelines in the United States (FNIC, 2000) as well as internationally (FAO and WHO, 1996). In addition, from a macroeconomic point of view, the expanding variety of consumption plays an important role in the process of long-run growth and development (Thiele and Weiss, 2003, pp. 99-115)

Lack of dietary diversity is a particular problem among poor populations because their diets are predominantly based on starchy staples with little animal products and few fresh fruits and vegetables.

Few studies have specifically addressed the association between dietary diversity and food security. Hoddinott and Yohannes (2002) examined whether household dietary diversity was associated with household per capita consumption (a proxy for household income) and energy availability (a proxy for food security). They also tested whether household dietary diversity was associated with individual food intake. This study draws on data from ten countries, among which is Egypt. The dietary diversity was measured as the sum of individual foods consumed in the previous seven days. Household per capita consumption was measured by a consumption/expenditure instrument, which estimated the value of consumption of food and non-food during the previous days. Household energy consumption was derived from the information on food consumption/expenditures in the same interval. The individual dietary intake was measured by a quantitative 24-hour recall. This study used linear regression techniques and derives elasticities, i.e., the percentage increase observed in the outcome as dietary diversity increases by a fixed percentage. It is found that 1 % increase in dietary diversity is associated with an average 1 % increase in per capita consumption/expenditure and a 0.7 % increase in total per capita energy availability. When separating energy from staples and non-staples, it is found that a 1 % increase in dietary diversity is associated with a 0.5 % increase in household energy availability from staples and a 1.4 % increase in energy availability from non-staples. These results indicate that as households diversify their diets, they tend to increase their consumption of non-staple foods rather than increase of staple foods.

Therefore, it is important that a number of different nutrient sources be consumed and efforts should be made to encourage consumption of a wide variety of foods to improve the nutritional quality of the diet and health of the population.

4.5.2 Nutritional Indicators

Egypt has achieved good progress towards improving the nutritional indicators in 2001. Based on data from the Egyptian Human Development Reports (EHDR) conducted by UNDP, the nutritional status of children has improved, through decreasing the prevalence of child malnutrition indicator (percent of children under 5 years) from 10.7 % in 1998 to 8.8 % in 2001, and by reducing the child mortality rate.
The following Table shows that malnutrition still constitutes a serious problem for children in Egypt. However, over the same period, health status of Egyptian women has improved by dropping the maternal mortality rate in 2001 to 60.7.

Table 4.5 Progress towards Selected Nutritional Indicators

Indicator	1998	2000	2001
Under 5 mortality rate (per 1000)	42.1	43.0	39.1
Infant mortality rate (per 1000 live births)	29.2	37.0	30.0
Prevalence of child malnutrition (Percent of children under 5)	10.7	4.0*	8.8
Maternal mortality rate (per 100,000 live births)	96.0	90.5	60.7

Source: UNDP, Egypt Human Development Reports, 2001-2003.

(*) World Bank, World Development Indicators, Database, August, 2003.

The incidence of low birth weight is a proxy indicator of maternal nutrition, which has a significant influence on a child's future health, development and growth. The Egyptian Human Development Report conducted by UNDP shows that this rate in 2000 was less than 10.1 % (EHDR, 2003).

4.5.3 Income Poverty Situation

Household food insecurity is closely related to poverty and under-nourishment. Malnutrition is not the only feature of low-income, but it is often associated with poverty, higher incidence of child mortality, lower education levels, poor housing conditions and limited access to basic services of water and sanitation.

The ILO used the cost of basic needs method to construct food poverty line[11] in Egypt for urban and rural areas. It also shows regional poverty lines for Lower and Upper Egypt. The differences observed in the poverty lines reflect different costs of obtaining minimum consumption bundles in Egypt's regions or reflect spatial price differences. Table 4.6 shows food and regional poverty lines for urban and rural areas in 1999/2000 based on the ILO report.

Table 4.6 Regional Poverty Lines (LE/capita), 1999/2000

Region	Food poverty line	Regional poverty lines	
		Upper Egypt	Lower Egypt
Urban	902.0	952.9	1,297.0
Rural	707.0	1,324.6	955.0

Source: ILO Report, Poverty, Employment and Policy-making in Egypt, A Country Profile, 2001.

In the ILO report, the poverty indices[12] are estimated. Table 4.7 shows poverty estimates for Egypt and its regions in 1999/2000. The incidence of poverty for Egypt as a whole amounted to 20.15 % of the total population by using the Lower poverty line. Thus, almost 12 million individuals in Egypt could not satisfy their basic food and non-food needs. The poverty gap index was 3.78 %. Using the Upper poverty line, overall poverty in Egypt results in 49.63 % of the total population, constituting about 32 million individuals.

[11] The food poverty line is the construction of a minimum food basket, which can be anchored to some normative nutritional requirements (see, Datt, Jolliffe, and Sharma, 1998).

[12] There are three poverty indices: The head-count, poverty gap, and squared poverty gap. All three poverty measures are members of the Foster-Greer-Thorbecke (FGT) class. The FGT measure of individual poverty is $p_{\alpha,i} = [\max(1 - x_i / z), 0]^{\alpha}$ $\alpha \geq 0$ in which x_i is the consumption level of the i person in a population of size n, z denotes the poverty line, and α is a parameter. Aggregate poverty is simply the mean of this measure across all persons, giving $P_\alpha = \sum_{i=1}^{n} p_{\alpha,i} / n$.

The head-count index (P_0) is obtained when $\alpha = 0$. It is the percentage of the population in households with a consumption per capita less than the poverty line. This index measures the incidence of poverty.

The poverty gap index (P_1) has $\alpha = 1$, and is defined by the mean distance below the poverty line expressed as a proportion of that line, where the mean is formed over the entire population, counting the non-poor as having a zero poverty gap. This measure reflects the depth of poverty, as well as its incidence.

The squared poverty gap index (P_2) is obtained when $\alpha = 2$, and is defined as the mean of the squared proportionate poverty gaps. This measure reflects the severity of poverty, because it is sensitive to distribution among the poor (Datt, Jolliffe, and Sharma, 1998).

Table 4.7 Regional Poverty Measures (%), 1999/2000

Region	Lower poverty line			Upper poverty line		
	P_0	P_1	P_2	P_0	P_1	P_2
All Egypt	20.15	3.78	1.15	49.63	14.52	4.91
All urban	18.44	3.89	1.31	46.07	16.81	5.43
All rural	21.41	3.69	1.03	52.27	12.82	4.52
Metropolitan	9.01	1.69	0.54	31.26	7.98	2.92
Lower urban	17.93	2.99	0.88	57.87	15.45	5.61
Upper urban	36.33	8.85	3.18	69.26	25.02	11.47
Border urban	10.38	1.65	0.45	35.90	9.07	3.20
Lower rural	11.26	1.38	0.30	44.62	8.66	2.60
Upper rural	34.68	6.72	1.98	69.13	20.37	8.04
Border rural	11.23	1.40	0.28	36.50	7.98	2.48

Source: ILO Report, Poverty, Employment and Policy-making in Egypt, A Country Profile, 2001.

P_0 The head-count index P_1 The poverty gap index

P_2 The squared poverty gap index

Poverty is still higher in rural areas than in urban areas. 42.67 % of the population live in Metropolitan and urban areas and among those 18.44 % are poor. In rural areas 21.41 % are poor. Generally, there is an improvement in the incidence of poverty in Egypt; it has decreased in urban areas, from 20.3 % in 1990/91 to 18.44 % in 1999/ 2000, and it also declined in rural areas from 28.6 % in 1990/91 to 21.41 % in 1999/ 2000 (ILO). Despite this positive development of poverty indicators at the national level, poverty and food insecurity still exist in Egypt.

There are regional differences in the incidence of poverty as shown also in Table 4.7. It is still concentrated in particular in both rural and urban Upper Egypt. Using the Lower poverty line, urban Upper region has the greatest incidence, depth, and severity of poverty indices (36.33 %, 8.85 %, and 3.18 %, respectively), followed by rural Upper Egypt (34.68 %, 6.72 %, and 1.98 %, respectively). The incidence of poverty is the lowest in Metropolitan region (9.01 %), and Lower Egypt has an intermediate level of poverty.

4.5.4 Inequality in the Distribution of Consumption Expenditures

The distribution of income (or expenditure) is one of the main features of the social system implying on an individual’s feelings of belonging to and participating in a society and of social division within the society. A high income inequality measure says that an important part of society does not participate equally in socio-economic life. Various measures of inequality try to express in different ways a degree of inequality, some of them are directly based on the Lorenz curve and others not.

The Lorenz curve is a tool in the analysis of the distribution of income. It is defined as the relationship between the cumulative portion of income received and the cumulative portion of income receiving units, and falls below the equality line.

The Gini coefficient is the most widely used measure of inequality based on the Lorenz curve. It is defined as the area between the equality line and the Lorenz curve divided by the total area below the equality line (Berhanu, 1999, pp. 64-66). As shown in Figure 4.6, the Gini coefficient is calculated as:

$$G = \frac{x}{x + y}$$

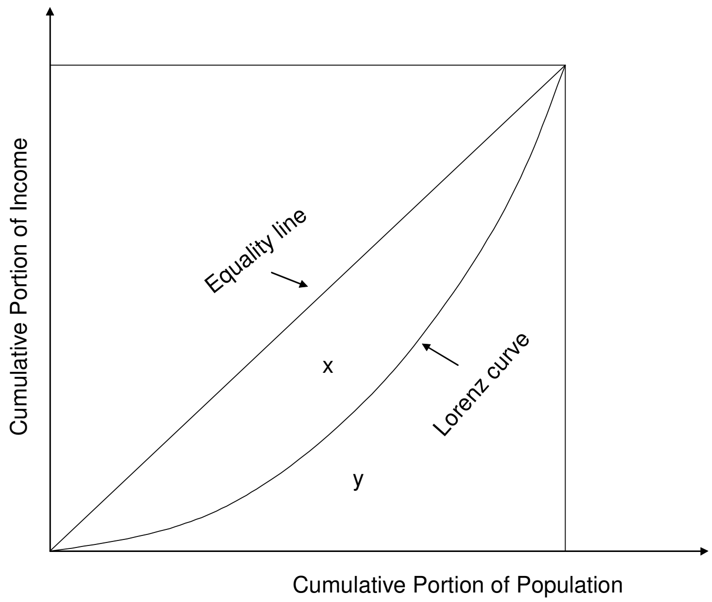


Figure 4.6 Lorenz Curve

Theoretically, the Gini coefficient can range from “zero” for perfect equality, where every person in the society has the same income, to “one” for perfect inequality where one person gets all the income and the rest receives nothing. Thus, higher values of the Gini coefficient indicate higher degrees of inequality in the distribution of the relevant attribute.

In this section, the expenditure inequality in Egypt is examined by using the Gini coefficient based on data from the last four household income, expenditure, and consumption surveys (HIECS) for the years 1981/82, 1990/91, 1995/96, and 1999/2000, conducted by (CAPMAS). A detail calculation of the Gini coefficients is given in the Appendix B from Table 1 to Table 8. It is found that urban inequality was consistently smaller than rural inequality.

Table 4.8 presents the trends in the distribution of expenditure from 1981/82 to 1999/2000 according to the Gini coefficient. A declining trend has been observed over the all periods, especially after 1981/82, where there is a decrease in the Gini coefficient in rural Egypt from 0.75 in 1981/82 to 0.42 in 1999/2000.

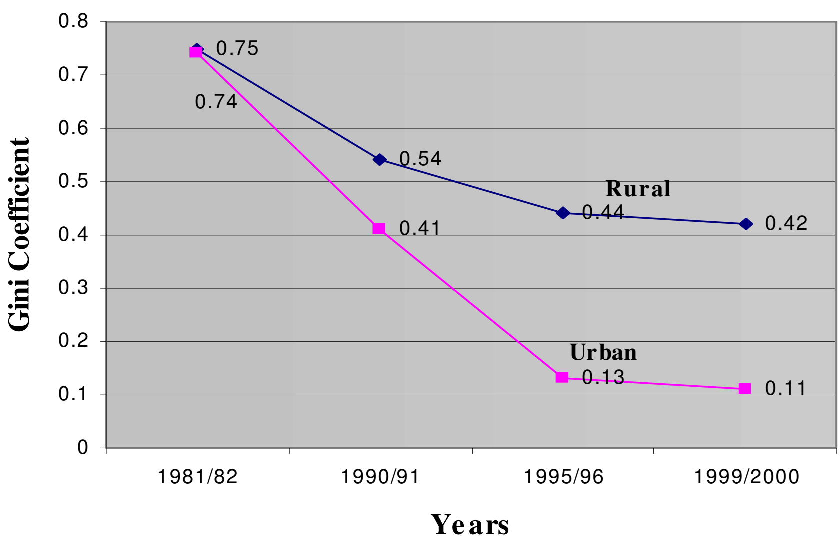
The urban coefficient exhibits a clearly declining trend from 0.75 in 1981/82 to 0.11 in 1999/2000, as shown in Figure 4.7. By calculating absolute decline and the annual growth rate of change in the Gini coefficient, Table 4.8 also shows that the inequality has decreased for urban areas by a rate of 0.64 % and at a significant annual decrease rate of 62.85 %. For rural areas, the inequality also decreased by 0.33 %, with a significant annual rate of 20.57 %.

Table 4.8 Trends in the Distribution of Expenditure (Gini Coefficient)

Year	Rural	Urban
1981/82	0.75	0.74
1990/91	0.54	0.41
1995/96	0.44	0.13
1999/2000	0.42	0.11
Change in Gini coefficient	-0.33	-0.64
Annual rate of change in Gini coefficient	-20.57	-62.85

Source: CAPMAS, HIECS, Various Issues.

Among the factors, which explain the decline in the incidence of inequality are the liberalisation policies accompanied by an improvement in socio-economic indicators and public expenditure policies favouring the poor such as the food subsidies programs.



Source: EHIECS, CAPMAS, Various Issues (1981/82-1999/2000).

Figure 4.7 Distribution of Expenditure (Gini Coefficient): 1981/82-1999/2000

4.6 The Food Subsidy System in Egypt

The Egyptian Government protects those who are unable to receive sufficient income through their own efforts. Assistance occurs through many channels including **direct assistance** to the poor through the Ministries of Insurance and Social Affairs (MISA); free education and literacy programs through the Ministry of Education and the General Authority for Literacy and Adult Education; free health care through local health units and hospitals of the Ministry of Health. The Government of Egypt has operated a **Food Subsidy Program**, which provides all the population with a subsidy on bread and other commodities. The MISA runs essentially two sets of programs. The first are the **Social Assistance Programs (SAP)**, which provide limited household allowances and cash transfers to poor families who do not have recourse to the labour market for income whether due to old age, disability, or because the family is headed by a woman with limited employment opportunities. In addition loans are granted at subsidised interest rates to finance small income-generating activities. The second are the **Social Insurance Programs (SIP)**, which provide payments to former workers with funds coming from employer and employee contributions. They also include some non-contributory schemes. The Social Fund for Development and the Ministry of Rural Development are implementing new social programs (**Community Development Program**, **Human Resources Development Program** and **the Public Works Program**) to help new graduates, unemployed youth and female-headed households.

The most effective and the largest social safety net program in Egypt is the food subsidy program covering *baladi* bread and a limited amount of basic foods distributed through ration cards. It is also an expensive way to improve food security in Egypt.

Section 4.4.2 showed a high level of calories and proteins consumption in Egypt. One important reason for this is that it has been the Government's commitment to ensure national food security by providing sufficient food to the whole population through food subsidy programs. Food subsidies came to be seen as both a safety net to protect the poor, as well as an important tool in the promotion of social equity. Generally, Egyptian food subsidies are widely credited with guaranteeing affordable staples to the population and helping to reduce infant mortality and malnutrition (World Bank, 1995).

As previously noted, the most important staple food in Egypt is wheat flour used in the making of bread or rice in addition to other foods commonly consumed such as maize, vegetables, fruits, vegetable oils, milk, meat, fish, and eggs.

The subsidy system covers four food commodities: bread, wheat flour, sugar, and cooking oil. Bread and wheat flour subsidies were not designed to serve the poor alone, since these foods are available to consumers of all income levels without restrictions. In contrast to bread and flour subsidies, sugar and cooking oil subsidies are explicitly designed to be targeted. They are available on a monthly quota basis to most Egyptian households through a ration card system. In principle, there are two types of ration cards, green and red. The green card has a high subsidy rate (full) for low-income households, while the red card has a low subsidy rate (partial) for higher income households.

Each year, representatives from MFTS (which has the overall responsibility for managing the food subsidy system), MALR, the Ministry of Finance and the Ministry of Enterprises form a program committee that determines the quota of subsidised foods that is to be delivered to each region and its governorates. The committee's assessment is based on the annual Needs Plan, which is essentially calculated by extrapolating past usage based on population growth.

In fact, Egypt has quietly reformed its food subsidy system over the years. Based on data from the country report 2002 (Abd El-Fattah, 2002), the overall subsidy for different food items is described in Table 4.9. The percentage of food subsidy costs to governmental expenditure has declined from 6.3 % in 1995/96 to 4.5 % in 1999/2000, which represented 2.20 % and 1.53 % of GDP, respectively. The government and various stakeholders agree that the system's costs can be further reduced and its efficiency improved by better targeting the needy.

Bread and wheat flour, which are subsidised at the highest rate, account for more than 64 % of the total subsidy cost in 1995/96 and increased to 66.26 % in 1999/2000. The provision of subsidised bread and wheat flour, major components of Egypt's food subsidy system, has been a particular challenge to the government. Egypt's self-sufficiency in wheat has been low (54.75 % in 2001)[13], leaving Egyptian food security vulnerable to swings in international wheat prices and stocks. Currently, Egypt is one of the world's top wheat importers, and growing wheat imports use scarce foreign exchange reserves.

[13] Based on estimation of food balance sheet for Egypt Country, FAO, 2001.

Table 4.9 Development of Food Subsidy System in Egypt (1995/96-1999/2000) in LE* Million

Year	Bread and Flour	Sugar	Food oils	Total	% of Subsidy to governmental expenditure	% of subsidy to GDP**
1995/96	2,185.0	590.0	600.0	3,375.0	6.3	2.20
1996/97	2,866.0	608.0	575.0	4,049.0	5.4	1.69
1997/98	2,520.0	575.0	615.0	3,924.0	5.5	1.55
1998/99	2,460.0	784.0	620.0	3,864.0	5.3	1.44
1999/2000	2,861.0	799.0	658.0	4,318.0	4.5	1.53

Source: Abd El-Fattah, M., "Development and Agri-food Policies in the Mediterranean Region, Country Report, Egypt, Cairo, July 2002.

(*) LE = Egyptian pound (100 Piasters).

(**) As a percent of GDP that conducted by Central Bank of Egypt, Various Years.

The rate of the subsidy per unit relative to the actual cost has been estimated at 57.6 % for bread in 1999/2000. It has been about 56.4 % for cooking oil for the full subsidy card, 32 % for sugar for the partial subsidy and 55.5 % for sugar for the full subsidy card. Table 4.10 shows the percent subsidy to the actual cost of subsidised food commodities in 1999/2000.

An IFPRI study (Bouis *et al.*, 2001) showed that the regional allocation of food subsidies is still not sensitive to the regional distribution of population (urban and rural areas) and the regional distribution of poverty. There is a strong urban bias in the allocation of food subsidies in Egypt. At the time of the 1996 census, 57 % of the population lived in rural areas, but only 30 % of the total food subsidies were allocated to rural areas (IFPRI, 2001).

Table 4.10 The Cost of Subsidised Food Commodities Per Unit, Subsidised Price Per Unit and Percentage of Subsidy Per Unit to Actual Cost, in 1999/2000

Food Commodities	Cost/ unit	Subsidised price/unit	% of subsidy/ unit to cost
Bread (Piasters/loaf)	11.80	5.00	57.60
Wheat flour LE/Kg	1.10	0.55	50.00
Sugar (green cards - full subsidy) LE/Kg	1.25	0.60	55.50
Sugar (red cards - partial subsidy) LE/Kg	1.25	0.85	32.00
Food oil (green cards - full subsidy) LE/Kg	2.75	1.20	56.40
Food oil (red cards - partial subsidy) LE/Kg	2.75	1.70	38.20

Source: Abd El-Fattah, M., "Development and Agri-food Policies in the Mediterranean Region, Country Report, Egypt, Cairo, July 2002.

A major reason for the difference in the allocation of benefits to urban and rural regions is that much higher subsidised *baladi* bread quantities are made available to urban areas. This may be due to many rural households producing wheat and other staple foods (maize). Therefore, they are perceived to depend less on purchased food staples than do their urban counterparts. Table 4.11 shows that the shares of total food subsidy benefits received by consumers in the five regions of Egypt correspond closely to the regional population shares and the regional distribution of poverty.

Table 4.11 Distribution of Food Subsidy Benefits and Poverty, by Region, 1997

Region	Share of total allocation of food subsidy benefits	Share of total benefits received by consumers	Population share	IFPRI poverty measure			
				Head-count poverty P_0	Distribution sensitive poverty P_2	Contribution to total poverty	
						P_0	P_2
Metropolitan	28.6	22.7	18.8	26.1	2.4	18.5	17.9
Lower urban	20.8	15.5	12.2	24.2	2.0	11.1	9.3
Lower rural	13.3	25.1	31.9	27.0	2.7	32.5	33.2
Upper urban	20.4	13.1	11.7	17.1	1.5	7.5	6.9
Upper rural	16.9	24.1	25.3	31.7	3.3	30.3	32.7
Egypt	100.0	100.0	100.0	26.5	2.6	100.0	100.0

Source: IFPRI, the Egyptian Food Subsidy System, Research Report 119, 2001.

From this Table, it is observed that the regional allocation of food subsidies is not sensitive to the regional distribution of poverty. The urban regions (Metropolitan, Lower, urban, and Upper urban) accounted only for 37.1 % of total poverty in Egypt in 1997, but they received 69.8 % of total food subsidy allocations. However, rural areas in Lower and Upper Egypt, which received only 30.2 % of total subsidy allocations, accounted for 62.8 % of total poverty.

The shares of total food subsidy benefits received by consumers are different from the shares of total allocation of food subsidy benefits. This difference can be due to bakeries producing subsidised *baladi* bread being highly concentrated in urban areas. Therefore, the allocation of subsidised wheat flour to urban bakeries is much greater. Urban areas, on average, have about 30 bakeries per 100,000 urban populations, while rural areas have only 9 bakeries per 100,000 rural populations. However, many rural residents purchase subsidised *baladi* bread from outlets located in their neighbouring urban centres. Therefore, the purchased quantity of subsidised *baladi* bread by rural consumers is higher than the allocation of wheat flour to rural bakeries for subsidised *baladi* bread production.

Generally, several factors reduce the effectiveness of the subsidy system in providing benefits to the poor:

- The untargeted food subsidy system including subsidised *baladi* bread and wheat flour is intended to be available to all households. However, because it provides benefits to the non-needy as well as to the needy, it can be an expensive way to improve food security and the nutritional status of the poor people.
- Rationed sugar and cooking oil subsidies are available only to those with ration cards, but some wealthier Egyptians carry the higher-subsidy green ration cards, and some of the poorest households hold red cards or no ration card at all.
- In addition, the geographical allocation of subsidies is biased toward urban areas. It seems likely that there is scope for improvement in the distribution of benefits from the ration card system.

According to a study conducted and published by the Food Consumption and Nutrition Division of the International Food Policy Research Institute, it is found that the food subsidy system is effective as a social equity tool and the results indicate that the system only classified 16.3 % of the actual needy as non-needy (IFPRI, 2002).

A policy reform might seek to provide a ration-card safety net only to the actual needy (poor) and reduce the benefits to the non-needy, where improvements in Egypt's social safety net are important in the country's war on poverty.

4.7 Conclusions

This chapter is based on data from food balance sheets compiled by the FAO, to examine the state of food security in Egypt at the macro level in terms of domestic supply, and at the micro level in terms of per capita food supplies. These are expressed in terms of quantity and also in terms of caloric value, protein, and fat content. It also shows Egyptian food intakes in comparison to developed countries and developing countries in 2001. This chapter discussed several factors as indicators of food security in Egypt such as dietary diversity, nutritional indicators, income poverty, and inequality in the distribution of income. Finally, it discusses the food subsidy system in Egypt.

In 2001, Egypt produced more than sufficient quantities of several food items namely rice, potatoes, vegetables, and fruits. Despite impressive gains in the production of strategic food crops, Egypt remains one of the major importing countries with a food import dependency ratio of 23.8. It is far from being self-sufficient in food importing wheat, lentils, sugar, meat, and oils.

There is a marked difference at the present time in attitudes towards food consumption and nutritional standard between the people of the Egypt and other countries. Egypt recorded the highest calorie intake followed by developed countries. However, developed countries recorded the highest protein intake and this is followed by Egypt. But, it is observed that the major sources of calories and proteins in Egypt are plant-based products. The diets in Egypt are characterised by a low intake of fat, since of all basic foodstuffs, fat is one of the most expensive.

Generally, it could be said that there are three main indicators, which determine the changes in per capita food consumption patterns. They are the cereal-calorie ratio, cereal-protein ratio, and livestock-protein ratio. In a normal development path with increasing incomes, the cereal-calorie ratio and the cereal-protein ratio will decline whereas livestock-protein ratio will increase. It is observed that the cereal-calorie ratio has declined from 66.42 in 1995 to 63.04 in 2001. Also, the cereal-protein ratio has declined from 67.37 in 1995 to 61.24 in 2001. However, the meat-protein ratio has increased from 8.88 in 1995 to 10.67 in 2001 and the animal-protein ratio including in addition to meat, fish, eggs, and milk has increased from 16.09 in 1995 to 20.41 in 2001.

By considering the factors associated with the incidence of food insecurity and food insufficiency, it is found that:

- Household dietary diversity is associated with household per capita consumption (a proxy for household income) and energy availability (a proxy for food security) from staples and non-staples. It is also found also that as households diversify their diets, they tend to increase their consumption of non-staple foods rather than staple foods.
- Egypt has achieved good progress towards improving the nutritional indicators in 2001. The nutritional status of children has improved through decreasing the prevalence of the child malnutrition indicator and reducing the child mortality rate. However, malnutrition still constitutes a serious problem for the children in Egypt.
- There is an improvement in the incidence of poverty in Egypt. It is still concentrated in rural areas while poverty is relatively low in urban areas. 42.67 % of the population reside in Metropolitan and urban areas, among which 18.44 % poor. This goes a long way to explain the relatively low national poverty rate. Despite the positive effect of food security on a national level, poverty and food insecurity still exist in Egypt.
- According to the Gini coefficient, there is a declining trend in the inequality in the distribution of expenditures over all periods, especially after 1981/82, resulting from

liberalisation policies accompanied by an improvement in socio-economic indicators and public policies favouring the poor such as food subsidies programs. There is a decrease in the Gini coefficient in rural Egypt from 0.75 in 1981/82 to 0.42 in 1999/2000 by 0.33 at a significant annual rate of 20.57 %. The urban coefficient exhibits a clear decreasing trend from 0.75 in 1981/82 to 0.11 by 0.64 and at a significant annual rate of 62.85 %.

The most effective and the largest social safety net program in Egypt is the food subsidy program covering *baladi* bread, wheat flour and a limited amount of basic foods (sugar and cooking oil) distributed through ration cards. The untargeted food subsidy program provides benefits to the non-needy as well as the needy, it can be an expensive way to improve food security and the nutritional status of the poor. It is found that the food subsidy system is generally effective in improving social equity, only 16.3 % of the actual needy as non-needy are classified, because it benefits equally all income categories.

CHAPTER 5

DESCRIPTIVE ANALYSIS OF FOOD CONSUMPTION AND EXPENDITURE PATTERNS IN EGYPT

5.1 Introduction

Egypt can be divided into several regions according to both the geographical distribution and the approximation of the average per capita expenditure share in each food commodities group based on data from the Household Income, Expenditure, and Consumption Survey (HIECS) conducted by CAPMAS in 2000.

Data of the most recent survey was collected from October 1999 to September 2000. The results were published in December 2000. This is the largest survey of its kind conducted in Egypt. The total sample consisted of 47,949 households, of which 28,754 were located in urban and 19,195 in rural areas.

This chapter presents the structure of food consumption and expenditure patterns for the selected food groups in the rural and urban regions of Egypt. An expenditure share measures the proportion of income devoted to a particular food group relative to total food expenditure. The objective is to find out the main components of food consumption and food expenditure in rural and urban Egypt. The expenditure shares will reveal what items constitute the major portion of per capita expenditure.

5.2 Conceptual Framework

5.2.1 Definition of Egypt Regions

Administratively, Egypt is divided into 27 governorates. The four urban governorates have no rural population. Each of the other 23 governorates has both urban and rural areas. Nine of these governorates are located in the Nile Delta (Lower Egypt), four in Middle Egypt and five in Upper Egypt. The five frontier governorates are located on the eastern and western boundaries of Egypt. The governorates comprising each region are described as follows;

- Rural areas include four main regions: Lower Egypt (Damietta, Dakahlia, Sharkia, Qalyoubia, Kafr EL-Sheikh, Gharbia, Monoufia, Behera, and Ismailia), Middle Egypt (Giza, Beni Suef, Fayoum, and Menia), Upper Egypt (Assiut, Souhag, Qena, Aswan, and Luxor), and Frontier Egypt (Red Sea, New Valley, Matrouh, North Sinai, and South Sinai).

- Urban areas include five main regions: Metropolitan areas (Cairo, Alexandria, Port Said, and Suez), Lower Egypt (Damietta, Dakahlia, Sharkia, Qalyoubia, Kafr EL-Sheik, Gharbia, Monoufia, Behera, and Ismailia), Middle Egypt (Giza, Beni Suef, Fayoum, and Menia), Upper Egypt (Assuit, Souhag, Qena, Aswan, and Luxor), and Frontier Egypt (Red Sea, New Valley, Matrouh, North Sinai, and South Sinai).

This chapter analyses the structure of food consumption and expenditure patterns in Egypt with special emphasis on the difference between rural and urban areas and within rural and urban regions across governorates.

5.2.2 Definition of Food Groups

This chapter concentrates on ten food commodity groups, which include: cereals, beans, vegetables, fruits, meats, fish, eggs, milk and its products, oils & fats, and sugar and its products.

The decision to break down the commodities into these groups is based on the pattern of the Egyptian diet and the available data. Each food group includes those commodities that have similar nutritional value and whose prices are very likely to move in tandem. Hence there should be no serious aggregation problem. Every set of representative commodities is a subset of the corresponding commodity group. For example, the cereals group comprises many goods including wheat, maize, and rice. The representative commodities, generally speaking, are the most common foodstuffs in the Egyptian diet.

5.3 Food Consumption and Expenditure Patterns in Rural Regions

This section considers how consumption and expenditure patterns vary across regions and across governorates within the same region. The expenditures on the selected food groups are divided into the shares of plant products including cereals, beans, vegetables, fruits, oils & fats, and sugar groups, and into shares of animal products, which include meats, fish, milk and its products, and eggs. The average food consumption quantity is calculated for each food commodity group and for each region at the rural level. The same analysis is then applied to each food group to see the expenditure pattern.

5.3.1 Lower Egypt

Table 5.1 shows average per capita food consumption and per capita food expenditure on different food commodity groups for Lower rural Egypt. The average per capita food expenditure on aggregate food groups is 701.93 LE/year, of which 56.73 % are allocated to plant and 43.27 % to animal products. The high expenditure share of animal products reflects a high price, while the high expenditure share of plant products reflects a high consumption level. As shown in Table 5.1, the average expenditure on meat products at the regional level is 184.02 LE/year, despite the reduction of its consumption (18.99 kg/year).

Specifically, the expenditure shares of food groups at governorate level are considered. The expenditures on cereal products are much higher for the Kafr El-sheik governorate (198.44 LE/year) resulting from the high quantity consumed from these products. However, the expenditures on cereal products is higher for Ismailia governorate (146.62 LE/year), despite a low quantity (88.23 kg/year). This is probably due to the fact that price level of cereals is higher in rural Ismailia than in other governorates in Lower Egypt, resulting from reduction of cereals production.

For animal products, Damietta has a higher expenditure share (54.42 %) than the region's share (43.27 %). This means that the Egyptian consumers in this governorate tend to believe in the nutritional superiority of animal products and they are ready to spend more on these products. In general, every household would like to consume meats or fish at least once a week.

It is immediately apparent that the major quantities of food consumption for all governorates went to the cereals group. The quantities of cereals are the highest for Kafr El-sheik at 184.54 kg/year, and for other governorates, they range from 90.02 kg/year to 152.26 kg/year, except for Ismaillia 88.23 kg/year. This explains that cereals are the most important constituent of an average food basket in almost all governorates. But the lowest quantity of cereals for Ismaillia reflects the features of the natural environmental (near the Red Sea and Suez Canal) on the one hand, and the relation effect between rural and urban of Ismaillia on the other hand.

The second largest consumption quantities for all governorates are those of vegetables. They are the highest for Ismaillia at 79.83 kg/year. The lowest is for Damietta at 54.91 kg/year. The quantities for other governorates range from 58.25 kg/year to 71.29 kg/year.

Table 5.1 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Rural Lower Egypt Governorates in 2000

Food group	Damietta			Dakahlia			Sharkia			Qalyoubia			Kafr El-sheikh		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	100.66	161.00	16.97	141.76	154.52	24.15	126.83	148.61	22.74	90.02	141.25	19.15	184.54	198.44	24.61
Beans	8.45	29.76	3.14	4.58	17.26	2.70	4.79	22.53	3.45	2.63	12.54	1.70	2.95	15.34	1.90
Vegetables	54.91	81.22	8.56	58.61	79.10	12.36	61.63	90.04	13.78	66.47	94.09	12.76	67.31	92.67	11.49
Fruits	16.45	68.46	7.21	16.21	42.57	6.65	14.88	42.68	6.53	13.32	46.34	6.28	20.41	59.14	7.34
Oils	11.86	47.01	4.95	7.94	43.03	6.72	7.88	65.57	10.03	7.24	81.27	11.02	8.18	53.10	6.59
Sugar	15.98	45.03	4.75	18.23	31.99	5.00	19.08	32.25	4.93	23.45	40.04	5.43	21.34	38.63	4.79
Total plant products		432.48	45.58		368.47	57.58		401.68	61.46		415.53	56.34		457.32	56.72
Meats	27.04	255.95	26.97	18.89	161.41	25.22	16.58	153.46	23.48	23.30	203.02	28.88	23.58	196.97	24.43
Fish	17.86	133.36	14.05	11.93	46.51	7.27	8.94	40.80	6.24	1.11	28.7	3.89	16.61	71.01	8.81
Eggs	5.78	25.55	2.69	4.03	17.74	2.77	4.54	20.86	3.19	5.44	24.04	3.26	5.51	22.17	2.75
Milk	25.46	101.58	10.70	16.88	45.77	7.15	15.76	36.80	5.63	20.55	56.27	7.63	30.43	58.79	7.29
Total animal p.		516.44	54.42		271.43	42.42		251.92	38.54		322.03	43.66		348.95	43.28
Total		948.92	100.00		639.90	100.00		653.60	100.00		737.56	100.00		806.27	100.00

Continued Table 5.1

Food group	Garbia			Monoufia			Behera			Ismailia			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	126.64	140.60	20.29	89.38	109.25	18.55	152.26	159.58	21.09	88.23	146.62	18.62	129.28	150.00	21.37
Beans	3.98	15.38	2.22	1.90	8.55	1.45	3.20	13.89	1.84	5.54	19.54	2.48	3.79	16.11	2.30
Vegetables	71.29	92.71	13.38	58.25	72.34	12.28	63.44	83.82	11.08	79.83	117.54	14.93	63.52	86.42	12.31
Fruits	18.92	49.38	7.13	15.30	36.04	6.12	19.16	54.12	7.15	20.70	68.67	8.72	16.96	48.06	6.85
Oils	6.68	63.08	9.11	6.77	67.36	11.44	7.56	67.53	8.92	11.83	83.16	10.56	7.72	62.40	8.89
Sugar	19.21	33.71	4.87	19.03	28.25	4.80	23.24	39.40	5.21	23.73	44.12	5.60	20.36	35.23	5.02
Total plant products		394.86	56.99		321.79	54.64		418.34	55.28		479.65	60.92		398.22	56.73
Meats	21.49	181.53	26.20	20.69	180.91	30.72	22.22	201.59	26.64	21.19	186.15	23.64	18.99	184.02	26.21
Fish	6.50	42.05	6.07	0.92	23.32	3.96	6.99	47.42	6.27	8.67	44.29	5.63	8.01	45.59	6.49
Eggs	4.96	21.95	3.17	4.86	20.53	3.49	5.54	24.19	3.20	5.01	22.66	2.88	4.96	21.68	3.09
Milk	22.60	52.41	7.56	19.58	42.43	7.20	32.37	65.25	8.62	16.92	54.62	6.94	22.38	52.42	7.47
Total animal p.		297.94	43.01		267.19	45.36		338.45	44.72		307.72	39.08		303.71	43.27
Total		692.80	100.00		588.98	100.00		756.79	100.00		787.37	100.00		701.93	100.00

Source: HIECS, CAPMAS, 2000.

Milk and its products range the third after cereals and vegetables. They are not only protein sources, but their prices - compared to prices of other food commodities - were for a long time relatively low. The consumption quantities of these products range from 19.58 kg/year to 32.37 kg/year for almost all governorates, except for Dakahlia, Sharkia, and Ismailia, where they figure around 16 kg/year.

The consumption quantity of meats is the highest for Dameitta at 27.04 kg/year. It is relatively higher for Kafr El-sheik (23.58 kg/year), Qalyoubia (23.30 kg/year), Behera (22.22 kg/year) and Ismailia (21.19 kg/year) than the region's average (18.99 kg/year), with expenditure shares of about 24.43 %, 28.88 %, 26.64 %, and 23.64 %, respectively. However, the consumption quantity is lowest in Sharkia at 16.58 kg/year.

Fish consumption shows considerable variations in its quantities. Fish is still an important food commodity for consumers in areas near the sea, where the quantities of fish are the highest for Damietta (17.86 kg/year) accounting for 14.05 % of the total food expenditure share. This reflects increases in fish production obtained from the Mediterranean Sea and Lake Manzala, in addition to contributions from aquaculture. In Damietta, there is the triangle region, which is defined by Damietta to the West, the Meditteranean Sea to the North, and Lake Manzala to the South. It comprises a triangle of low-level and reclaimed land, which has found a natural use for aquaculture, being unsuitable for other purposes. On the other hand, Menoufia has the lowest amount of fish consumed (0.92 kg/year). This is explained by a high price of fish, and so this region mainly depends on the consumption of red meat and poultry.

The consumption of fruits group averages around 18 kg/year, except for Ismailia with 20.70 kg/year because of increasing fruits production in this governorate.

5.3.2 Middle Egypt

The consumption quantities of different food commodity groups and the expenditure share spent on each of these groups are presented in Table 5.2 for the Middle rural region taken as a whole and its governorates. The total food expenditure accounts for 588 LE/year. The expenditures on plant products (329.98 LE/year) is consistently higher than for animal products (258.02 LE/year), representing about 56.12 % and 43.88 %, respectively, of the total per capita food expenditure in this region. The expenditure shares of plant and animal products in Middle Egypt decline by 17.14 % and 15.04 %, respectively, compared to Lower Egypt as may be expected due to the importance of subsistence agriculture in Middle region. The average consumption quantities of food groups correspond to the pattern observed in Egypt in general.

Table 5.2 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Rural Middle Egypt Governorates in 2000

Food group	Giza			Beni Seuf			Fayoum			Menia			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	73.89	115.92	17.80	69.71	115.52	22.82	103.41	102.10	19.75	85.11	147.31	23.32	82.08	123.94	21.08
Beans	3.04	14.86	2.28	2.42	9.40	1.86	3.23	10.60	2.05	2.67	11.96	1.89	2.81	11.89	2.02
Vegetables	62.83	83.05	12.75	37.02	46.96	9.28	42.56	57.28	11.08	41.28	60.36	9.56	46.13	62.68	10.66
Fruits	13.37	42.93	6.59	7.36	21.69	4.28	10.53	30.22	5.84	10.87	33.35	5.28	10.67	32.66	5.55
Oils	8.52	66.95	10.28	4.31	57.90	11.44	5.01	62.34	12.06	4.21	65.87	10.43	5.49	63.73	10.84
Sugar	22.86	37.59	5.77	26.73	38.09	7.52	14.96	20.63	3.99	22.68	38.88	6.16	22.24	35.07	5.97
Total plant products		361.30	55.48		289.56	57.20		283.17	54.76		357.73	56.64		329.98	56.12
Meats	20.91	195.62	30.04	16.91	162.39	32.07	18.13	164.90	31.89	19.40	197.70	31.31	19.00	183.36	31.18
Fish	2.34	21.33	3.28	1.64	18.38	3.63	8.85	33.27	6.43	2.77	18.04	2.86	3.51	21.72	3.69
Eggs	4.43	21.02	3.23	3.24	13.58	2.68	3.48	13.53	2.62	4.32	16.70	2.64	3.96	16.55	2.81
Milk	19.32	51.89	7.97	12.51	22.34	4.41	11.19	22.20	4.29	21.75	41.41	6.56	17.15	36.39	6.19
Total animal p.		289.87	44.52		216.69	42.80		233.90	45.24		273.85	43.36		258.02	43.88
Total		651.17	100.00		506.25	100.00		517.07	100.00		631.58	100.00		588.00	100.00

Source: HIECS, CAPMAS, 2000.

The individuals in Middle Egypt depend on cereals, vegetables, sugar, and milk and its products. The quantities of cereals range from 69.71 kg/year to 103.41 kg/year for almost all the governorates. This demonstrates that cereals (rice, wheat, maize, etc) have a fixed position in the Egyptian Menu.

The consumption quantities of vegetables are relatively high, around 42 kg/year for all governorates, except for Giza (62.83 kg/year). The highest quantity for Giza reflects the features of the natural environment, near the Metropolitan region (Cairo) on the one hand, and the strong relation between rural and urban areas of the Giza governorate on the other hand.

Consumption of sugar and its products is third after cereals and vegetables due to the processing sugar plants in this region. The highest quantity is observed in Beni Seuf at 26.73 kg/year. Milk and its products are important parts of breakfast and dinner of the Egyptian consumer. The quantity of milk and its products is highest in Menia 21.75 kg/year; this can be ascribed to the high home production and the low price level.

The per capita quantity of meats consumed shows that all around 19 kg/year, except for Beni Seuf at 16.91 kg/year. The expenditure shares of this group are the highest in Beni Suef at 32.07 %. They are relatively high compared to the regional average in Menia and Fayoum at 31.89 % and 31.31 %, respectively.

The quantities of fish are highest for the Fayoum governorate at 8.85 kg/year. There, fish is obtained from Lake Qarun, which accounts for one of the most important fish sources in Egypt. However, the quantities of fish for all governorates are around 2.5 kg/year. This is explained by a high price for fish and by the dependency mainly on red meat and poultry.

The consumption of fruits is relatively high as may be expected due to increasing home production in general, it varies around 11 kg/year for Giza, Fayoum, and Menia, an exception is Beni Seuf at 7.52 kg/year.

5.3.3 Upper Egypt

Table 5.3 presents the food consumption quantities of different food groups and the expenditure shares spent on these groups for rural Upper Egypt. The average expenditure on selected food groups for the Upper region taken as a whole is 575.94 LE/year, and a 16.96 % below food expenditures in Lower Egypt and a 0.21 % below Middle region of Egypt.

A similar pattern is observed in all Upper Egypt. With respect to plant products, the consumers depend on cereals, vegetables, sugar and its products, and fruits by order of importance.

Table 5.3 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Rural Upper Egypt Governorates in 2000

Food group	Assuit			Souhag			Qena			Aswan			Luxor			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	119.28	128.93	27.58	142.64	120.21	21.64	137.84	131.01	20.56	136.52	122.33	17.13	174.62	155.79	19.07	135.60	127.38	22.12
Beans	4.45	12.93	2.77	7.83	20.55	3.70	14.94	33.39	5.24	10.48	31.28	4.38	14.25	43.74	5.35	8.89	23.25	4.04
Vegetables	40.66	47.14	10.08	42.22	53.65	9.66	50.31	73.94	11.60	59.24	94.58	13.25	51.08	113.88	13.94	45.63	63.37	11.00
Fruits	8.81	18.91	4.05	13.20	30.67	5.52	10.08	36.99	5.80	8.06	40.44	5.66	11.25	76.02	9.30	10.57	31.89	5.54
Oils	3.86	44.95	9.62	3.58	53.52	9.63	5.92	57.35	9.00	9.84	44.09	6.17	6.48	65.81	8.05	4.95	51.42	8.93
Sugar	20.72	26.92	5.76	21.70	29.26	5.27	27.56	39.87	6.26	22.20	39.72	5.56	28.29	57.28	7.01	23.04	33.38	5.80
Total pl. p.		279.78	59.85		307.86	55.42		372.55	58.46		372.44	52.16		512.52	62.72		330.68	57.42
Meats	13.01	137.67	29.45	17.18	180.71	32.53	16.74	180.82	28.38	21.39	218.22	30.56	20.40	199.73	24.44	16.40	172.25	29.91
Fish	2.94	14.18	3.03	2.91	14.12	2.54	4.07	20.83	3.27	6.22	26.04	3.65	7.42	43.54	5.33	3.75	18.39	3.19
Eggs	3.09	11.01	2.36	4.26	15.32	2.76	3.42	13.11	2.06	7.33	33.10	4.64	2.52	10.22	1.25	3.93	15.02	2.61
Milk	12.95	24.79	5.30	18.70	37.51	6.75	20.91	49.91	7.83	23.27	64.25	9.00	15.45	51.12	6.26	17.66	39.61	6.88
Total ani. p.		187.65	40.15		247.66	44.58		264.67	41.54		341.61	47.84		304.61	37.28		245.26	42.58
Total		467.43	100.00		555.52	100.00		637.22	100.00		714.05	100.00		817.13	100.00		575.94	100.00

Source: HIECS, CAPMAS, 2000.

The consumption of cereals ranges from 119.28 kg/year to 174.62 kg/year for all governorates. This shows that the diet of people consists primarily of cereals (rice, wheat, corn, etc) with little intake of other foods that would be needed for healthy growth including vegetables, meats, fish, milk, and eggs. However, wheat and rice appear to have received major emphasis at the cost of coarse grains, the poor man's diet.

The consumption of vegetables is relatively low as may be expected due to the production decrease. In general, hot dry summers and very little rainfall characterize Upper Egypt's climate. The quantities of vegetables range from 40.66 kg/year to 59.24 kg/year for all governorates.

Upper Egypt is characterized by increasing the production of sugar and its products because of suitable weather conditions, and high temperatures. The consumption of sugar ranges from 20.72 kg/year to 28.29 kg/year for all governorates, with low expenditure shares of around 6 %, except for Luxor at 7.01 % of the total expenditure share.

Generally, with respect to animal products, the consumers depend on milk and its products and meats. This region and its governorates have a low consumption share of fish, except for Aswan with the Lake Nasser considered an important fish source in Egypt, and a significant amount of fish production.

5.3.4 Frontier Egypt

Average per capita food consumption of different food groups and the expenditure shares are presented for rural Frontier Egypt in Table 5.4. The expenditures for the selected food groups for the Frontier region taken as a whole are 774.89 LE/year, of which 54.92 % and 45.08 % for plant and animal products, respectively. It is found that the total expenditure for food in this region is higher than in the Lower, Middle, and Upper region by 10.39 %, 31.79 %, and 34.54 %, respectively. The expenditure on plant products in Frontier Egypt increases by 6.87 %, 28.97%, and 28.70%, compared to the above regions, respectively. Also, the total expenditure on animal products in this region is higher than the shares in Lower, Middle, and Upper regions by 15.02 %, 35.38 %, and 42.43 %, respectively.

Generally, a different pattern is observed in Frontier Egypt, with respect to plant products, the consumers in Matruh and South Sinai depend mainly on vegetables, cereals, sugar and its products, and fruits by order of importance. The consumption of vegetables for these two governorates amounts to 72.73 kg/year and 75.30 kg/year, respectively.

Table 5.4 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Rural Frontier Egypt Governorates in 2000

Food group	Red Sea			New Valley			Matruh			North Sinai			South Sinai			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	100.52	144.79	19.45	119.62	119.61	15.15	61.67	141.63	19.50	187.34	145.34	23.01	54.42	151.49	14.80	107.15	140.55	18.14
Beans	12.11	36.20	4.86	8.60	31.88	4.04	3.30	18.78	2.59	5.26	22.69	3.59	9.05	29.55	2.89	7.64	27.79	3.59
Vegetables	51.48	114.57	15.39	68.75	132.36	16.77	72.73	100.78	13.88	52.78	88.01	13.93	75.30	138.31	13.51	63.60	113.79	14.68
Fruits	10.96	47.98	6.45	17.23	65.54	8.30	11.81	40.83	5.62	3.15	48.48	7.68	14.70	68.13	6.66	17.47	53.70	6.93
Oils	8.83	47.34	6.36	6.03	38.11	4.83	10.27	56.82	7.82	8.04	44.34	7.02	13.44	71.65	7.00	9.22	51.10	6.59
Sugar	22.18	34.61	4.65	22.08	32.17	4.08	20.13	30.44	4.19	16.82	29.54	4.68	31.51	70.68	6.91	22.26	38.64	4.99
Total pl. p.		425.49	57.16		419.67	53.17		389.28	53.60		378.40	59.91		529.81	51.76		425.57	54.92
Meats	16.43	173.87	23.35	22.97	257.33	32.60	22.42	221.91	30.55	17.27	167.38	26.50	20.38	206.35	20.16	19.78	204.11	26.34
Fish	7.83	58.11	7.81	6.74	21.02	2.66	6.73	42.06	5.79	6.71	56.03	8.87	12.84	89.38	8.73	6.74	52.79	6.81
Eggs	6.26	27.53	3.70	7.21	34.87	4.42	4.03	19.53	2.69	2.30	11.35	1.80	7.67	32.01	3.13	5.40	24.67	3.18
Milk	4.05	59.39	7.98	23.88	56.38	7.14	13.93	53.43	7.36	2.11	18.48	2.93	13.68	165.96	16.21	11.19	67.75	8.74
Total ani. p.		318.89	42.84		369.60	46.83		336.93	46.40		253.24	40.09		493.70	48.24		349.33	45.08
Total		744.38	100.00		789.27	100.00		726.21	100.00		631.64	100.00		1,023.51	100.00		774.89	100.00

Source: HIECS, CAPMAS, 2000.

However, the quantities of cereals are 61.67 kg/year and 54.42 kg/year, respectively, for Matruh and South Sinai. This means that the consumption pattern for these two governorates may be affected by the tourism sector and the resulting high per capita income and expenditure. The individual in the governorates of Red Sea and North Sinai depends on cereals, vegetables, sugar and its products, and fruits by order of importance.

For animal products, Table 5.4 shows that different consumption patterns are occurred, resulting from the geographical allocation of each governorate and from consumer's preferences within the same governorate. The individual in Red Sea depends on meats, fish, eggs, and milk and its products. In New Vally, the individual consumes milk and its products, meats, eggs, and fish. However, the consumer in North Sinai depends on meats, fish, and eggs. And in South Sinai, he consumes mainly meats, milk and its products, fish, and eggs. The consumption of fish for South Sinai and Red Sea is higher than in the other governorates of Egypt relating to the narrow strips on the African Red Sea coast.

From the previous section, it is found that all rural regions still depend mainly on the consumption of plant products. Therefore, the nutrition ratio of the Egyptian rural population has an extremely high content of carbohydrates and a low portion of animal proteins. Despite of these results, in rural areas of some governorates like Damietta in Lower Egypt, Giza in Middle Egypt, Aswan in Upper region and South Sinai in Frontier Egypt, the quantities of animal products consumed are relatively plausible, as compared to urban regions, because of the increasing of income in these governorates.

5.4 Food Consumption and Expenditure Patterns in Urban Regions

Average food consumption is calculated for each food commodity group and urban region. The same analysis is then applied to obtain the expenditure pattern.

5.4.1 Lower Egypt

The consumption quantities of different food groups and their expenditure shares are presented in Table 5.5 for urban lower region taken as a whole and its governorates. The total expenditure on plant and animal products for this region is about 816.82 LE/year, containing about 52.48 % for plant and 47.52 % for animal products. Compared to rural Lower Egypt,

Table 5.5 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Urban Lower Egypt Governorates in 2000

Food group	Damietta			Dakahlia			Sharkia			Qalyoubia			Kafr El-sheikh		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	74.62	158.30	16.86	85.60	153.12	19.58	65.99	121.84	17.45	48.39	128.99	15.94	109.85	175.72	18.96
Beans	5.61	22.40	2.39	5.14	19.44	2.49	3.25	17.04	2.44	2.47	10.97	1.36	2.47	13.67	1.47
Vegetables	60.21	88.81	9.46	54.14	89.24	11.41	66.75	95.83	13.72	69.27	105.46	13.03	71.04	102.23	11.03
Fruits	18.39	92.71	9.88	16.38	64.35	8.23	15.65	56.43	8.08	18.72	67.47	8.34	23.86	82.30	8.88
Oils	12.22	51.79	5.52	9.23	45.90	5.87	7.48	70.16	10.05	7.82	72.20	8.92	8.17	53.25	5.75
Sugar	17.29	63.09	6.72	17.52	39.69	5.07	20.84	40.52	5.80	21.90	43.92	5.43	19.12	39.86	4.30
Total pl. p.		477.10	50.82		411.74	52.64		401.82	57.54		429.01	53.01		467.03	50.39
Meats	28.39	167.61	17.86	21.31	198.79	25.41	17.40	173.59	24.86	25.80	242.75	29.99	30.60	253.45	27.34
Fish	19.19	141.61	15.08	12.79	64.71	8.27	11.17	52.80	7.56	3.03	43.25	5.34	21.25	112.51	12.14
Eggs	6.61	29.13	3.10	5.47	24.26	3.10	4.98	21.35	3.06	5.94	25.81	3.19	6.09	26.82	2.89
Milk	29.77	123.36	13.14	27.52	82.66	10.57	15.84	48.78	6.99	21.04	68.47	8.46	27.70	67.03	7.23
Total ani. p.		461.72	49.18		370.42	47.36		296.52	42.46		380.28	46.99		459.82	49.61
Total		938.82	100.00		782.16	100.00		698.34	100.00		809.29	100.00		926.85	100.00

Continued Table 5.5

Food group	Garbia			Monoufia			Behera			Ismailia			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	61.96	128.23	15.55	53.79	111.81	17.01	82.78	134.35	16.00	65.69	157.04	15.71	71.67	137.93	16.89
Beans	2.95	13.82	1.68	1.83	7.23	1.10	2.64	12.04	1.43	5.62	24.84	2.49	3.34	14.98	1.83
Vegetables	73.09	103.49	12.55	63.68	82.01	12.48	65.00	92.52	11.02	88.82	144.11	14.42	67.23	98.90	12.11
Fruits	21.53	79.19	9.60	17.73	51.10	7.77	17.46	70.15	8.35	24.24	86.15	8.62	18.88	69.93	8.56
Oils	7.24	61.79	7.49	7.35	64.58	9.83	7.90	69.70	8.30	10.23	81.25	8.13	8.24	63.54	7.78
Sugar	19.87	46.64	5.66	19.88	34.87	5.31	22.23	42.98	5.12	21.46	51.47	5.15	20.21	43.39	5.31
Total pl. p.		433.16	52.54		351.60	53.50		421.74	50.22		544.86	54.52		428.67	52.48
Meats	25.21	224.10	27.18	21.61	198.34	30.18	25.92	248.40	29.58	26.87	254.73	25.49	24.13	223.67	27.38
Fish	10.29	66.87	8.11	2.65	31.13	4.74	9.60	64.70	7.70	12.37	71.41	7.15	10.68	66.37	8.13
Eggs	6.23	26.94	3.27	5.67	24.38	3.71	6.19	28.27	3.37	7.39	35.10	3.51	5.94	26.13	3.20
Milk	21.59	73.43	8.91	19.62	51.79	7.88	31.95	76.64	9.13	24.05	93.25	9.33	23.92	71.98	8.81
Total ani. p.		391.34	47.36		305.64	46.50		418.02	49.78		454.49	45.48		388.15	47.52
Total		824.50	100.00		657.24	100.00		839.76	100.00		999.35	100.00		816.82	100.00

Source: HIECS, CAPMAS, 2000.

the expenditures for plant and animal products in the urban region increased by 7.47 % and 27.80 %, respectively. This is, as may be expected, due to increasing the total food expenditures in the urban Lower region reflecting higher nutritional status of the individuals in the urban compared to the rural region.

Differences in the consumption patterns of food groups are clearly present. With respect to plant products, the individuals in urban areas of Sharkia, Qalyoubia, Garbia, Menia, and Ismailia depend mainly on vegetables, cereals, sugar, and fruits, except for Garbia and Ismailia depending on vegetables, cereals, fruits, and sugar by order of importance. This is a result of the high home production of fruits in these two rural governorates. This indicates that vegetables have a higher fixed position in the Egyptian Menu in urban lower region than in rural lower region. For oil, consumption is highest in urban Damietta at 12.22 kg/year.

For animal products, meats, milk and its products, and fish are important food commodities for Ismailia, Garbia, and Kafr El-sheik. In urban Damietta, Dakahlia, and Behera, the individual depends mainly on milk and its products, meats, fish, and eggs by order of importance. However, the individual in urban Menoufia and Qalyoubia consumed meats, milk and its products, and eggs, where the consumers do not allow themselves to eat fish because it is very expensive in areas far from the sea.

5.4.2 Middle Egypt

Table 5.6, for urban Middle Egypt, reveals that the total expenditure on food for this region is 789.49 LE/year and exceeds the expenditure in its rural counterpart 34.30 %. It represents about 52.34 % for plant and 47.66 % for animal products, with increasing percentage change compared to rural Middle Egypt of 25.24 % and 45.82 %, respectively.

The total expenditure on plant products is much higher for Menia (447.8 LE/year) and Giza (434.15 LE/year) than the average of this region (413.26 LE/year). It accounts for 52.04 % and 52.53 % of the total annual per capita food expenditure for the two governorates, respectively.

Menia seems to have a higher consumption of meat products (27.42 kg/year) than the region's average 23.07 kg/year, resulting from the high production in the rural Menia region and the strong relationship effect between rural and urban areas of this region.

Table 5.6 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Urban Middle Egypt Governorates in 2000

Food group	Giza			Beni Seuf			Fayoum			Menia			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	37.31	133.61	16.17	30.96	105.55	17.06	53.35	110.29	16.69	30.91	137.82	16.02	38.98	128.47	16.27
Beans	3.03	14.36	1.74	2.34	7.77	1.26	2.51	9.89	1.50	2.68	10.36	1.20	2.99	12.49	1.58
Vegetables	53.15	91.62	11.09	42.64	55.11	8.91	51.40	72.24	10.93	63.34	88.51	10.29	55.96	84.66	10.72
Fruits	14.04	77.55	9.38	10.05	38.53	6.23	15.71	55.81	8.45	17.84	76.56	8.90	15.00	70.37	8.91
Oils	7.98	70.47	8.53	5.02	68.96	11.15	6.23	66.58	10.08	5.64	82.82	9.62	7.50	71.79	9.09
Sugar	18.28	46.54	5.63	28.41	45.88	7.41	15.98	27.89	4.22	23.33	51.73	6.01	21.07	45.48	5.76
Total pl. p.		434.15	52.53		321.80	52.01		342.70	51.86		447.80	52.04		413.26	52.34
Meats	20.64	223.87	27.09	21.19	206.09	33.31	23.31	214.02	32.39	27.42	279.88	32.52	23.07	229.21	29.04
Fish	4.29	44.66	5.40	3.06	31.95	5.16	8.38	38.29	5.79	5.55	36.60	4.25	4.93	41.21	5.22
Eggs	3.96	19.27	2.33	3.60	15.51	2.51	4.40	18.95	2.87	5.58	25.76	2.99	4.41	19.75	2.50
Milk	27.15	104.49	12.64	13.56	43.40	7.01	15.48	46.87	7.09	24.10	70.47	8.19	25.26	86.06	10.90
Total ani. p.		392.30	47.47		296.95	47.99		318.12	48.14		412.71	47.96		376.24	47.66
Total		826.45	100.00		618.75	100.00		660.82	100.00		860.51	100.00		789.50	100.00

Source: HIECS, CAPMAS, 2000.

The consumption patterns of food groups are presented. For plant products, a similar pattern is observed in all governorates of the urban Middle region. The individuals in this region consume vegetables, cereals, sugar and its products, fruits, oils, and beans, by order of importance, except for Fayoum, where the consumer depends mainly on cereals, vegetables, sugar and its products, fruits, oils, and beans. The amount of vegetables consumed ranges from 51.40 kg/year in Fayoum to 63.34 kg/year in Menia.

With respect to animal products, there are three consumption patterns in the urban Middle region: First, in urban Giza, the individual depends on milk and its products, meats, fish, and eggs. Second, in urban Beni Suef and Menia meats, milk and its products, eggs, and fish are important food commodities for the consumer. It is observed that the individuals in the urban Beni Suef and Menia consume fish at low level because it is very expensive in areas far from the sea. Third, in urban Fayoum, the consumer depends mainly on meats, milk and its products, and fish, where it is observed that the highest consumption of fish is for this governorate (8.38 kg/year). The fish consumed here mainly comes from Lake Qarun.

5.4.3 Upper Egypt

The consumption quantities of different food commodity groups and the expenditure shares spent on these groups are presented in Table 5.7 for the urban Upper region taken as a whole and its governorates. The total expenditures on food for this region are 634.31 LE/year, exceeding the amount of its rural counterpart 10.13 %. It represents about 55.13 % for plant products and 44.87 % for animal products, with increasing percentage change (compared to rural Upper Egypt) of 5.74 % and 16.06 %, respectively.

Within the same region, the consumption of cereals is lowest in the Assuit governorate (44.81 kg/year); however, it is the highest in Luxor (106.75 kg/year). The consumption of sugar and its products is high in this region due to the processing sugar plants in this region. It ranges from 24.12 kg/year to 33.83 kg/year, except for Assuit at 19.95 kg/year.

Luxor has the highest consumption of meats representing about 21.54 kg/year. This indicates that the consumption pattern for this governorate may be affected by the tourism sector and the resulting high income and expenditure level.

Table 5.7 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Urban Upper Egypt Governorates in 2000

Food group	Assuit			Souhag			Qena			Aswan			Luxor			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	44.81	108.38	21.64	93.55	105.69	17.35	101.84	126.03	17.75	88.64	134.91	18.95	106.75	123.43	14.29	80.92	117.05	18.45
Beans	4.68	13.46	2.69	6.46	19.67	3.23	10.70	32.43	4.57	9.80	29.00	4.07	10.53	33.10	3.83	7.70	23.10	3.64
Vegetables	40.31	52.97	10.58	47.35	61.00	10.02	56.43	89.45	12.60	60.42	93.29	13.10	50.91	110.48	12.79	49.64	73.74	11.63
Fruits	11.69	29.81	5.95	13.02	40.51	6.65	15.74	58.18	8.19	12.59	56.23	7.90	8.10	56.40	6.53	12.78	44.90	7.08
Oils	5.15	45.25	9.03	3.88	47.92	7.87	7.08	56.33	7.93	9.06	49.60	6.97	6.77	59.16	6.85	6.03	50.04	7.89
Sugar	19.95	29.45	5.88	24.16	36.05	5.92	26.12	42.23	5.95	25.51	54.40	7.64	33.83	68.40	7.92	24.26	40.84	6.44
Total pl. p.		279.32	55.76		310.84	51.04		404.65	56.99		417.43	58.62		450.97	52.21		349.67	55.13
Meats	12.94	150.29	30.00	20.04	208.35	34.21	18.80	200.24	28.20	14.97	173.49	24.36	21.54	229.44	26.56	16.92	184.98	29.17
Fish	4.49	24.16	4.82	5.23	28.85	4.74	6.18	32.67	4.60	5.85	22.62	3.18	7.08	58.58	6.78	5.45	29.41	4.64
Eggs	3.26	12.78	2.55	4.64	17.72	2.91	3.72	16.54	2.33	4.84	20.23	2.84	3.96	14.50	1.68	4.01	16.17	2.55
Milk	13.25	34.34	6.86	16.89	43.24	7.10	15.91	55.88	7.87	11.40	78.26	10.99	31.53	110.33	12.77	15.75	54.06	8.52
Total ani. p.		221.57	44.24		298.16	48.96		305.33	43.01		294.60	41.38		412.84	47.79		284.64	44.87
Total		500.89	100.00		609.00	100.00		709.98	100.00		712.03	100.00		863.81	100.00		634.31	100.00

Source: HIECS, CAPMAS, 2000.

Table 5.7 also shows the consumption patterns of food groups in this region. For plant products, there are three consumption patterns: First, in urban areas of Souhag, Qena, and Aswan, where the individual consumes cereals, vegetables, sugar and its products, fruits, beans, and oils by order of importance. The second pattern is observed in urban Assuit, where the consumer depends on cereals, vegetables, sugar and its products, fruits, oils, and beans. The third pattern, in urban Luxor, consists of cereals, vegetables, sugar and its products, beans, fruits, and oils. The difference between these three patterns is found with respect to the beans group.

For animal products, there are two consumption patterns in the urban Upper region: First, in Assuit and Luxor, where the individual depends on milk and its products, meats, fish, and eggs by order of importance. Second, in urban Souhag, Qena, and Aswan, meats, milk and its products, fish, and eggs, are important animal food commodities for consumers.

5.4.4 Frontier Egypt

Table 5.8 presents the quantities of food consumption of different food groups and their expenditure shares for urban Frontier Egypt. This Table reveals that the average total food expenditure in this region is 1,047.69 LE/year, 51.11 % for plant and 48.89 % for animal products. It is observed that the average expenditure in this region is by 26.04 % higher than in the rural area of the same region. In addition, the expenditures on plant and animal products in urban Frontier Egypt are higher than in its rural area by 20.53 % and 31.80 %, respectively. Differences in food expenditures between rural and urban areas of Frontier Egypt indicate that the diet of the consumer in the urban Frontier region contains a high portion of animal protein.

A similar consumption pattern of plant products is observed in all urban Frontier Egypt, except the governorate Red Sea. The consumer in New Valley, Matruh, North Sinai, and South Sinai depends mainly on vegetables, cereals, sugar and its products, fruits, oils, and beans, where the consumption of vegetables for these governorates ranges from 61.84 kg/year to 96.28 kg/year. However, the quantities of cereals range from 49.37 kg/year to 64.75 kg/year. The individual in Red Sea depends on cereals, vegetables, sugar and its products, fruits, beans, and oils.

For animal products, differences in consumption patterns are significant. The consumer in Red Sea depends mainly on meats, fish, eggs, and milk and milk products. In New Valley, the individual consumes meats, milk and its products, eggs, and fish by order of importance.

Table 5.8 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Urban Frontier Egypt Governorates in 2000

Food group	Red Sea			New Valley			Matruh			North Sinai			South Sinai			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	51.38	190.43	16.19	53.33	115.85	12.76	64.75	134.64	15.01	49.37	123.87	14.10	60.39	174.26	12.24	55.69	147.29	14.06
Beans	13.17	48.95	4.16	5.69	22.59	2.49	5.76	20.90	2.33	7.40	24.95	2.84	10.00	35.70	2.51	8.38	30.58	2.92
Vegetables	29.00	80.81	6.87	74.47	140.91	15.53	77.42	130.06	14.50	61.84	111.45	12.69	96.28	189.91	13.34	66.77	128.69	12.28
Fruits	13.02	81.01	6.89	20.94	100.07	11.03	21.88	95.07	10.60	15.67	73.08	8.32	33.12	140.88	9.90	20.54	96.75	9.23
Oils	8.24	101.15	8.60	7.44	49.76	5.48	10.57	66.89	7.46	10.95	62.80	7.15	10.53	105.39	7.41	9.50	76.50	7.30
Sugar	23.11	74.46	6.33	24.89	42.60	4.69	22.44	41.88	4.67	19.16	35.30	4.02	25.64	88.09	6.19	22.83	55.69	5.32
Total pl. p.		576.81	49.04		471.78	51.98		489.44	54.57		431.45	49.13		734.23	51.59		535.50	51.11
Meats	27.66	350.17	29.78	37.48	283.58	31.24	22.55	216.42	24.13	28.51	236.33	26.91	30.66	337.68	23.72	27.44	284.84	27.18
Fish	9.29	83.50	7.10	4.47	28.26	3.11	5.74	47.95	5.35	10.61	89.26	10.16	14.99	127.40	8.95	8.12	73.69	7.03
Eggs	6.66	26.82	2.28	10.94	48.59	5.35	5.58	24.80	2.76	7.01	29.32	3.34	11.92	52.50	3.69	8.32	35.93	3.43
Milk	5.65	138.82	11.80	18.82	75.39	8.31	23.20	118.36	13.20	20.61	91.84	10.46	32.47	171.32	12.04	19.70	117.73	11.24
Total ani. p.		599.32	50.96		435.82	48.02		407.53	45.43		446.75	50.87		688.90	48.41		512.19	48.89
Total		1,176.13	100.00		907.60	100.00		896.97	100.00		878.20	100.00		1,423.13	100.00		1,047.69	100.00

Source: HIECS, CAPMAS, 2000.

However, the consumer in Matruh and South Sinai depends on milk and its products, meats, fish, and eggs. In North Sinai, the individual depends on meats, milk and its products, fish, and eggs. The consumption of fish for South Sinai (14.99 kg/year) and North Sinai (10.61 kg/year) are higher than in the other governorates of Egypt relating to the narrow strips on the African Red Sea and Mediterranean Sea coasts.

5.4.5 Metropolitan Egypt

Average annual per capita consumption of different food commodity groups and the expenditure shares spent on these groups are presented in Table 5.9 for the Metropolitan region taken as a whole and its governorates, which include Cairo, Alexandria, Port Said, and Suez, characterised by their complete urbanization (no rural areas).

It is interesting to note that average total plant and animal expenditure in Metropolitan region is relatively higher than in other rural and urban regions. It accounts for 1,069.67 LE/year, containing 47.47 % for plant and 52.53 % for animal products.

Despite low levels of consumption of animal products in Egypt, a relatively high level is observed in this region compared to all previous urban and rural regions.

Compared to the region's average, the quantity of meats consumed is the highest for Port Said at 32.22 kg/year. The consumption ranges from 26.82 kg/year to 28.17 kg/year for all other governorates. It is interesting to note that the consumption of fish is higher in the governorates of this region, especially for Port Said, Alexandria and Suez relating to the narrow strips on the Suez Canal, the Mediterranean Sea and the Red Sea coasts, and the Maryut and Idku Lakes. It is the highest for Port Said at 28.72 kg/year. Fish consumption is relatively high for Suez and Alexandria accounting for 18.41 kg/year and 13.15 kg/year, respectively. However, the lowest fish consumption is observed in Cairo at 6.77 kg/year.

The average quantities of selected food groups are well known. A similar consumption pattern is observed in all Metropolitan Egypt for plant products. The consumer depends mainly on vegetables, cereals, sugar and its products, fruits, oils, and beans, where the amount of vegetables for these governorates ranges from 59.79 kg/year for Cairo to 71.67 kg/year for Suez.

For animal products, similar consumption patterns have been observed in all Metropolitan governorates, where the individuals depend mainly on milk and its products, meats, fish, and eggs.

Table 5.9 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Metropolitan Egypt Governorates in 2000

Food group	Cairo			Alex			Port Said			Suez			Average		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	38.27	152.48	14.51	43.11	142.65	13.85	68.79	198.66	13.02	48.13	160.30	14.74	41.75	152.15	14.22
Beans	3.52	16.65	1.58	3.28	13.67	1.33	3.10	14.77	0.97	4.03	13.69	1.26	3.45	15.49	1.45
Vegetables	59.79	107.76	10.25	62.94	102.66	9.97	70.72	124.84	8.18	71.67	101.86	9.36	61.90	106.73	9.98
Fruits	17.04	104.76	9.97	19.25	96.02	9.33	29.94	153.89	10.08	17.19	77.93	7.16	18.36	103.11	9.64
Oils	9.74	80.35	7.64	10.04	69.56	6.76	12.78	80.13	5.25	12.89	81.99	7.54	10.14	77.13	7.21
Sugar	19.17	53.75	5.11	20.43	47.12	4.58	19.35	76.67	5.02	25.24	59.14	5.44	19.88	53.13	4.97
Total pl. p.		515.75	49.07		471.68	45.81		648.96	42.52		494.91	45.50		507.74	47.47
Meats	28.17	302.22	28.76	26.82	263.37	25.58	32.22	358.99	23.53	27.31	287.34	26.41	27.91	292.38	27.34
Fish	6.77	64.31	6.12	13.15	100.10	9.72	28.72	275.81	18.07	18.41	125.56	11.54	10.39	88.73	8.30
Eggs	5.28	23.16	2.20	5.96	25.87	2.51	6.85	30.34	1.99	6.79	28.33	2.60	5.64	24.61	2.30
Milk	39.03	145.60	13.85	46.07	168.68	16.38	41.71	212.10	13.90	42.63	151.64	13.94	41.50	156.21	14.60
Total ani. p.		535.29	50.93		558.02	54.19		877.24	57.48		592.87	54.50		561.93	52.53
Total		1,051.04	100.00		1,029.70	100.00		1,526.20	100.00		1,087.78	100.00		1,069.67	100.00

Source: HIECS, CAPMAS, 2000.

5.5 Conclusions

The previous presentation revealed that there are variations and differences in food consumption and expenditure patterns among rural and urban regions of Egypt and within the same region across governorates. The dominant consumption pattern for each governorate depends mainly on its geographical location, consumer's preferences, and the level of food production within the same governorate. For example, in a region that has a high home production of a food item, the level of consumption is high and the expenditure on this food item is low. In addition, fish is still an important food commodity for consumers in areas near the sea like in the Damietta governorate in Lower Egypt and the Red Sea governorate in Frontier Egypt. This indicates that increases in fish production obtained from the Mediterranean Sea, the Lake Manzala, and the high contribution of aquaculture in Damietta, and from the African Red Sea in Red Sea governorate have mainly a regional impact.

Generally, all urban regions have high average annual per capita food expenditures, and consequently, a high nutritional status compared to rural regions. This results from increasing the expenditure share - in urban regions - on animal products that are characterised by a high portion of proteins containing essential amino acids, necessary for the healthy physiological existence of the human body according to nutritional scientists and international recommendations.

Table 5.10 presents the consumption of different food commodity groups and the expenditure shares spent on these groups in rural and urban regions, reflecting a map of the consumption and expenditure patterns in Egypt. In rural regions, consumers still depend mainly on consumption of cereal products with small amounts from animal products, where the diets have an extremely high content of carbohydrates and a low portion of animal proteins. Despite these results, in rural areas of some governorates like Damietta in Lower Egypt, Giza in Middle Egypt, Aswan in Upper Egypt, and South Sinai in Frontier Egypt, the quantities of animal products consumed are relatively plausible, because of the rise of income in these governorates. However, low animal consumption are found in rural areas of other governorates like Sharkia in Lower region, Beni Suef in Middle region, Assuit in the Upper region, and North Sinai in the Frontier region.

In urban regions, the diets contain a relatively high level of vegetables and animal products, as compared to rural areas, reflecting the high nutritional status in these regions.

It is also found from Table 5.10 that the highest average consumption of cereals occurs in rural Upper Egypt accounting for 135.60 kg/year.

Table 5.10 Average Annual Per Capita Consumption (kg/year) and Per Capita Expenditure (LE) on Different Food Groups in Rural and Urban Egypt Regions

Food group	Rural regions											
	Lower			Middle			Upper			Frontier		
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	129.28	150.00	21.37	82.08	123.94	21.08	135.60	127.38	22.12	107.15	140.55	18.14
Beans	3.79	16.11	2.30	2.81	11.89	2.02	8.89	23.25	4.04	7.64	27.79	3.59
Vegetables	63.52	86.42	12.31	46.13	62.68	10.66	45.63	63.37	11.00	63.60	113.79	14.68
Fruits	16.96	48.06	6.85	10.67	32.66	5.55	10.57	31.89	5.54	17.47	53.70	6.93
Oils	7.72	62.40	8.89	5.49	63.73	10.84	4.95	51.42	8.93	9.22	51.10	6.59
Sugar	20.36	35.23	5.02	22.24	35.07	5.97	23.04	33.38	5.80	22.26	38.64	4.99
Total pl. p.		398.22	56.73		329.98	56.12		330.68	57.42		425.57	54.92
Meats	18.99	184.02	26.21	19.00	183.36	31.18	16.40	172.25	29.90	19.78	204.11	26.34
Fish	8.01	45.59	6.49	3.51	21.72	3.69	3.75	18.39	3.19	6.74	52.79	6.81
Eggs	4.96	21.68	3.09	3.96	16.55	2.81	3.93	15.02	2.61	5.40	24.67	3.18
Milk	22.38	52.42	7.47	17.15	36.39	6.19	17.66	39.61	6.88	11.19	67.75	8.74
Total ani. p.		303.71	43.27		258.01	43.88		245.26	42.58		349.32	45.08
Total		701.93	100.00		587.99	100.00		575.94	100.00		774.89	100.00

Continued Table 5.10

Food group	Urban regions															Total Egypt		
	Metropolitan			Lower			Middle			Upper			Frontier					
	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)	Quantity	Value	% (V)
Cereals	41.75	152.15	14.22	71.67	137.93	16.89	38.98	128.47	16.27	80.92	117.05	18.45	55.69	147.29	14.06	82.55	140.21	17.58
Beans	3.45	15.49	1.45	3.34	14.98	1.83	2.99	12.49	1.58	7.70	23.10	3.64	8.38	30.58	2.92	4.22	16.32	2.05
Vegetables	61.90	106.73	9.98	67.23	98.90	12.11	55.96	84.66	10.72	49.64	73.74	11.63	66.77	128.69	12.28	58.77	88.66	11.10
Fruits	18.36	103.11	9.64	18.88	69.93	8.56	15.00	70.37	8.91	12.78	44.90	7.08	20.54	96.75	9.23	15.99	64.59	8.10
Oils	10.14	77.13	7.21	8.24	63.54	7.78	7.50	71.79	9.09	6.03	50.04	7.89	9.50	76.50	7.30	7.86	65.64	8.23
Sugar	19.88	53.13	4.97	20.21	43.39	5.31	21.07	45.48	5.76	24.26	40.84	6.44	22.83	55.69	5.32	20.98	42.27	5.30
Total pl. p.		507.74	47.47		428.67	52.48		413.26	52.34		349.67	55.13		535.50	51.11		417.68	52.36
Meats	27.91	292.38	27.34	24.13	223.67	27.38	23.07	229.21	29.04	16.92	184.98	29.17	27.45	284.84	27.18	22.11	221.64	27.78
Fish	10.39	88.73	8.30	10.68	66.37	8.13	4.93	41.21	5.22	5.45	29.41	4.64	8.12	73.69	7.03	7.73	53.80	6.74
Eggs	5.64	24.61	2.30	5.94	26.13	3.20	4.41	19.75	2.50	4.01	16.17	2.55	8.32	35.93	3.43	5.01	21.60	2.71
Milk	41.50	156.21	14.60	23.92	71.98	8.81	25.26	86.06	10.90	15.75	54.06	8.52	19.70	117.73	11.24	26.32	83.01	10.41
Total ani. p.		561.93	52.53		388.15	47.52		376.24	47.66		284.63	44.87		512.19	48.89		380.05	47.64
Total		1069.67	100.00		816.82	100.00		789.49	100.00		634.31	100.00		1047.69	100.00		797.73	100.00

Source: HIECS, CAPMAS, 2000.

The highest consumption of beans and sugar is found d in the urban Upper region, with 7.70 kg/year and 24.26 kg/year, respectively. However, urban Lower Egypt has the highest quantity of vegetables consumed at 67.23 kg/year. The consumption of fruits is the highest in urban Frontier Egypt at 20.54 kg/year. It is interesting to note that Metropolitan Egypt has the highest consumption of meats, milk and its products, and oils representing about 27.91 kg/year, 41.50 kg/year, and 10.14 kg/year, respectively. This indicates that average consumption quantities of animal products in urban Egypt exceed their quantities in rural Egypt; in addition, fish is an important food commodity in lower and Metropolitan Egypt, as shown in Table 5.10. Fish is a healthy, lean protein product and contains “omega-3” fatty acids, which may help protect the heart.

CHAPTER 6

EMPIRICAL ANALYSIS OF FOOD EXPENDITURES IN EGYPT

6.1 Introduction

Food is not only a basic need, but it also has an enormous economic impact on Egyptian households. For that reason, it is essential to gain thorough knowledge of the determinants of food demand in order to design comprehensive agricultural, food and social policy options that improve access to food. Income and price elasticities of food demand represent key information for this purpose, and econometric analyses are needed to estimate them empirically. Therefore, this chapter analyses partial and complete food demand systems as a basis for future choice of Egyptian food policies. It presents the estimation of expenditure elasticities for rural and urban areas and for each household size, using an Engel double-log model of household expenditures because of the absence of data for each household size in each governorate (Section 6.2). Due to the specific features of the data, spatial variation in regional prices estimated using household survey data are used as proxies for food prices. They are incorporated into the complete food demand analysis (LA/AIDS) after calculating the "unit value of the aggregated commodity", to measure own- and cross-price elasticities (Section 6.3).

6.2 Partial Demand System - Engel Curve Analysis

This section aims to analyse the possible effects of income changes on patterns of per capita expenditure in both rural and urban areas (Section 6.2.2) and to investigate and examine the existence and the effects of economies of scale on household food expenditure in Egypt among several scales of household sizes (Section 6.2.3). Also, it examines the simultaneous effect of total expenditure, location, and household size on food expenditure patterns (Section 6.2.4).

The data used are based on the Egyptian Household Income, Expenditure, and Consumption Survey (HIECS) conducted in 2000 by CAPMAS. The total annual per capita expenditure and per capita expenditure on 10 major food groups were calculated (with 19 or 20 income categories for each food group) and used separately for both rural and urban areas and for each household size (one person, 2-3, 4-6, and 7 or more persons). It is hypothesized that the relative importance of economies of scale increases with household size.

This provides a basis for estimating Engel curves that are based on the relationships between expenditure on an individual good and the income level as measured by total expenditures.

In cross-sectional budget studies, provided the surveys are completed in a short time-span, prices faced by all households can be regarded as constant, apart from minor variations due to social and regional factors. This allows focusing on responses of household demand to variation in income or total expenditure. After statistically estimating the Engel curves, the nature of these responses can be summarised by computing expenditure elasticities.

The income elasticity of demand is estimated based on the regression model of Engel curves. It represents the percentage change in the quantity demanded as a response to the percentage change in income level. According to the income elasticities, the commodities are classified into two categories as necessities and luxuries. The commodities, which have income elasticity less than one, are called necessities, while, the commodities whose income elasticity exceeds one, are called luxuries.

In the literature, there is a tendency to use total expenditure instead of income as explanatory variable. The central theme behind this adoption is that people declare total expenditures more truly than income. Therefore, in this study the total expenditure elasticities are estimated instead of income elasticities.

6.2.1 Model Specification

A double-log specification of the Engel function has been chosen in order to estimate expenditure elasticities for rural and urban areas and for each household size. A double-log specification has proven the most appropriate way of estimating the expenditure elasticity of demand; it generates more realistic expenditure elasticities. The general model can be written as follow:

$$\ln w_j = \alpha_j + \beta_j \ln y + \eta_j \qquad (6.1)$$

where w_j is the average annual per capita expenditure share for food group j, α_j, and β_j are the estimated coefficients, y is the average total per capita income calculated as the average annual total per capita expenditure, and (η_j) is the disturbance term. As pointed out before, the derivation of the Engel function assumes constant prices.

Equation (6.1) is estimated for each of the 10 food groups for rural and urban areas, and for each household size in both rural and urban Egypt.

Three hypotheses are to be tested in this section: First, it is assumed that the income (or expenditure) variable is an important determinant of food expenditures. Second, there is a difference in the expenditure elasticity for each food group between rural and urban areas (location effect). The third hypothesis suggests that there is a difference in the elasticity for each food group among several scales of household size. Dummy variables are included to test the second and third hypotheses.

There are four categories of household size. Therefore, the number of dummies is three (Gujarati, 1995, pp. 505-507). Assuming that the four types household size have a common slope but different intercepts in the regression of annual per capita expenditure share for a food group on average annual total expenditures[14]. The equation estimated for this is of the form:

$$\ln w_j = \alpha_j + \beta_j \ln y + \gamma_0 D_{0j} + \gamma_1 D_{1j} + \gamma_2 D_{2j} + \gamma_3 D_{3j} + \eta_j \qquad (6.2)$$

where D_0 = 1, if rural, 0 otherwise

D_1 = 1, if household size 2-3 persons, 0 otherwise.

D_2 = 1, if household size 4-6 persons, 0 otherwise.

D_3 = 1, if household size 7 and more persons, 0 otherwise.

All other variables have been as defined above.

The two equations (6.1) and (6.2) are estimated using (OLS) regression. Expenditure elasticities are calculated as $(\varepsilon_j = \beta_j)$, where β_j is the coefficient of regression. The results are presented in the following.

6.2.2 Food Expenditure Elasticities by Region

There are variations in elasticities for selected food groups that tend to indicate a difference in households' attitudes toward these groups as their income rises. The corresponding expenditure elasticities are reported for both rural and urban Egypt.

[14] The first household type (one person) is treated as the base category and the intercept α_j reflects the intercept of this category.

6.2.2.1 Rural Egypt

On an economic basis, the estimated elasticities in Table 6.1 seem to be plausible. All expenditure elasticities have positive signs and for all of the food commodity groups are less than one. This means that all selected food groups are necessities for Egyptian households in rural regions, i.e., as income increases their expenditure will increase at a lower rate.

Table 6.1 reveals that income elasticities of demand for all food groups will be significant at an α - level of 1 %. The elasticities of cereals and beans are relatively similar at low numbers, which means that the consumption of these commodities is relatively little affected by income changes. The smaller elasticities, the less the consumption is affected by a change in income. The cereals group has an expenditure elasticity of 0.43, which means that as total expenditure rises by one percent the expenditure on cereals would tend to rise by only 0.43 %. The elasticity of beans is 0.40, the lowest, indicating that as total expenditure rises by one percent the quantity consumed from beans group would tend to rise by 0.40 %. This result is consistent with the fact that consumption of bean commodities is important for the poor and is likely to decrease with higher income.

Table 6.1 Expenditure Elasticities for Selected Food Groups in Rural Egypt, 2000

Food group	α_j	β_j	Std. error	R^2	T	F
Cereals	1.90	0.43	0.05	0.75	7.94***	62.96***
Beans	0.08	0.40	0.06	0.64	6.14***	37.73***
Vegetables	0.55	0.53	0.06	0.75	8.02***	64.37***
Fruits	-3.08	0.92	0.07	0.87	11.77***	138.53***
Meats	-0.60	0.80	0.05	0.91	15.09***	227.66***
Fish	-1.86	0.72	0.09	0.74	7.73***	59.69***
Eggs	-1.93	0.67	0.05	0.87	12.11***	146.68***
Milk & Its products	-2.35	0.84	0.04	0.94	17.95***	322.18***
Oils & Fats	-0.49	0.63	0.06	0.84	10.37***	107.63***
Sugar	-1.89	0.75	0.03	0.96	24.94***	621.88***

Source: Calculated Based on Data from HIECS, CAPMAS, 2000.

*** Indicates significant at one percent level of significance.

The vegetables group has a fixed position in the Egyptian menu. It has an expenditure elasticity of 0.53 compared to fruits group, which has a relatively high expenditure elasticity of 0.92. An increase in total expenditure by one percent would tend to generate a 0.92 % increase in fruits expenditure in rural Egypt. Fruits such as citrus, banana, and grapes are consumed extensively during religious fasting, especially in rural areas. For other fruits, dates are not only a fruit but also a major food source (in particular, pressed dates).

The meats group has a relatively high expenditure elasticity of 0.80, indicating that an increase in total expenditure by one percent would tend to cause a 0.80 % increase in meat expenditure.

Milk and its products are used for breakfast and dinner in Egypt. Not only are they protein sources, but also their prices, compared to prices of other animal products, were for a long time relatively low. Increased total expenditure has a clear impact on the expenditure on milk and its products; its expenditure elasticity is 0.84. This means that a one percent increase in total expenditure would tend to cause an increase in expenditure on milk and its products by 0.84 %.

For fish group, it is still an important food commodity for consumers in areas near the sea and is mainly consumed more than meats in rural areas (as previously noted in chapter 5). The expenditure elasticity of fish group is 0.72, indicating that an increase in total expenditure by one percent would tend to increase fish expenditure by 0.72 %. The poor mainly consume fish commodities more than meats. Although, animal products including meats, milk and its products, and fish are a relatively concentrated source of essential protein, of high quality and highly digestible, they are very expensive in Egypt as compared to vegetable products.

For sugar, the expenditure elasticity is 0.75, where an increase in total expenditure by one percent would tend to generate 0.75 % increase in sugar expenditure in urban Egypt.

The estimated expenditure elasticity for the oils & fats group is 0.63, which means that a one percent increase in total expenditure would tend to cause an increase in the expenditure on the oils & fats group by 0.63 %. With higher income perhaps the quantity of oils & fats consumed will not increase but the quality of oils & fats consumed will improve, where in Egypt, the consumption of hydrogenated oils and sunflower oil increased more with higher income than the consumption of cottonseed oil.

6.2.2.2 Urban Egypt

It is found that all food groups have positive expenditure elasticities in urban regions and all are less than one (see Table 6.2). This means that all selected food groups are necessities for Urban Egypt. It is found that the change in the consumption of food groups will be significant at 1 % probability level as income increases.

The estimated expenditure elasticity for cereals group is 0.44, which indicates that a one percent increase in total expenditure is associated with an increase of about 0.44 % in cereals expenditure. The cereals group has an important place in the menu of the Egyptian consumer.

For the beans group, the expenditure elasticity is only 0.26, the lowest, compared to the elasticities for other food commodities. The expenditure elasticity for the vegetables group is 0.50, where an increase in total expenditure by one percent would tend to cause 0.50 % increase in vegetables expenditure in urban Egypt.

Table 6.2 Expenditure Elasticities for Selected Food Groups in Urban Egypt, 2000

Food group	α_j	β_j	Std. error	R^2	T	F
Cereals	1.57	0.44	0.01	0.99	79.87***	6379.83***
Beans	0.69	0.26	0.01	0.93	15.58***	242.78***
Vegetables	0.57	0.50	0.02	0.95	20.00***	400.04***
Fruits	-3.26	0.95	0.03	0.97	25.01***	625.51***
Meats	-0.07	0.71	0.02	0.97	24.87***	618.54***
Fish	-2.19	0.80	0.04	0.94	17.76***	315.43***
Eggs	-0.86	0.49	0.04	0.86	10.20***	104.10***
Milk & Its products	-2.55	0.90	0.05	0.93	15.71***	246.76***
Oils & Fats	-0.18	0.56	0.02	0.96	22.12***	489.28***
Sugar	-1.80	0.72	0.01	0.99	69.49***	4828.66***

Source: Calculated Based on Data from HIECS, CAPMAS, 2000.

*** Indicates significant at one percent level of significance.

Increased total expenditure has a clear impact on the consumption of fruits in urban Egypt. Its consumption is likely to increase more with higher income than any other commodity. The expenditure elasticity of fruits is 0.95, which means that a one percent increase in total expenditure is associated with an increase of about 0.95 % in expenditure on fruits.

The expenditure elasticity for the meats group is 0.71, which indicates that an increase in total expenditure by one percent would tend to cause a 0.71 % increase in meats group expenditure in urban Egypt. The expenditure elasticity of milk and its products group is relatively high, 0.90, indicating a one percent increase in total expenditure is associated with an increase of about 0.90 % in expenditure on milk and its products group.

For fish, the expenditure elasticity is 0.80, where an increase in total expenditure by one percent would tend to cause a 0.80 % increase in fish expenditure in Urban Egypt, probably caused by a shift to higher quality fish (expensive species of fish).

The estimated expenditure elasticity of the sugar group is 0.72, which means that an increase in total expenditure by one percent would tend to cause a 0.72 % increase in expenditure on the sugar and its products group. The high expenditure elasticity of sugar is also an indicator of increasing sweets consumption with higher income. The expenditure elasticity for oils & fats is 0.56, indicating a one percent increase in total expenditure would tend to generate an increase in the share of oils & fats group by 0.56 %, as improvement of the quality of oils & fats consumed.

From the previous results, the cereals group has a fixed position in the menu of the Egyptian consumer in both rural and urban areas. Its consumption is relatively little affected by income changes. The expenditures on vegetables and meats increase with higher income in rural areas compared to urban areas. However, the expenditures on fruits, fish, and milk and its products are more likely to increase with higher income in urban areas than in rural areas. In rural Egypt, fruits such as citrus, banana, and grapes are consumed extensively only during religious fasting, in addition, dates are not a fruit but also a major food item. Fish is mainly consumed more than meats in rural areas, especially by the poor, where the cheaper species of fish (sardine and frozen fish) are a constituent of their diet.

6.2.3 Food Expenditure Elasticities by Household Size

This section examines the existence of economies of scale in household food expenditure in Egypt. Engel relationship is estimated for 10 food groups using data from HICES. The survey includes data on food expenditure by household size. This data were divided into four brackets as follows: one person, 2-3 persons, 4-6 persons, and 7 and more persons.

Economies of scale in consumption are present if expenditures increase at a decreasing rate as household membership increases. Some studies examine the interactions between household size, economies of scale, and the consumption of private goods such as food (Deaton and Paxson, 1998, pp. 897-930, Gibson, 2002, Horowitz, 2002, and Abdulai, 2003, pp. 247-267).

Economies of scale in consumption may occur for mainly three reasons: First, the public goods within the household can be shared and serve their function without needing to be replicated in relation to the number of individuals within the household. Second, larger households may process food more efficiently and with less waste than smaller households (for example, food portions and leftovers that may be discarded by smaller households may be used by larger ones). Third, larger households may receive quantity discounts because they buy larger quantities.

It is found that household size has a significantly influence on household food expenditures. The expenditures on most food groups increase at a decreasing rate as household size increases (as shown in Table 6.3 for rural Egypt and Table 6.4 for urban Egypt. There are differences in elasticity estimates for selected food groups that tend to indicate a difference in economies of scale in consumption of these foods.

Table 6.3 Expenditure Elasticities for Selected Food Groups by Household Size in Rural Egypt, 2000

Food group	One person				2-3 persons				4-6 persons				7 and more persons			
	α_j	β_j	R^2	T	α_j	β_j	R^2	T	α_j	β_j	R^2	T	α_j	β_j	R^2	T
Cereals	2.53	0.35	0.52	4.28***	2.01	0.41	0.96	18.51***	2.66	0.31	0.81	8.41***	1.76	0.43	0.95	19.04***
Beans	0.74	0.36	0.62	4.06***	1.43	0.23	0.48	3.58***	1.38	0.21	0.52	4.14***	0.03	0.37	0.32	2.77***
Vegetables	2.03	0.37	0.43	2.73***	2.69	0.28	0.45	3.36***	1.60	0.38	0.82	8.64***	0.29	0.53	0.91	13.01***
Fruits	-3.52	0.96	0.86	7.81***	-1.28	0.71	0.75	6.44***	-2.56	0.84	0.86	10.06***	-3.81	0.99	0.84	9.20***
Meats	0.17	0.72	0.88	8.69***	1.17	0.58	0.94	14.38***	1.61	0.49	0.70	6.16***	-1.10	0.87	0.94	16.29***
Fish	-2.99	0.86	0.50	3.18***	0.44	0.44	0.45	3.40***	-2.11	0.77	0.87	10.56***	-1.98	0.72	0.73	6.30***
Eggs	-0.27	0.52	0.86	7.73***	0.03	0.44	0.94	15.04***	-0.21	0.42	0.56	4.55***	-1.77	0.62	0.89	11.23***
Milk	-2.27	0.85	0.88	8.71***	-1.52	0.75	0.95	15.73***	-1.02	0.64	0.72	6.41***	-2.27	0.81	0.91	12.45***
Oils & Fats	0.37	0.56	0.44	2.78***	1.41	0.41	0.74	6.37***	0.99	0.41	0.74	6.83***	-1.38	0.73	0.92	13.95***
Sugar	-2.09	0.82	0.83	8.97***	-0.32	0.57	0.95	16.65***	0.86	0.38	0.70	6.09***	-1.45	0.68	0.96	12.04***

Source: Calculated Based on Data from HIECS, CAPMAS, 2000.

*** Indicates significant at one percent level of significance.

Table 6.4 Expenditure Elasticities for Selected Food Groups by Household Size in Urban Egypt, 2000

Food group	One person				2-3 persons				4-6 persons				7 and more persons			
	α_j	β_j	R^2	T	α_j	β_j	R^2	T	α_j	β_j	R^2	T	α_j	β_j	R^2	T
Cereals	2.38	0.36	0.72	6.62***	1.82	0.41	0.97	28.16***	1.57	0.43	0.99	72.29***	1.20	0.48	0.94	15.59***
Beans	0.18	0.37	0.49	30.40***	1.60	0.17	0.63	5.41***	1.35	0.17	0.85	9.47***	-0.15	0.38	0.67	5.67***
Vegetables	2.02	0.39	0.84	9.26***	1.84	0.37	0.91	13.59***	1.49	0.38	0.95	17.31***	0.94	0.44	0.90	11.93***
Fruits	-1.27	0.76	0.74	6.94***	-1.70	0.78	0.96	20.76***	-2.39	0.85	0.95	18.20***	-3.02	0.91	0.95	17.46***
Meats	2.31	0.48	0.68	6.06***	1.41	0.55	0.87	10.99***	0.46	0.64	0.94	16.67***	-0.34	0.74	0.97	22.39***
Fish	0.12	0.58	0.75	7.18***	-1.14	0.68	0.93	15.47***	-1.80	0.75	0.92	13.99***	-1.95	0.75	0.83	8.87***
Eggs	2.30	0.20	0.41	3.44***	1.44	0.23	0.58	4.85***	0.15	0.36	0.74	6.82***	-1.51	0.57	0.84	9.34***
Milk	0.79	0.55	0.73	6.71***	0.09	0.62	0.91	13.01***	-1.48	0.76	0.91	13.17***	-2.55	0.89	0.92	13.29***
Oils & Fats	1.90	0.37	0.88	11.06***	0.90	0.45	0.93	15.50***	0.93	0.41	0.94	15.78***	0.20	0.48	0.80	8.02***
Sugar	-0.11	0.57	0.72	6.57***	-0.93	0.62	0.94	15.93***	-1.28	0.65	0.98	34.67***	-1.29	0.63	0.97	25.30***

Source: Calculated Based on Data from HIECS, CAPMAS, 2000.
*** Indicates significant at one percent level of significance.

Table 6.3 presents the expenditure elasticities for selected food groups for the four household sizes at rural level in 1999/2000. All coefficients appear to be significant at the 1 % significance level and expenditure elasticities have the expected positive signs.

Expenditure elasticity for cereals group is 0.35 for the smallest household size (one person). It increased to reach 0.43 for the biggest household size (7 persons and more), but it is the lowest, 0.31, for the household size 4-6 persons. It is observed that the expenditure elasticities for most food groups decrease for the household size 2-3 persons and 4-6 persons, and then increase for the largest household size (7 persons and more), as shown in Table 6.4.

The expenditure elasticity for vegetables, fruits, and fish has each achieved the lowest for the household size 2-3 persons, indicating high economies of scales in consumption of these food groups for this household size as compared to other household sizes. For other food groups, the expenditure elasticities are the lowest for the household size of 4-6 persons.

For urban Egypt, the corresponding expenditure elasticities are reported in Table 6.4 for each household size for 10 food groups. The expenditure elasticity for the cereals group increases at a decreasing rate as household membership increases. It is 0.36, 0.41, 0.43, and 0.48 for the household sizes: one person, 2-3 persons, 4-6 persons and 7 and more persons, respectively.

The same pattern of elasticity estimates is observed for fruits, meats, fish, eggs, and milk and its products with differences in economies of scale in consumption of these food groups as household size increases.

6.2.4 Simultaneous Effect of Total Expenditure, Location, and Household Size

Important determinants of food expenditure patterns are income (or expenditure) level of the household, the household size, and the local food habits. These determinants are analysed simultaneously by using dummy variables for each food group (Equation 6.2). The major results are shown in Table 6.5.

As can be expected, total expenditure (income) variable is an important determinant of food expenditure. There is a marked difference between rural and urban areas in the expenditure on most food commodity groups. Most of the coefficients appear to be significant at the one significance level and expenditure elasticities have the expected positive signs.

For most food commodity groups, the household sizes; 4-6 persons and 7 and more persons, have significantly influences on household food expenditures.

Table 6.5 Double-Logarithmic Curves: Estimated Coefficients and Related Statistics for Selected Food Groups, 2000

Food group	Explanatory variables	Parameter	T	R^2	F
Cereals	(Constant)	1.99	15.39***	0.90	239.43***
	Ln total expenditure	0.40	28.74***		
	Location	0.15	5.06***		
	Household size				
	2-3 persons	-0.10	-2.48***		
	4-6 persons	-0.20	-4.64***		
	7 and more persons	-0.17	-3.73***		
Beans	(Constant)	1.63	4.46***	0.41	18.13***
	Ln total expenditure	0.20	5.06***		
	Location	0.29	3.57***		
	Household size				
	2-3 persons	-0.24	-2.05**		
	4-6 persons	-0.48	-4.01***		
	7 and more persons	-0.54	-4.27***		
Vegetables	(Constant)	1.96	11.64***	0.89	222.71***
	Ln total Expenditure	0.39	21.81***		
	Location	0.04	0.96		
	Household size				
	2-3 persons	-0.30	-5.65***		
	4-6 persons	-0.53	-9.58***		
	7 and more persons	-0.69	-11.85***		
Fruits	(Constant)	-1.99	-5.96***	0.88	192.52***
	Ln total expenditure	0.86	23.86***		
	Location	-0.06	-0.75		
	Household size				
	2-3 persons	-0.38	-3.54***		
	4-6 persons	-0.55	-4.96***		
	7 and more persons	-0.69	-5.98***		
Meats	(Constant)	1.06	4.91***	0.89	223.40***
	Ln total expenditure	0.62	26.49***		
	Location	0.02	0.32		
	Household size				
	2-3 persons	-0.21	-3.08***		
	4-6 persons	-0.42	-5.94***		
	7 and more persons	-0.36	-4.80***		
Fish	(Constant)	-1.09	-3.10***	0.80	105.88***
	Ln total expenditure	0.66	18.08***		
	Location	-0.33	-4.31***		
	Household size				
	2-3 persons	-0.10	-0.89		
	4-6 persons	-0.12	-1.02		
	7 and more persons	-0.32	-2.62***		

Continued Table 6.5

Food group	Explanatory variables	Parameter	T	R^2	F
Eggs	(Constant)	0.55	2.41**	0.82	123.61***
	Ln total expenditure	0.39	15.78***		
	Location	0.20	4.01***		
	Household size				
	2-3 persons	-0.37	-5.12***		
	4-6 persons	-0.64	-8.42***		
	7 and more persons	-0.76	-9.56***		
Milk & Its products	(Constant)	-0.72	-2.93***	0.91	265.91***
	Ln total expenditure	0.72	26.91***		
	Location	-0.40	-7.33***		
	Household size				
	2-3 persons	-0.15	-1.93		
	4-6 persons	-0.39	-4.75***		
	7 and more persons	-0.48	-5.61***		
Oils & Fats	(Constant)	1.04	4.92***	0.86	167.56***
	Ln total expenditure	0.46	20.30***		
	Location	0.17	3.54***		
	Household size				
	2-3 persons	-0.27	-3.96***		
	4-6 persons	-0.55	-7.88***		
	7 and more persons	-0.63	-8.49***		
Sugar	(Constant)	-0.40	-2.02***	0.92	290.14***
	Ln total expenditure	0.60	28.30***		
	Location	0.12	2.69***		
	Household size				
	2-3 persons	-0.32	-5.05***		
	4-6 persons	-0.54	-8.27***		
	7 and more persons	-0.64	-9.27***		

Source: Calculated Based on Data from HIECS, CAPMAS, 2000.

*** Indicates significant at one percent level of significance.

** Indicates significant at five percent level of significance.

6.3 Complete Demand System

Demand elasticities for a particular country provide valuable information for policy analysts in understanding the pattern of growth of the national food consumption. Specific country elasticities are influenced by both the level of income attained and the quantities of food that are currently eaten by the consumer. Estimation of complete demand functions is very useful not only in obtaining price elasticities, but also in getting reliable estimates of expenditure (income) elasticities. The measurement of these elasticities is required for the design of many different policies; for example, intelligent policy design for indirect taxation and subsidies requires knowledge of these elasticities for taxable commodities (Deaton, 1987, p. 7) and, in addition, in the projections for future food consumption. Such knowledge would normally be obtained by the analysis of time-series data on demand for commodities, prices, and incomes. For Egypt as well as for many developing countries, there is typically rather few time-series data from which price elasticities can be inferred. As a result of this limitation and with the available cross-sectional data resulting from extensive surveys on household expenditures, most studies in Egypt concentrated on the estimation of expenditure elasticities (Engel relationship) and ignored the price elasticities (see Section 6.2).

Deaton (1987) developed a methodology for using such household survey data to detect the spatial variation in prices and to estimate the price elasticities by comparing spatial price variation to spatial demand patterns. He states that these household surveys contain information on the spatial distribution of prices, and thus, by recovering this information in a useful form, there is a potential for estimating the impact of prices on quantity-demanded. Since prices for food products are not provided by the survey, the ratio of expenditure to purchased quantity can be used as a proxy for prices. These prices should be corrected before being incorporated into the demand system according to the causes of cross-sectional price variations.

In the survey data used by Deaton, there are variations in the cross-sectional price data due to region, household characteristics (male, female, age groups,…), seasonal effects, aggregation of the commodities,….etc. Similar data for the survey data used by Deaton are available for a wide range of developing countries so that the technique should have wide applicability.

Prais and Houthakker (1971, p. 110) identify price variation due to region, price discrimination, services purchased with the commodity, seasonal effects, and quality differences caused by heterogeneous commodity aggregates. When the structure of demand is relatively constant, price variation can be attributed to changed supply conditions and can be used to identify commodity demand curves. In order to interpret correctly the effects of prices in the analysis of household budget data, the causes of cross-sectional price variations must be identified and only supply related price variations should be used to estimate the demand functions.

For the Egyptian household survey, and due to the limitations of the survey data in its published form, the causes of price variation are due to region and the aggregation of commodity group. The survey data do not show any seasonal variations from one month to another, because the monthly data are added together to give annual consumption and expenditure. But the survey did not collect data on the other conditions such as household characteristics in each region.

Nine food aggregate commodity groups were chosen for the analysis of this study: cereals, beans and vegetables, fruits, oils and fats, sugar, meats, fish, eggs, and milk and its products. Each of selected food group, except fish and eggs, is not a homogeneous good but consists of a number of components. For example, in the data it is possible to separate the cereals group in to wheat, rice, and maize, but a category such as "rice" does not encompass different kinds of rice, some of which are more expensive than others. This food-grouping is to reduce the total number of parameters in the model and then estimation demand system more manageable (Abdulai, 2002, pp. 1-18 and Abdulai and Aubert, 2004, pp. 67-79). In each equation, 11 parameters must be estimated from only 50 observations, each observation belongs to one governorate in Egypt, and any addition of new parameters is likely to reduce the number of degrees of freedom. Each food group includes those commodities that have the same nutritional value and their prices are very likely to move in tandem and hence there would be no serious aggregation problem.

The variation in food group prices is due to differences in consumed items in each group and the variation in prices of each item across governorates. The latter is due to regional market conditions. Therefore, the price of each food group is computed as a weighted average of prices on specific items. The price obtained is effectively a value and quantity ratio, which is called a "unit value" by Deaton (1988) and in the present study the "unit value of the aggregated commodity".

Using unit values as price proxies, as in this study, brings about another specific concern. Unit values are not only affected by the actual prices consumers face, but also by the composition of the commodity group. When separate goods are aggregated into a single commodity group, this leads to variations in the average price, i.e. unit value of the aggregated commodity, changing with the quantities of the goods of which it is composed. This means that quality choice in this context is not only a question of differentiated goods but also quality choice is reflected in the quantity shares of the component goods.

The published data of the Egyptian household income, expenditure, and consumption survey is aggregated at fifty governorates (27 for urban Egypt and 23 for rural Egypt). The ratio of expenditure to quantity, the cost of the purchase, gives the cost of the commodities for fifty governorates. This information can be used as a proxy for the prices after calculating the "unit value of the aggregated commodity". Given, for example, different cereals costs, and then, there will be spatial variation in the costs of this food group across the governorates. This variation can be used to obtain the price information, which is missing in the household survey data. Thus, a complete demand system can be estimated, and price and expenditure (income) elasticities can be calculated as a result.

Therefore, in this section: First, the model for the estimation of complete demand system will be presented (Section 6.3.1). Second, the data source and the estimation procedure will be described (Section 6.3.2). Third, the empirical findings will be reported (Section 6.3.3). Finally, some conclusions will be discussed (Section 6.3.4).

6.3.1 Demand System Specification (LA/AIDS)

The LA/AIDS has been chosen as the basic model for the empirical application of this study (see, Chapter 2). Its demand functions in budget share form can be expressed as:

$$w_{ir} = \alpha_i + \sum_j \gamma_{ij} \ln p_{jr} + \beta_i \ln x_r / P_r^* \qquad (6.3)$$

where the commodities i = 1,… 9, and the regions r = 1,….50. w_{ir} is the budget share of good i in region r, p_{jr} is the price of good j in region r, x_r is the total food household expenditure in region r. P_r^* is the Stone's price index, and α_i, β_i , and γ_{ij} are the parameters that need to be estimated.

Researchers and policy makers are very much interested in demand elsticities. Due to the flexible functional form of the LA/AIDS model, elasticity analysis can be carried out. The demand elasticities are calculated as functions of the estimated parameters, and they have standard implications.

The expenditure elasticity (ε_i) , which measures sensitivity of demand in response to changes in expenditure, is calculated using

$$\varepsilon_i = 1 + (\beta_i / w_i) \qquad (6.4)$$

The uncompensated (Marshallian) own-price elasticity (ε_{ii}) and cross-price elasticity (ε_{ij}) measure how a change in the price of one product affects the demand of this product and other products with the total expenditure and other prices held constant. They are given by the following, respectively:

$$\varepsilon_{ii} = (\gamma_{ii} / w_i) - (\beta_i + 1) \tag{6.5}$$

$$\varepsilon_{ij} = (\gamma_{ii} / w_i) - \beta_i \, w_j / w_i \tag{6.6}$$

In the same way, the compensated (Hicksian) price elasticities (ε_{ii}^* and ε_{ij}^*), which measure the price effects on the demand assuming the real expenditure x_r / P_r^* is constant, are calculated as:

$$\varepsilon_{ii}^* = \gamma_{ii} / w_i + w_i - 1 \tag{6.7}$$

$$\varepsilon_{ij}^* = \gamma_{ij} / w_i + w_j \tag{6.8}$$

Also, the compensated price elasticity can be derived easily by using ε_i, ε_{ii}, and ε_{ij} and the following relation:

$$\varepsilon_{ij}^* = \varepsilon_{ij} + \varepsilon_i \times w_j \tag{6.9}$$

In particular, the sign of the calculated ε_{ij}^* indicates the substitutability or complementarily between the destinations under consideration.

6.3.2 System Assumptions

The data used to estimate the LA/AIDS model were obtained from the household income, expenditure, and consumption survey, conducted by CAPMAS in 2000. The survey data is aggregated at fifty governorates. The cost indices of the aggregated food groups for the fifty governorates are also obtained from the survey data. It is assumed that cost indices of these food groups are only different across the governorates, but not within the governorate according to Deaton’s methodology. This study includes the following nine food aggregates: cereals, beans and vegetables, fruits, oils and fats, sugar, meats, fish, eggs, and milk and its products. The cost indices of these commodities in each governorate are used as proxies for prices. Total expenditure is deflated by the consumer price index available in the Statistical Year Book of the Government of Egypt, conducted by CAPMAS.

The demand system works under the following assumptions:

- Food commodities are separable from non-food commodities in household's preference ordering. This assumption enables to express the food demand for any commodity group as a function of total food expenditure and the prices of food commodities groups. In the first budgeting stage, the household allocates the total expenditure to commodity groups (food and non-food). In the second stage, the household allocates the food budget to food commodity groups. This section of the study is concerned with the second stage.
- Each household has the same utility function. This is an assumption of most demand studies. Without this assumption, we should model for each household separately.
- The economic variables - income and prices - are the only variables that determine food demand.
- It is assumed that income distribution is the same for all regions.
- The household is assumed to have the same demographic characteristics, because of the absence of complete data about demographic variables for each governorate.

6.3.3 Model Results

The empirical results from OLS regressions for the specified model for demand functions showed that all estimated coefficients agree with a priori theoretical expectations. Estimates of the structural parameters for the LA/AIDS model are shown in Table 6.6. The parameters estimates satisfy the adding-up restriction. That is

$$\sum \alpha_i = 1, \quad \sum \beta_i = 0 \qquad (i, j = 1, 2, \ldots 9).$$

Overall, it can also be seen from the estimated results that a reasonable number of coefficients of the explanatory variables are significant. Out of 81 coefficients we have 23 γ_{ij} 's with significant t-statistics.

However of interest to researchers here and policy makers is the knowledge concerning elasticities of demand for food. According to value of the expenditure elasticities, the selected food groups are classified as inferior goods $(\varepsilon_i < 0)$, necessities $(0 < \varepsilon_i < 1)$, or luxuries $(\varepsilon_i > 1)$. Demand for a specific commodity is defined as price inelastic (elastic), if the absolute amount of its own-price elasticity is lower than unity (larger than unity).

Table 6.6 Parameter Estimates of Demand System (LA/AIDS Model)

(t values in parentheses)

Food group	α_i	β_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	γ_{i9}	R^2
Cereals	0.368 (1.234)	-0.068 (-1.486)	0.052 (1.111)	0.090 (1.067)	-0.155 (-1.856)*	0.169 (1.477)	-0.175 (-2.572)***	0.076 (0.926)	-0.089 (-2.387)**	-0.055 (-0.465)	-0.026 (-0.910)	0.513
Beans & Vegetables	0.042 (0.441)	-0.013 (-0.870)	0.003 (0.221)	0.073 (2.724)***	0.020 (0.764)	0.005 (0.132)	-0.060 (-2.809)***	0.005 (0.207)	-0.009 (0.783)	0.089 (2.360)**	0.006 (0.657)	0.512
Fruits	-0.034 (-0.858)	0.008 (1.394)	-0.004 (-0.646)	-0.017 (-1.507)	0.007 (0.608)	0.057 (3.701)***	-0.017 (-1.963)*	-0.013 (-1.230)	0.001 (0.040)	0.005 (0.363)	0.010 (2.657)***	0.511
Oils & Fats	-0.057 (-1.104)	-0.006 (-0.778)	0.017 (2.123)**	0.010 (0.701)	-0.017 (-1.181)	0.025 (1.285)	-0.006 (0.491)	-0.002 (-0.142)	0.001 (0.025)	0.061 (2.938)***	0.004 (0.750)	0.398
Sugar	0.204 2.950)***	-0.019 (-1.539)	-0.015 (-1.296)	0.020 (0.911)	-0.003 (-0.165)	-0.028 (-0.953)	0.017 (0.948)	-0.002 (-0.124)	0.011 (1.095)	-0.058 (-1.844)*	0.005 (0.695)	0.392
Meats	0.153 (0.510)	0.086 (1.887)*	-0.039 (-0.844)	-0.060 (-0.697)	0.075 (0.895)	-0.020 (-0.180)	0.036 (0.520)	0.013 (0.154)	0.025 (0.661)	-0.077 (-0.645)	0.007 (0.248)	0.181
Fish	0.079 (0.416)	-0.010 (-0.335)	0.031 (1.032)	0.032 (0.597)	-0.037 (-0.695)	-0.134 (-1.821)	0.104 (2.369)**	-0.052 (-0.996)	0.019 (0.794)	0.141 (1.835)*	-0.020 (-1.049)	0.256
Eggs	0.115 (2.163)**	-0.007 (-0.796)	0.002 (0.245)	0.005 (0.358)	0.039 (2.600)***	0.031 (1.478)	-0.023 (-1.907)*	-0.028 (-1.919)*	-0.001 (-0.055)	0.006 (0.284)	-0.008 (-1.632)	0.351
Milk & Its products	0.130 (0.818)	0.029 (1.217)	-0.049 (-2.013)**	-0.148 (-3.282)***	0.064 (1.444)	-0.105 (-1.728)*	0.123 (3.402)***	-0.002 (-0.050)	0.052 (2.622)***	-0.112 (-1.757)*	0.019 (1.200)	0.504

Source: Empirical Results for the LA/AIDS Model Based on HIECS, 2000.

*** Indicates significant at one percent level of significance.

** Indicates significant at five percent level of significance.

* Indicates significant at ten percent level of significance.

Pairs of commodities are denoted as substitutes or complements if their compensated cross-price elasticities are positive or negative, respectively. As has been explained previously (Section 6.3.1), compensated elasticities indicate the change in demand for a commodity due to a price variation, when the real expenditure change caused by this price variation is compensated by an expenditure variation so that utility is kept constant. Using formulae (6.4)-(6.9) the expenditure, uncompensated and compensated price elasticities, respectively, are presented in Tables 6.7 through 6.9. The calculated elasticities and the relative order of magnitude among them are reasonable as compared with those values one would expect given heuristic considerations.

Table 6.7 Expenditure (Income) and Marshallian Own-price Elasticities

Food group	LA/AIDS model	
	Expenditure	Own-price
Cereals	0.541	-0.582
Beans & Vegetables	0.871	-0.238
Fruit	1.327	-0.745
Oils & Fats	0.821	-0.247
Sugar	0.664	-0.672
Meats	1.222	-1.053
Fish	0.864	-0.725
Eggs	0.833	-0.839
Milk & Its products	1.209	-0.898

Source: Empirical Results for the LA/AIDS Model Based on EHIECS, 2000.

6.3.3.1 Expenditure Elasticities

It can be seen from the above Table that expenditure and own-price elasticities are of expected sign. The income (expenditure) elasticities for all food groups are positive and less than one $(0 < \varepsilon_i < 1)$, except for fruits, meats, and milk, indicating that food groups are normal and necessary goods, and there are no inferior products. For vegetables, the expenditure elasticity amounts to 0.871, and for fish and sugar to 0.864 and 0.664, respectively. The food groups such as fruits, meats, and milk have expenditure elasticities larger than unity $(\varepsilon_i > 1)$, which identifies them as luxuries. It is expected that these food groups will experience an increase in demand when consumers' income increases in tandem with the overall economic growth of the country. However, if real income of households further decreases, in relative terms, less expenditures will be allocated to these food commodities. This result supports and agrees with the result of Hoddinott and Yohannes study (2002), discussed in chapter 4, indicating that as households' expenditures increase and households' diversify their diets, they tend to increase their consumption of non-staple foods rather than staple foods.

Another interesting finding is that cereals tend to have the lowest expenditure elasticity of demand. The consumption of this group is relatively little affected by income changes and has already occupied a special position in the Egyptian diet, as it is a staple food among the population.

Generally, the expenditure elasticities for selected food groups in Egypt are relatively high. This can be explained by the economic situation in Egypt. Many households, especially the poor, face tight budgetary constraints and all of the selected food commodity groups are considered as very important items because they fulfil fundamental needs of people.

6.3.3.2 Uncompensated Own-price Elasticities

Uncompensated own-price elasticities of demand for all food groups are negative and consistent with the a priori expectation. The absolute amounts of these elasticities for all commodity groups are lower than unity. The demand reacts inelastically to own price changes. An exception is meat where the elasticity amounts to -1.053 (elastic).

The uncompensated own-price elasticities for most the selected food groups, such as beans and vegetables, oils and fats, fish, and milk, are much lower than the total expenditure elasticities, implying that responsiveness of demand to own price changes of these aggregates is much lower than to variations in total expenditure. The largest absolute value of uncompensated own-price elasticity is calculated for the meats commodity group (-1.053). This implies that demand reacts elastically to changes in prices of these products. The elasticities are lowest for vegetables (-0.238), oils & fats (-0.247), and cereals (-0.582) where demand reacts least to price changes.

6.3.3.3 Compensated Own-price Elasticities

As predicted by demand theory, the compensated own-price elasticities are negative for all commodities (see Table 6.9). For all commodity groups, they are lower in absolute terms than the uncompensated ones. Especially for vegetables, meats, milk, and cereals, the compensated own-price elasticities are much smaller in absolute terms than the uncompensated ones, suggesting that a rise or fall in the price of the respective commodities would have considerable real expenditure effects. Given the huge average total food budget shares of, especially, meats (27.78 %) and vegetables (11.11 %), but also of milk (10.41 %), this is plausible.

6.3.3.4 Cross-price Elasticities

The values of the cross-price elasticities are smaller - in absolute terms - than those of the expenditure or own-price elasticities. This holds true for uncompensated and compensated cross-price elasticities (see Tables 6.8 and 6.9). The cross-price elasticities characterise pairs of goods as substitutes or complements. On the level of all selected food commodity groups, there are only substitution relationships and no complementary ones.

As previously noted (in chapter 4), many diets in Egypt are based on a single food with small amounts from plant or animal products. They lack dietary diversity. The fact that all food groups result as substitutes may be one reason explaining the lack of diversity in the Egyptian diet. It is important that a number of different food sources be consumed and efforts should be made to encourage a wide variety of foods to improve the nutritional quality of the Egyptian diet and health of the population. Dietary diversity is one of the most important ways to ensure a balance of nutrients for people of all ages.

However, one would have expected a complementary relationship for cereal products with vegetable products, where in Egypt, cereal products are frequently consumed jointly with vegetables (especially potatoes). This might result from aggregation decisions of the composite commodities.

Table 6.8 Uncompensated (Marshallian) Price Elasticities[15]

Quantity	Price								
	Cereals	Be. & Veg.	Fruits	Oils & Fats	Sugar	Meats	Fish	Eggs	Milk
Cereals	**-0.582**	0.396	0.363	0.366	0.376	0.529	0.384	0.369	0.419
Beans & Vegetables	0.768	**-0.238**	0.753	0.754	0.757	0.799	0.759	0.755	0.768
Fruits	0.279	0.295	**-0.745**	0.316	0.309	0.200	0.303	0.314	0.281
Oils & Fats	0.773	0.764	0.751	**-0.247**	0.757	0.816	0.760	0.754	0.772
Sugar	0.359	0.343	0.319	0.321	**-0.672**	0.441	0.334	0.323	0.357
Meats	0.000	0.011	0.027	0.025	0.020	**-1.053**	0.017	0.024	0.001
Fish	0.285	0.278	0.269	0.270	0.273	0.318	**-0.725**	0.270	0.284
Eggs	0.179	0.171	0.159	0.160	0.164	0.219	0.167	**-0.839**	0.178
Milk & Its products	0.100	0.111	0.126	0.124	0.120	0.050	0.116	0.123	**-0.898**

Source: Empirical Results for the LA/AIDS Model Based on EHIECS, 2000.

[15] Uncompensated (Marshallian) own-price elasticities are written in bold letters.

Table 6.9 Compensated (Hicksian) Price Elasticities[16]

Quantity	Price								
	Cereals	Be. & Veg.	Fruits	Oils & Fats	Sugar	Meats	Fish	Eggs	Milk
Cereals	**-0.502**	0.449	0.377	0.385	0.406	0.739	0.423	0.390	0.492
Beans & Vegetables	0.897	**-0.153**	0.777	0.786	0.847	1.097	0.817	0.802	0.891
Fruits	0.474	0.425	**-0.710**	0.361	0.382	0.715	0.399	0.366	0.368
Oils & Fats	0.894	0.845	0.773	**-0.219**	0.802	1.135	0.819	0.786	0.888
Sugar	0.456	0.407	0.336	0.344	**-0.695**	0.695	0.382	0.349	0.450
Meats	0.180	0.131	0.059	0.067	0.088	**-0.579**	0.105	0.072	0.174
Fish	0.412	0.363	0.291	0.299	0.320	0.653	**-0.663**	0.304	0.406
Eggs	0.302	0.253	0.181	0.189	0.210	0.544	0.227	**-0.806**	0.296
Milk & Its products	0.278	0.229	0.157	0.165	0.186	0.519	0.203	0.170	**-0.728**

Source: Empirical Results for the LA/AIDS Model Based on EHIECS, 2000.

[16] Compensated (Hicksian) own-price elasticities are written in bold letters.

6.4 Conclusions

Generally, as compared to the previous section estimating only the expenditure elasticities (Engel relationship) for Egypt, the results of the complete demand analysis are different only in the value but are of the same order of magnitude. Thus, as expected, incorporating of prices into the demand analysis is vital not only in obtaining the price elasticities, but also in getting reliable estimates of the expenditure elasticities. Until it becomes possible to use time-series price data, the current estimates of price elasticities should be very useful in the design of many different government policies.

The results of the analysis of food expenditure and income elasticities of demand for different food commodity groups showed that expenditure elasticities for all food groups were positive; indicating that demand for these products will continue to increase with growing real income and improving the level of Egyptian society. Therefore, the future demand for these foods would most likely increase steeply. Egypt will need to increase its production of these foods, especially livestock products that have high expenditure elasticities. In addition, the growth in demand for these food groups will contribute to a strong need for market improvements and for an efficient market distribution. In Egypt, the prices of some foods, like meat and fish have been rising in the recent past. This has been an important point of contention by consumers in Egypt, and despite efforts to regulate or even control prices this trend continues. The price of meats has tended to be high in many parts of the country. The same holds true for fish whose prices have not only been subject to sharp fluctuations but also to an increasing trend. These constitute impediments to economic access by consumers.

CHAPTER 7

FORECASTING FOOD PRODUCTION AND CONSUMPTION

7.1 Introduction

The findings of the analysis of food expenditure and elasticities of demand for different food groups presented previously - in chapter 6 - provide a useful basis for food policy formulation. In the context of food security, which is now given high priority by the government, the issues and prospects concerning the three integral components of food security - access, availability, and stability - as well as the question of food quality need to be considered in their proper perspective.

The projections in this section are not statements of what will happen, but of what might happen, given the assumptions and methods used. The reference case projections are business-as-usual trend forecasts, given known technology and demographic trends, and current laws and regulations. Thus, these projections provide a policy-neutral starting point that can be used to analyse national food requirement and policy initiatives.

7.2 Assumptions and Methodology

The assumption of the study in this section is that the trends of production and consumption for the selected food items tend to remain as currently observed.

Production

In this section, the simple linear trend models, presented in the third chapter, are used to forecast future production for major food commodities.

Consumption

The consumption of food is influenced by several factors. This section limits the variables to population growth, per capita consumption, and expected increase in income and prices i.e. the most important factors influencing the levels of food consumption. These variables are utilised in the projections for future food consumption until the year 2015, using price and expenditure (income) elasticities of demand for the selected food groups estimated from LA/AIDS model (see, Section 6.3.3). This means that expenditure elasticity for the cereals group is used in forecasting the future consumption of wheat, maize, and rice. Also, the expenditure elasticity for vegetables is used for tomatoes, potatoes, and onions. And the expenditure elasticity for fruits is used in forecasting the future consumption of citrus, banana, and grapes. The per capita food consumption is estimated using the Consumption Bulletin issued by CAPMAS. For the purpose of forecasting food consumption, the per capita real income growth rate for the base year is used depending on the Economic Bulletin published by the Ministry of Foreign Trade and Supply of the Government of Egypt.

7.3 Results

In this section, projections are made for the years 2005, 2010, and 2015. The analysis is to estimate future consumption and production of the selected food items. Fifteen food items were selected based on their importance to the Egyptian diet and availability of data, expenditure and price elasticities.

Results of the analysis are shown in Tables 7.1 to 7.15 and in Figures 7.1 to 7.15. The self-sufficiency ratios for the selected food items are also shown in these Tables.

Cereals are expected to remain the dominant source of energy through 2015. Over the projection period, strong growth in rice self-sufficiency is projected to continue in Egypt over the 15-year forecast period, averaging 285.69 % through 2015. Wheat self-sufficiency is expected to improve slightly from 76.73 % in 2005 to 89.89 % in 2015. Egypt is projected to be far from being self-sufficient in wheat. Thus, Egypt will have to require an increase in the current rate of growth in national wheat production.

The decline in self-sufficiency ratios of sugar and oils & fats are expected to occur in all projection years. For sugar, it might reduce to 49.52 % in 2005, and then improve slightly to 51.26 % in 2015. Oils and fats self-sufficiency is projected to decline to 56.47 % in 2015.

Production of fish, red meat, and milk are expected to remain low relative to their consumption. Thus, self-sufficiency ratios of these food groups are projected to be lower in 2015, accounting for 81.96 %, 82.77 %, and 84.17 %, respectively. As indicated earlier, although these food groups are a relatively concentrated source of essential protein, of high quality and highly digestible, the diets in Egypt are low in the intake of these food groups because they are very expensive. Therefore, in order to improve the quality of the diets and increase of dietary diversity, in addition, improving livestock products self-sufficiency, Egypt will have to increase the production through long-term public investment in agricultural research and extension.

Table 7.1

Total Production and Total Consumption of Wheat

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	4,268.10	9,278.00	46.00
1995	5,722.40	11,360.70	50.37
2000	6,564.05	9,134.79	71.86
2005	8,182.37	10,664.30	76.73
2010	9,629.92	11,463.89	84.00
2015	11,077.47	12,323.47	89.89

Figure 7.1

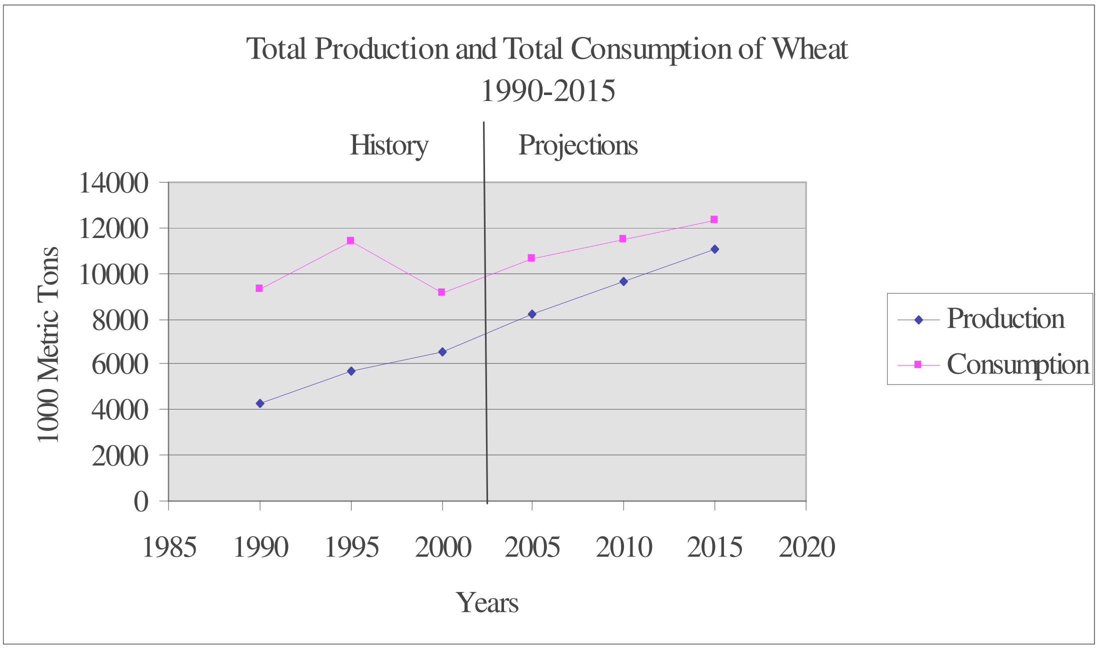


Table 7.2

Total Production and Total Consumption of Maize

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	4,798.60	4,284.90	111.99
1995	5,178.10	5,223.80	99.13
2000	5,650.40	4,975.00	113.58
2005	6,908.54	5,808.31	118.94
2010	7,637.99	6,243.81	122.33
2015	8,367.44	6,711.98	124.66

Figure 7.2

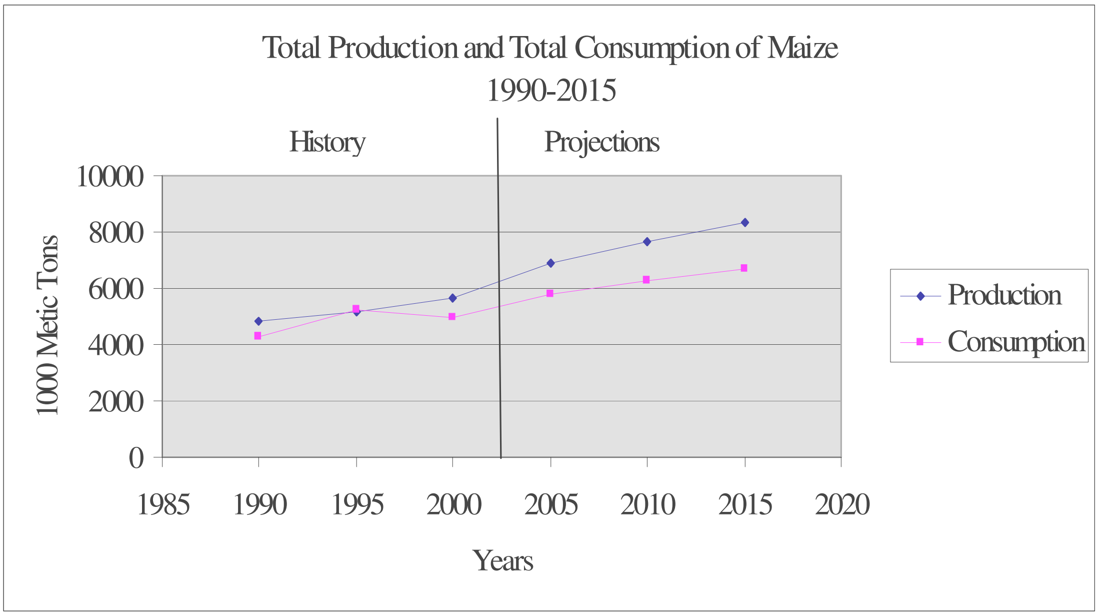


Table 7.3

Total Production and Total Consumption of Rice

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	4,798.60	4,284.90	111.99
1995	5,178.10	5,223.80	99.13
2000	6,000.50	2,687.70	223.26
2005	7,459.86	3,137.85	237.74
2010	8,909.46	3,373.12	264.13
2015	10,359.06	3,626.04	285.69

Figure 7.3

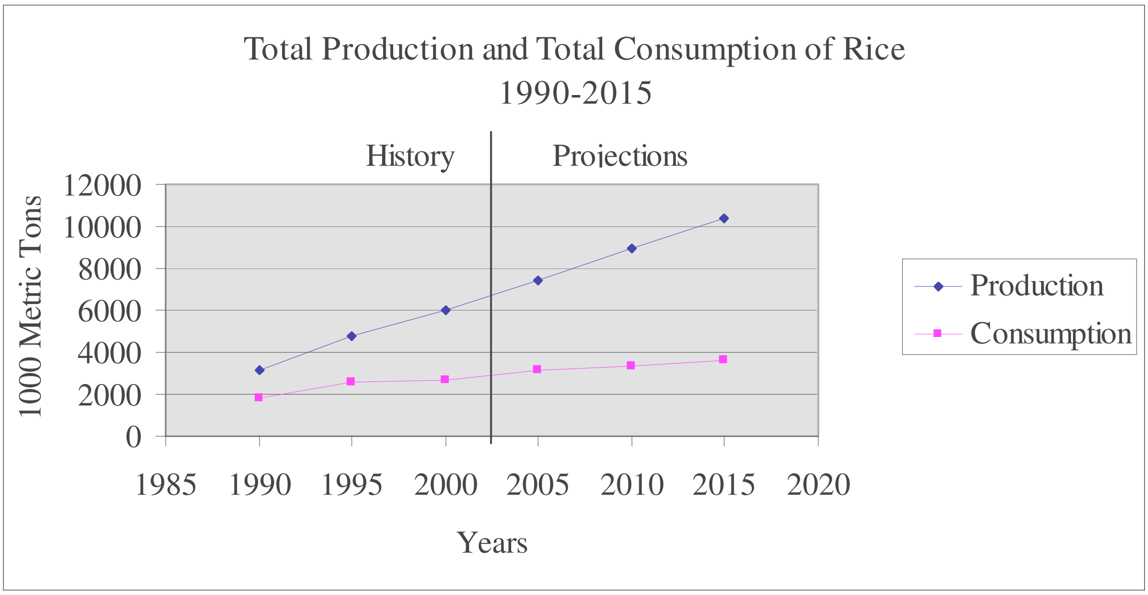


Table 7.4

Total Production and Total Consumption of Sugar

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	807.30	1,380.70	58.47
1995	1,371.57	1,639.87	83.64
2000	1,342.50	2,457.69	54.62
2005	1,080.55	2,182.08	49.52
2010	1,174.70	2,324.11	50.54
2015	1,268.85	2,475.39	51.26

Figure 7.4

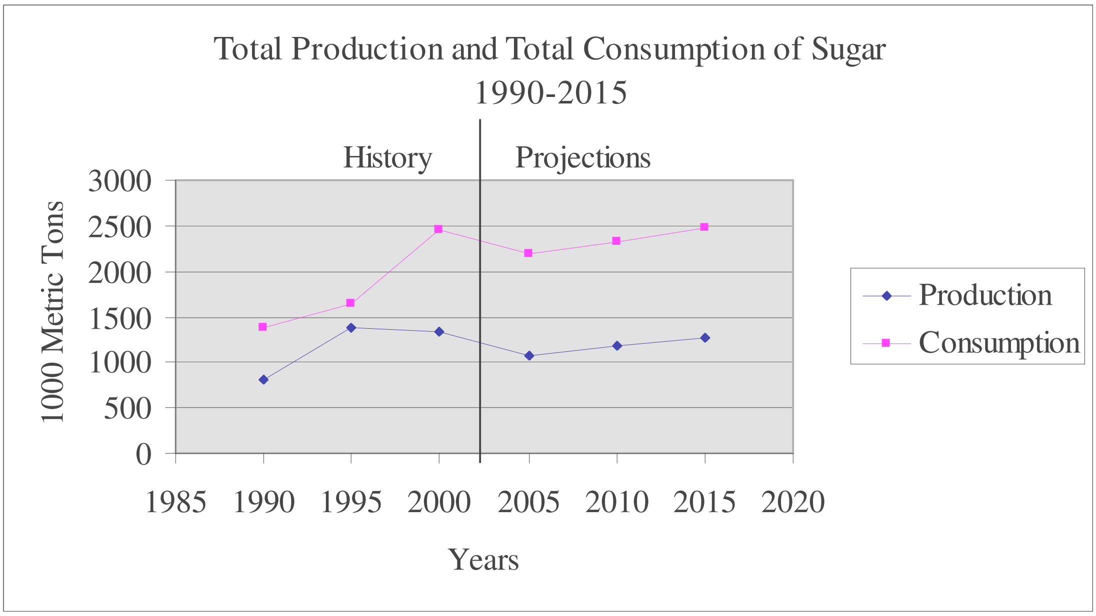


Table 7.5

Total Production and Total Consumption of Oils & Fats

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	331.00	469.10	70.56
1995	412.27	647.39	63.68
2000	606.00	1,052.50	57.58
2005	624.59	1,238.52	50.43
2010	722.84	1,341.91	53.87
2015	821.09	1,453.93	56.47

Figure 7.5

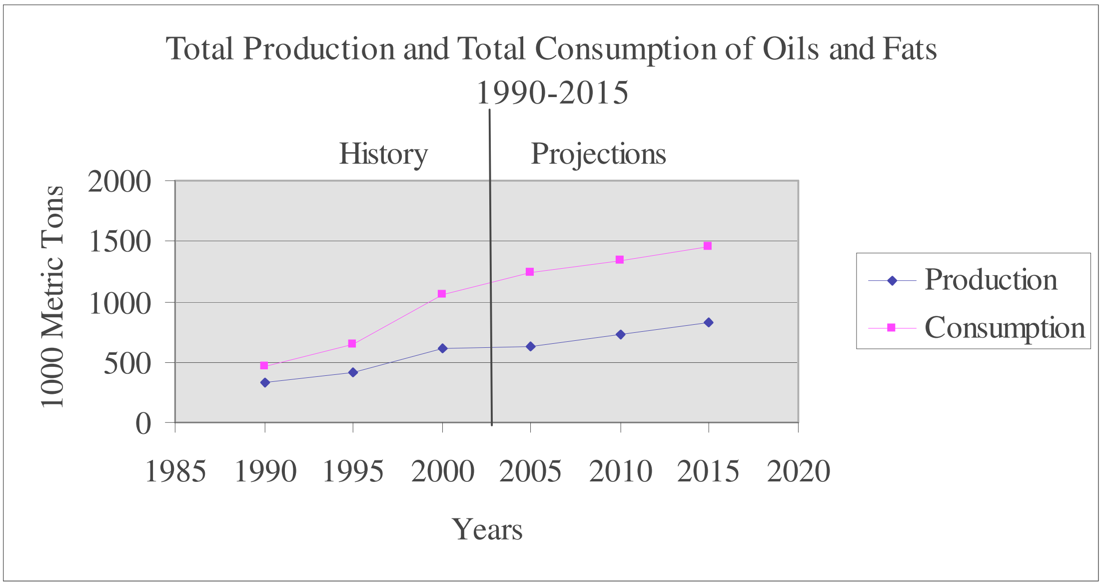


Table 7.6

Total Production and Total Consumption of Fish

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	295.00	427.10	69.07
1995	343.84	487.37	70.55
2000	632.78	835.95	75.70
2005	625.76	954.55	65.56
2010	745.51	1,003.84	74.27
2015	865.26	1,055.67	81.96

Figure 7.6

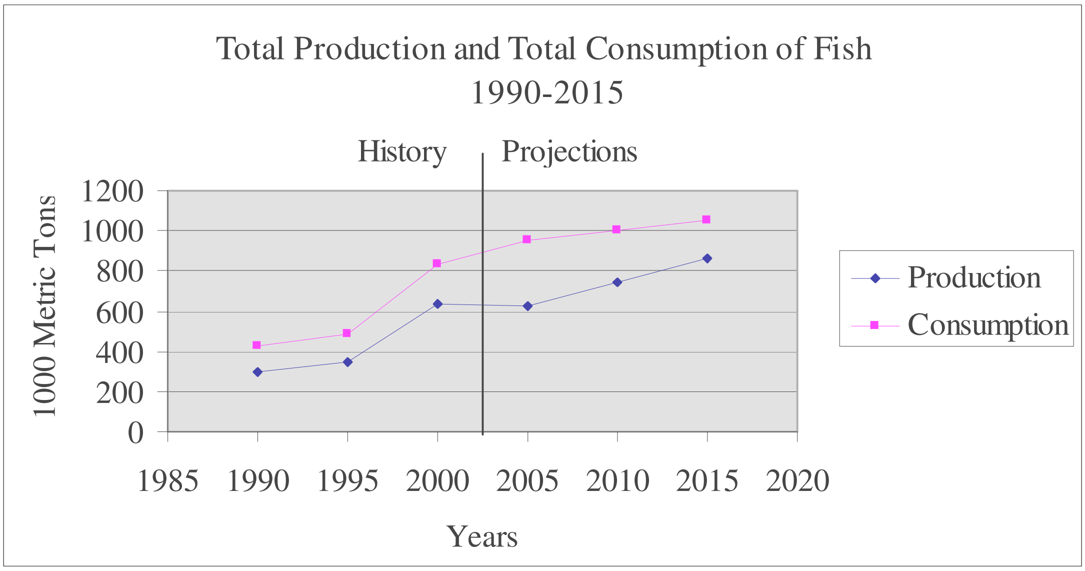


Table 7.7

Total Production and Total Consumption of Milk

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	2,154.00	2,303.00	93.53
1995	1,723.00	1,593.26	108.14
2000	3,632.00	5,351.54	67.87
2005	3,986.98	5,916.55	67.39
2010	4,573.78	6,022.86	75.94
2015	5,160.58	6,131.09	84.17

Figure 7.7

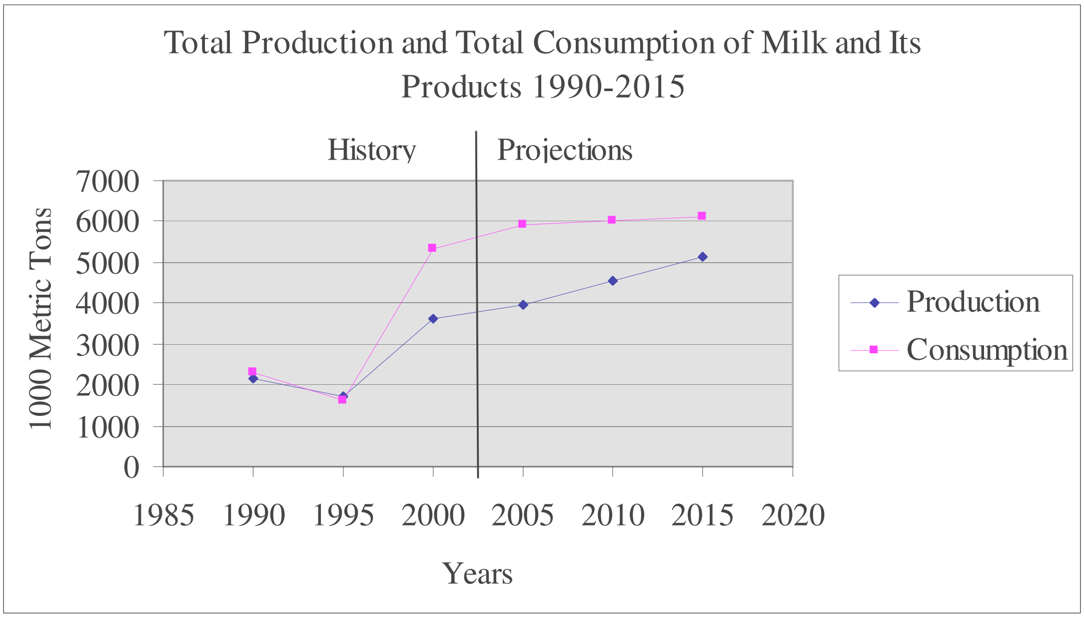


Table 7.8

Total Production and Total Consumption of Red Meat

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	511.20	538.70	94.90
1995	577.57	780.28	74.02
2000	519.25	856.59	60.62
2005	679.18	934.07	72.71
2010	728.88	937.65	77.73
2015	778.58	940.62	82.77

Figure 7.8

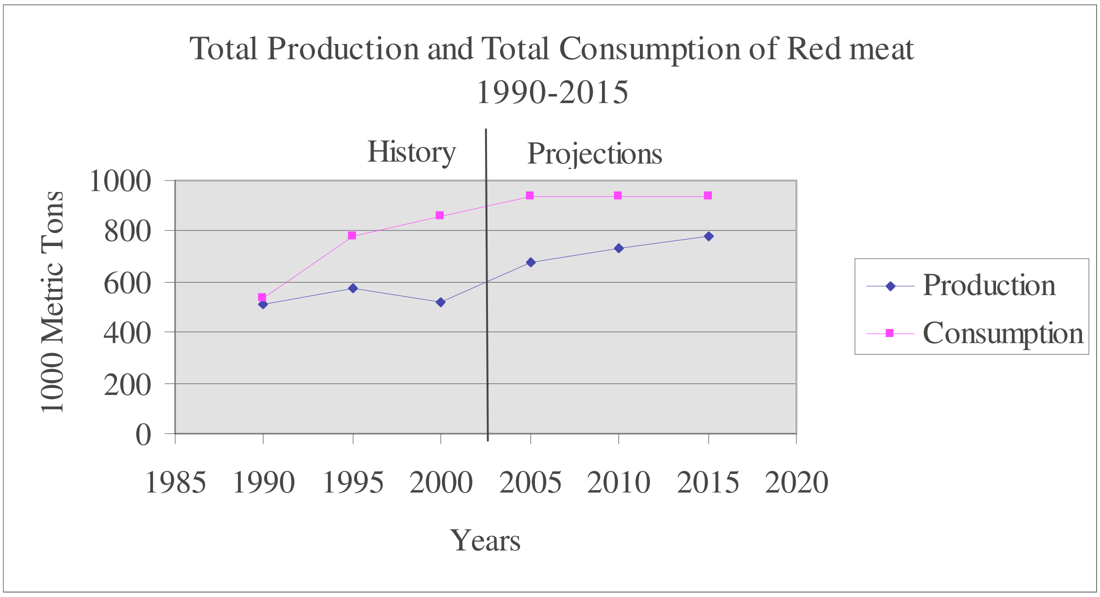


Table 7.9

Total Production and Total Consumption of Poultry

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	449.00	453.50	99.01
1995	578.50	578.60	99.98
2000	524.41	524.41	100.00
2005	714.56	572.18	124.88
2010	808.91	574.19	140.88
2015	903.26	576.20	156.76

Figure 7.9

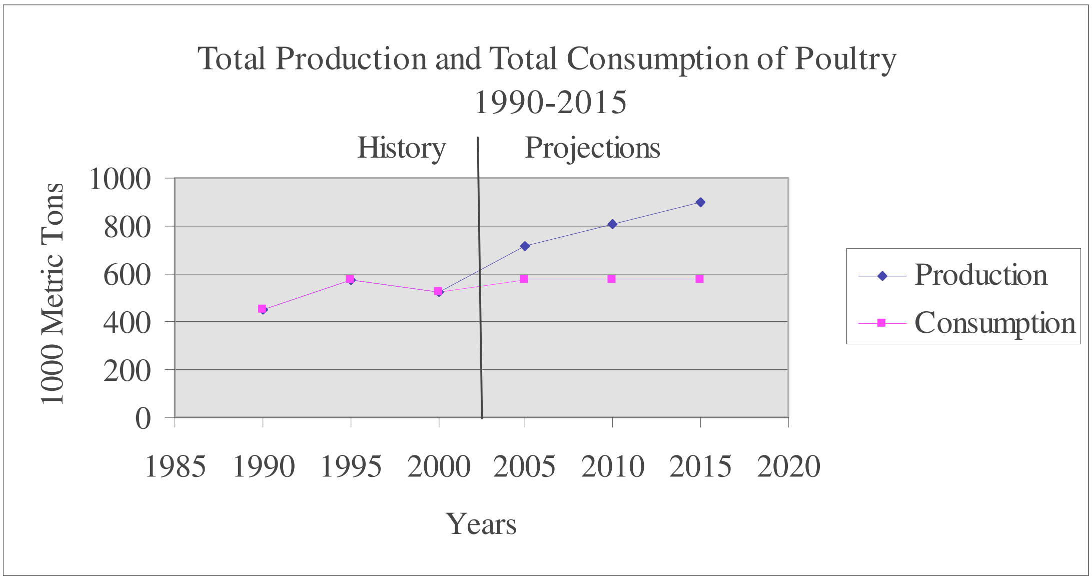


Table 7.10

Total Production and Total Consumption of Citrus

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	2,244.75	1,258.40	178.38
1995	2,291.48	1,429.92	160.25
2000	2,401.05	1,459.17	164.55
2005	2,651.88	1,624.33	163.26
2010	2,869.53	1,664.95	172.35
2015	3,087.18	1,706.60	180.90

Figure 7.10

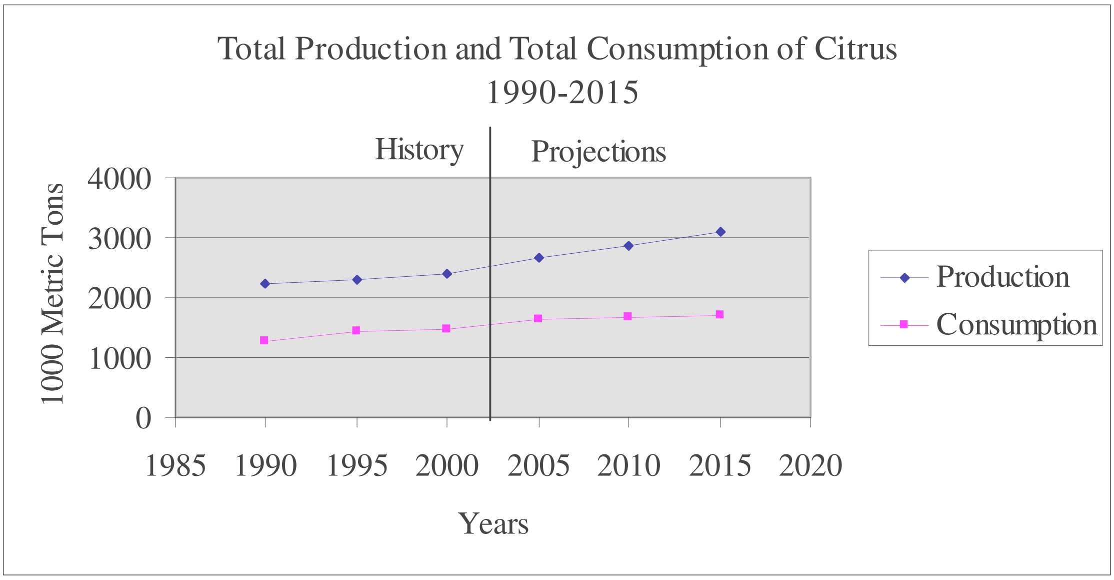


Table 7.11

Total Production and Total Consumption of Banana

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	415.50	289.30	143.62
1995	498.68	329.24	151.46
2000	760.51	469.13	162.11
2005	891.05	522.38	170.58
2010	1,063.15	535.44	198.55
2015	1,235.25	548.84	225.07

Figure 7.11

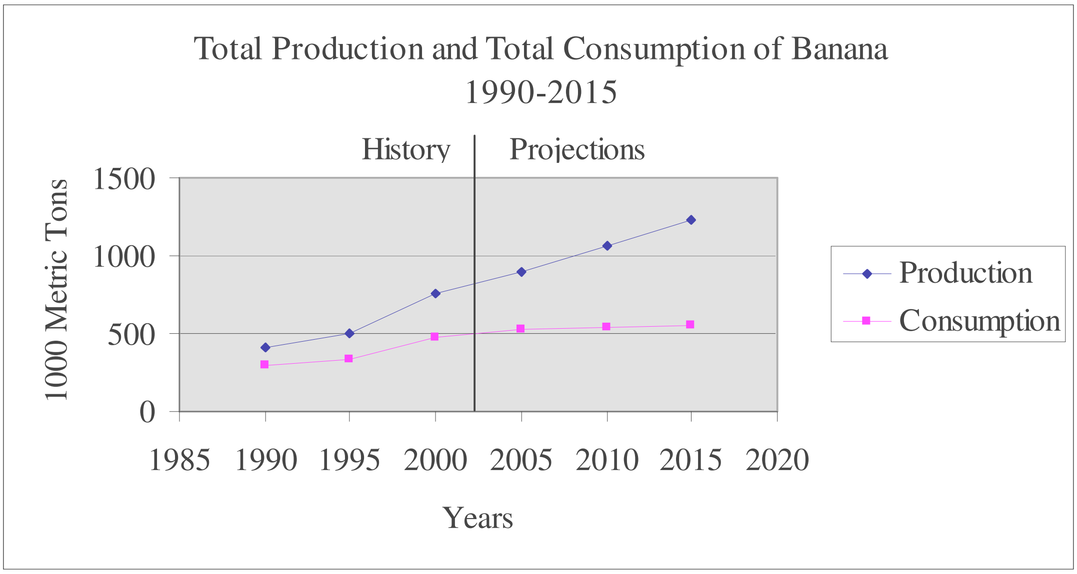


Table 7.12

Total Production and Total Consumption of Grapes

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	584.69	638.30	91.60
1995	739.48	649.32	113.89
2000	1,075.11	924.83	116.25
2005	1,260.05	1,029.41	122.40
2010	1,484.05	1,055.16	140.65
2015	1,708.05	1,081.55	157.93

Figure 7.12

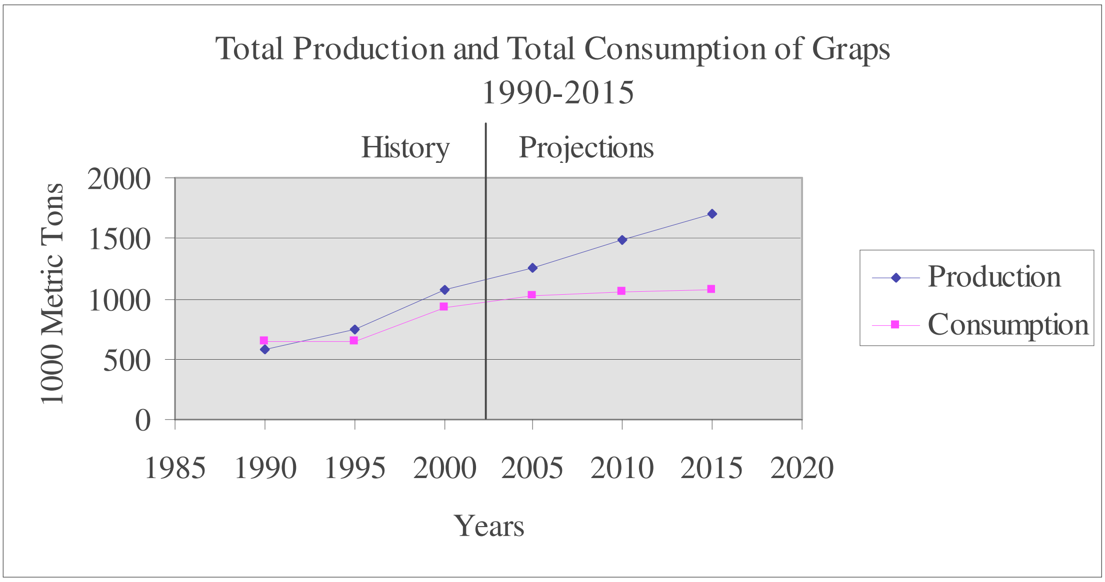


Table 7.13

Total Production and Total Consumption of Tomatoes

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	4,233.84	3,897.70	108.62
1995	5,034.20	4,686.33	107.42
2000	6,785.64	4,703.83	144.26
2005	7,648.36	5,531.05	138.28
2010	8,802.46	5,991.17	146.92
2015	9,956.56	6,488.92	153.44

Figure 7.13

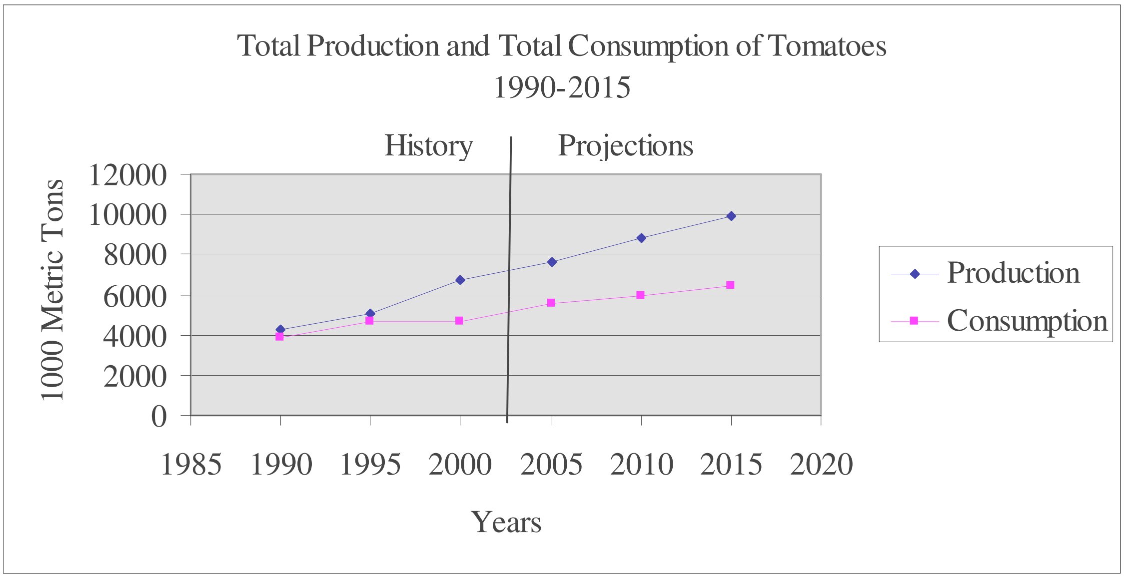


Table 7.14

Total Production and Total Consumption of Potatoes

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	1,637.80	1,292.70	126.70
1995	2,599.10	711.75	365.17
2000	1,764.91	1,044.19	169.02
2005	2,125.15	1,228.55	172.98
2010	2,270.25	1,330.68	170.61
2015	2,415.35	1,441.31	167.58

Figure 7.14

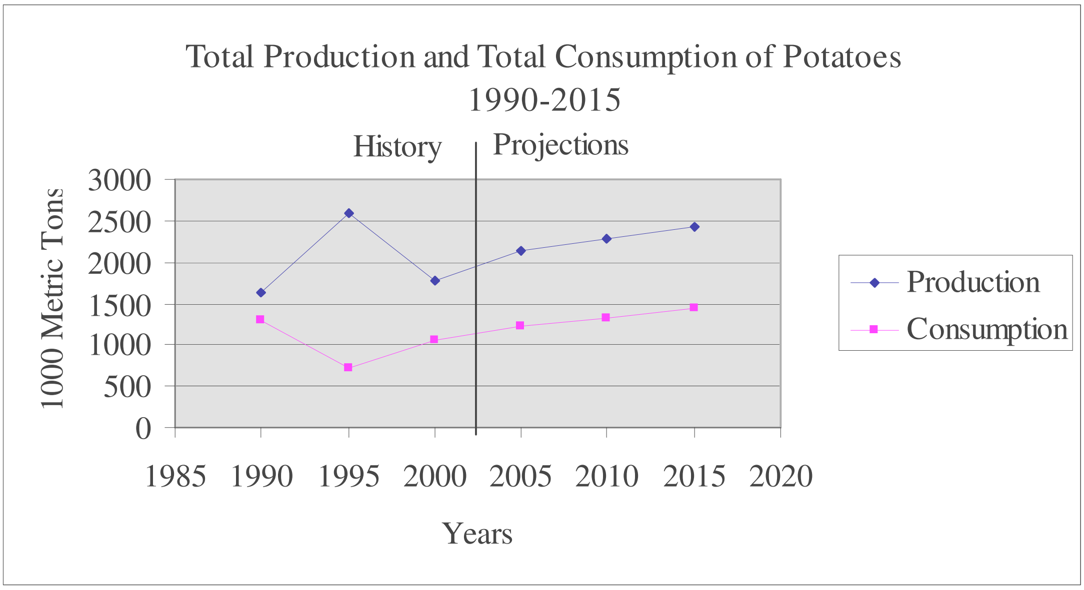


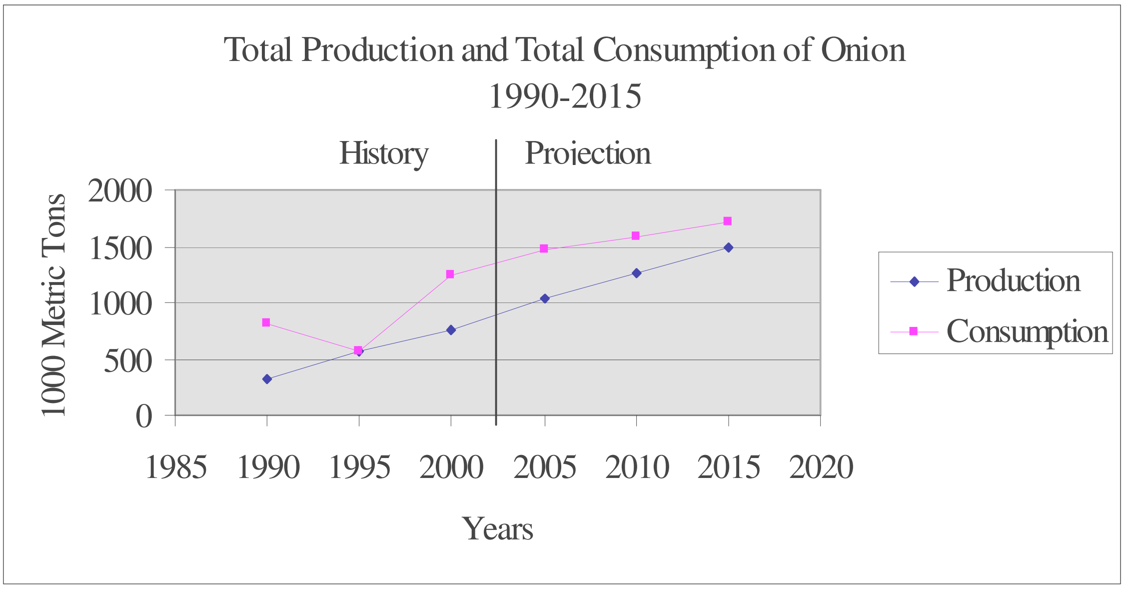
Table 7.15

Total Production and Total Consumption of Onions

1990-2015

Year	Production (Thousand tons)	Consumption (Thousand tons)	Self-sufficiency %
1990	312.07	817.50	38.17
1995	575.11	570.93	100.73
2000	762.99	1,245.00	61.28
2005	1,043.55	1,464.38	71.26
2010	1,266.45	1,586.12	79.85
2015	1,489.35	1,717.99	86.69

Figure 7.15



For vegetables and fruits, Egypt is expected to produce more than sufficient quantities over the projection period. The self-sufficiency of tomatoes and potatoes is expected to be 153.44 % and 167.58 %, respectively in 2015. And the self-sufficiency of citrus and banana is projected to account for 180.90 %, and 225.07 %, respectively, in 2015.

7.4 Conclusions

Although Egypt has the capability to produce more than sufficient quantities of several food items namely, rice, potatoes, vegetables, and fruits in the last decade or so, it is far from being self-sufficient in food, importing wheat, sugar, red meat, fish, milk, and oils. The analysis found that there is a steady increase in future consumption of most selected food items on the one hand. Production for most food items, on the other hand, appears to be leveling off. Taking both consumption and production together, Egypt is expected to be getting further and further away from being self-sufficient in its food production, especially for livestock products.

If this continues, Egypt will become more and more dependent on foreign countries to meet the national food requirement. To reverse the situation will be very difficult. There has to be adrastic change in the positioning of the agricultural sector. What is needed is not merely astabilisation programme, but structural changes to the entire sector.

Egypt will need to increase its food production and improve its food distribution system if it is to successfully feed its burgeoning population. This will require an increase in the current rate of growth in national food production, and achieving this in sustainable ways, i.e., without degrading the underlying natural resource base. As available land and water resources dwindle in Egypt, future growth in food production will have to come from further intensification of agriculture in both the high and low potential areas. The high-potential areas will be crucial for meeting national food demands, particularly in the face of rapid industrialisation and urbanisation. In most cases, Egypt can effectively compete through high and stable yields and cheap water and labour.

Another concern is the price of food; especially the demand of meats is price elastic, implying that demand reacts to changes in prices of these products. In Egypt, the prices of some of the foods, like red meat and fish, have been rising over the recent past. This has been an important point of contention by consumers in Egypt, and efforts to regulate or even control prices have not been fully successful. The price of meat has tended to be high in many parts of the country. The same goes for fish where its prices have not only been subjected to sharp fluctuations but also to an increasing trend. These constitute impediments to economic access by consumers. Therefore, policy makers have to reduce and regulate the prices of livestock products. To achieve this, the Government of Egypt may need to make greater public investment in primary and applied research and in extension services to encourage adoption of technologies that allow livestock to fulfil multiple simultaneous roles, i.e. savings, insurance, food and income.

CHAPTER 8

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Lack of dietary diversity is a particularly problem among the populations in Egypt, because their diets are predominantly based on starchy staples with little animal products and few fresh fruits and vegetables. It is observed that the major sources of calories and proteins in Egypt are plant products with small amounts from animal products as a concentrated source of essential protein that are of high quality and highly digestible. A total of 91.91 % of total calories and 79.59 % of total proteins consumed per capita per day in 2001 came from plant products. In addition, the diets in Egypt are low in fat intake, since of all basic foodstuffs, fat is one of the most expensive. Therefore, the Egyptian individual is still suffering from malnutrition and unbalanced essential nutrients like caloric value, proteins, and fat content. Also, there is a marked difference between rural and urban areas in food consumption patterns.

Food is not only a basic need, but it also has an enormous economic impact on Egyptian households. For that reason, it is essential to gain thorough knowledge of the determinants of food demand in order to design comprehensive agricultural, food, and social policy options that improve access to food in Egypt. Predictions of changes in consumer expenditure caused by changes in income and prices are key information for this purpose, and econometric analyses are needed to estimate them empirically. Therefore, the study estimates partial and complete food demand systems as a basis for future decisions on Egypt's food policies. It presents the estimation of expenditure elasticities for rural and urban areas and for each household size, using an Engel model because of the absence of data for each household size in each governorate. Due to the specific features of the data, spatial variation in regional prices estimated using household survey data are used as proxies for food prices after calculating the "unit values of the aggregated commodity" and incorporated into the complete food demand analysis to measure own- and cross-price elasticities. The expenditure and price elasticities of demand for different food groups are used in the projections for future food consumption up to the year 2015. In addition, the results of simple linear trend models are used to forecast future production for major food commodities.

The study depends mainly on both a descriptive and an econometric analysis of the most recent Egyptian Household Income, Expenditure, and Consumption Survey, issued by the Central Agency for Public Mobilisation and Statistics (CAPMAS) of the Government of Egypt. This survey was conducted from October 1999 to September 2000 and the results were published in December 2000. This is the largest survey of its kind conducted in Egypt and forms a representative sample for the whole of Egypt. The total sample was 47,949 households, of which 28,754 were located in urban and 19,195 in rural areas. In addition, the study uses data from the Ministry of Agriculture and Land Reclamation (MALR), the Economic Affairs Sector, the General Department of Agricultural Statistics; data of the Consumption Bulletin issued by CAPMAS; data of the Economic Bulletin published by the Ministry of Foreign Trade and Supply (MFTS); data of the Food Balance Sheet issued by the FAO; and data from the World Bank, IFPRI, and ILO.

The descriptive analysis examines the structure of food consumption and expenditure patterns for selected food groups in Egypt, with special emphasis on the difference between rural and urban areas and within rural and urban regions across governorates. This reflects a map of consumption and expenditure patterns in Egypt. The descriptive analysis identifies disparities in food consumption and expenditure of different food groups by region. However, it cannot answer the question of whether the disparities arise from varying economic conditions that the households are facing or whether they are the consequence of systematic differences in their economic behaviour due to different preferences. Food demand elasticities for the selected food groups reflect this economic behaviour.

Consumer behaviour theory provides a useful theoretical framework for analysing food consumption. In the basic setting, income, prices, and preferences are the factors that determine food demand. In order to choose a suitable model for the purpose of this study, selected complete demand systems are presented. The comparative assessment leads to the selection of the "Linear Approximation of the Almost Ideal Demand System" (LA/AIDS) because of its theoretical consistency and its ability to depict non-linear Engel curves.

The results of the econometric analysis indicate that as compared to estimating only the expenditure elasticities using Engel relationships for Egypt, the results of the complete demand system are different only in value but are of the same order of magnitude. Thus, as expected, incorporating prices into the demand analysis is vital not only for obtaining price elasticities, but also for getting reliable estimates of the expenditure elasticities. Expenditure and price elasticities for selected food groups are relatively high in Egypt. As expected, the estimation results show that expenditure elasticities for all food groups are positive and less than one, except for fruits, meats, and milk; indicating that the selected food groups are necessities. With the food groups such as fruits, meats, and milk having expenditure elasticities larger than unity, identifying them as luxuries, it is expected that these food groups will experience an increase in demand when consumers' income increases in tandem with the overall economic growth of the country. Another interesting finding is that cereals tend to have the lowest expenditure elasticity of demand. This indicates that cereals have already occupied a special position in the Egyptian diet, as it is the staple food of the population.

Uncompensated own-price elasticities of demand for all food groups are negative and consistent with the theoretical expectation. The absolute amounts of these elasticities for all commodity groups are lower than unity and so the demand reacts inelastically to own price changes, except for meats amounting to -1.053 (elastic). The uncompensated own-price elasticities (in absolute value) for most food groups, such as beans and vegetables, oils and fats, fish, and milk, are much lower than the total expenditure elasticities, implying that food demand reacts more elastically to expenditure changes than to own price changes. The elasticities are lowest (in absolute value) for vegetables (-0.238), oils & fats (-0.247), and cereals (-0.582) where demand reacts least to price changes.

For all commodity groups, the compensated own-price elasticities are lower - in absolute terms - than the uncompensated ones, suggesting that a rise or fall in the price of the respective commodities would have considerable real expenditure effects.

According to the values of cross-price elasticities and on the level of all selected food commodity groups, only substitution relationships are observed. Many diets in Egypt are based on a single of food with small amounts from vegetables or animal products and lack dietary diversity in the diet, which supports this result. However, one would have expected a complementary relationship for cereal products with vegetables, because in Egypt, cereal products are frequently consumed jointly with vegetables (especially potatoes). This might result from aggregation decisions of the composite commodities.

Regarding household specific elasticity estimates, households residing in rural and urban areas, and households of different sizes show that the expenditures on vegetables and meats increase with higher income in rural areas compared to urban areas. However, the expenditures on fruits, fish, and milk and its products are more likely to increase with higher income in urban areas than in rural areas. Also, the expenditure of most food groups has increased at decreasing rates as household size increased.

The findings of the empirical analysis of price and expenditure (income) elasticities for the selected food groups estimated from OLS regressions for the LA/AIDS model are used in the projections for future food consumption until the year 2015. Egypt is expected to be getting further and further away from being self-sufficient in its food production. This holds true particularly for food items exhibiting high expenditure elasticities such as livestock products. The high price elasticities of demand for many food items stress the importance of food price changes for Egyptian households, and their reactions should be taken into account in the development of comprehensive agricultural and food policies in order to avoid unattended effects harming consumers.

Due to the strong influence of diets on health, adequate food consumption is an important public health concern. In Egypt, diets are traditionally overly rich in calories due to high consumption of cereal products and comparatively low consumption of healthy food such as fruits and livestock products. Considering the relatively high expenditure elasticities of demand for fruits and livestock products of all households, income increases would exert a positive influence on the intake of micronutrients that are delivered by fruits and livestock products. The results of this study suggest that income oriented policies are important to achieve better nutrition and reduce the problem of unbalanced diets in Egypt. In addition, complementing policies are necessary.

Recommendations

Several recommendations, based on the findings can be made for future food policies. The following are some of them:

In the Field of Food Security

- Increased food production and efficient food distribution systems are needed to meet nutritional needs of the population and to enhance the food security position of the nation.
- Increasing the quantities of imported fish and meats is expected to have an effect on fish and meat prices as a whole and as a result may benefit consumers.
- Dietary diversity is one of the most important ways to ensure a balance of nutrients for people of all ages. It is important, therefore, that efforts undertaken to encourage consumption of a wide variety of foods to improve the nutritional quality of the diet and health of the population.

Food subsidies can be better targeted to the poor people by the following:

- Subsidised *baladi* bread and wheat flour should be targeted and distributed in villages and urban neighbourhoods where the poor are known to be concentrated.
- The ration card system for sugar and cooking oil should provide high-subsidy green cards only to low-income households and reduce the benefits to the non-needy.
- The total annual food subsidy resources could be allocated to each region according to its contribution to total poverty.
- The subsidy system should re-establish subsidies on some of the healthy foods like red meat and fish that were abolished in 1990/91 and 1991/92, respectively. They are a relatively concentrated source of essential protein of high quality and highly digestible.

Or the best way for Egypt to improve its food distribution system is that the food subsidy system should be changed from the commodities form to a cash subsidy provided only to low-income households and reduce the benefits to the non-needy.

In the Field of Food Production and Consumption

- Developing and adopting new high-yielding varieties of wheat, rice, and other food crops.
- Focussing on increasing animal production, particularly small ruminants and fisheries, aiming at increasing the per capita consumption of animal protein in its various forms by means of:
  - Raising productivity of domestic cattle of buffalo, cow and sheep using improved genetic techniques.
  - Development of small ruminants, poultry, and fisheries farming.
  - Introducing high-yield genetics as a means to increase milking rate, meats and eggs production.
- Decrease per capita consumption of cereals (236 kg/year according to FAO, 2001), being the highest at world’s level, through redistribution of flour uses, raising the standard of living of the population and changing food consumption patterns.

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APPENDICES

Appendix A

Food Balance Sheet: Egypt, 2001

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protein (grams)	Fat (grams)
Grand total													3,385	96.5	62.2
Vegetable products													3,111	76.8	42.4
Animal products													273	19.7	19.9
Cereals – excluding beer	17,569	9,295	942	665	27,141	7,967	255	174	1,957	489	16,300	236.0	2,134	59.1	15.8
Wheat	6,255	4,444	750	23	11,425	1,398	167	0	662	250	8,948	129.5	1,086	34.3	6.3
Rice (milled equivalent)	3,486	3	328	639	3,178	133	47		207	97	2,693	39.0	409	7.9	0.8
Barley– excluding beer	94	10	43	0	147	91	4	23	11	0	17	0.3	2	0.0	0.0
Maize	6,842	4,838	-180	2	11,498	5,893	32	123	1,006	141	4,303	62.3	595	15.7	8.3
Rye	30	0		0	30	2	0	28	0	0	0	0.0	0	0.0	0.0
Oats		0			0						0	0.1	0	0.0	0.1
Millet		0		0	0						0	0.0	0	0	0.0
Sorghum	862	0	0	0	862	449	4		71		338	4.9	42	1.2	0.4
Cereals, other		1	0	0	1	1					0	0	0	0.1	0.1
Starchy roots	2,266	38	0	212	2,092	0	238	0	230	2	1,644	23.8	51	0.7	0.1
Cassava		0		0	0	0				0	0	0	0	0	0
Potatoes	1,903	36	0	206	1,733		232		194	2	1,326	19.2	39	0.6	0.1
Sweet potatoes	315	0		5	310	0	0	0	31	0	279	4.0	10	0.1	0.0
Yams															
Roots, other	48	2		1	49	0	6		4		39	0.6	1	0.0	0.0
Sugarcrops	18,429	0		4	18,426	100	1550	12,176	155	900	3,545	51.3	39	0.4	0.1
Sugar cane	15,572	0		4	15,568	0	1550	10,318	155	0	3,545	51.3	39	0.4	0.1
Sugar beet	2,858	0		0	2,858	100		1,858		900	0	0.0	0	0.0	0.0
Sugar & Sweeteners	1,564	637	272	39	2,433			0		402	2,031	29.4	294	0.0	0.0
Sugar, non-centrifugal															

Continued

Products	Domestic supply					Domestic utilization						Per capita cupply			
	Produc tion	Impor ts	Stock changes	Expor ts	Total	Feed	Seed	Proces sing	Waste	Others uses	Food	Kg/ year	Per day		
													Calories (No.)	Protien (grams)	Fat (grams)
	- 1000 Metric tons -														
Sugar (raw equivalent)	1,476	631	272	35	2,344			0		402	1,941	28.1	282	0.0	0.0
Sweeteners, other	79	6	0	4	81			0		0	81	1.2	12		
Honey	9	0		0	8						8	0.1	1	0.0	
Pulses	516	371	0	49	838	132	33		43	0	631	9.1	87	6.6	0.4
Beans	41	6	0	16	31		4			0	26	0.4	4	0.2	0.0
Peas	0	2	0	0	2		0		0		2	0.0	0	0.0	0.1
Pulses, other	475	363	0	33	805	132	28		43		603	8.7	83	6.3	0.3
Treenuts	33	11	0	0	44				1		44	0.6	5	0.1	0.5
Oil crops	929	493	34	19	1,436	0	32	825	25	43	519	7.5	62	2.0	5.6
Soyabeans	15	350	0	0	365			351			14	0.2	2	0.2	0.1
Groundnuts (shellled Eq.)	144	0	0	3	141		3	56	4	0	78	1.1	18	0.8	1.5
Sunflowerseed	44	11		4	51		1	49	2						
Rape and mustard seed		0		0	0						0	0.0	0	0.0	0.0
Cottonseed	368	0	15		383		25	319	4	35					
Coconuts – incl. copra		30	0	6	24						30	0.4	2	0.0	0.2
Sesameseed	35	69	0	2	102		0		3		98	1.4	23	0.7	2.1
Palmkernels		0			0						0	0.0	0	0.0	0.0
Olives	294	1	0	2	293				9		285	4.1	15	0.2	1.6
Oil crops, other	30	33	18	3	79	0	3	50	3	8	14	0.2	2	0.1	0.2
Vegetable oils	170	558	119	23	824			0		378	451	6.5	158	0.0	17.9
Soyabean oil	59	180	0	0	238					120	118	1.7	42		4.7
Groundnut oil	24	0			24						24	0.3	8		1.0
Sunflowerseed	14	107	110	0	231					20	211	3.1	74		8.4
Rape and mustard oil		0		0						0					
Cottonseed oil	54	4	0	5	54						54	0.8	19	0.0	2.2
Palmkernel oil		21	6	0	27						27	0.4	9		1.1

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Palm oil		210	0	0	210					210					
Copra oil		2	0	0	2						2	0.0	1		0.1
Sesameseed oil		0		0	0					0					
Olive oil		1	0	0	0						0	0.1	0		0.0
Ricebran oil															
Maize germ oil		11	3	0	14						14	0.2	5		0.6
Oil crops oil, other	19	22	0	18	23			0		28	0	0.0	0	0.0	0.0
Vegetables	13,851	10	6	281	13,587	1			1,377		12,210	176.7	107	5.2	0.8
Tomatoes	6,329	5	4	28	6,309				633		5,676	82.2	41	2.2	0.4
Onions	628	0	0	166	462				63		399	5.8	7	0.2	0.0
Vegetables, other	6,894	5	2	86	6,816	1			681		6,134	88.8	60	2.7	0.3
Fruit – excluding wine	7,355	132	0	343	7,144			6	736		6,402	92.7	160	2.0	0.8
Oranges, mandarines	2,261	1		258	2,004				226		1,778	25.7	21	0.5	0.1
Lemons, limes	296	0		18	278				30		248	3.6	2	0.0	0.0
Grapes fruit	3	0		0	3				0		3	0.0	0	0.0	0.0
Citrus, other	2	0		0	2				0		2	0.0	0	0.0	0.0
Bananas	849	6		0	855				86		770	11.1	18	0.3	0.2
Apples – excl. cider	474	52	0	0	525				53		473	6.8	9	0.1	0.0
Pineapples		2	0	0	2						2	0.0	0	0.0	
Dates	1,113	1	0	1	1,114				111		1,002	14.5	62	0.6	0.2
Grapes – excl. wine	1,079	44		5	1,118			6	110		1,002	14.5	27	0.2	0.1
Fruit, other	1,277	26	0	60	1,243				120		1,123	16.3	21	0.2	0.1
Stimulants		74	0	1	73						73	1.1	2	0.3	0.1
Coffee		5	0	0	5						5	0.1	0	0.0	
Cocoa beans		12	0	0	12						12	0.2	1	0.0	0.1
Tea		56	0	1	56						56	0.8	1	0.2	

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Spices	68	9	0	8	68				3		65	0.9	8	0.4	0.2
Pepper		6		0	6						6	0.1	1	0.0	0.0
Pimento	46	0		0	46				2		44	0.6	5	0.3	0.1
Cloves		0		0	0						0	0.0	0	0.0	0.0
Spices, other	22	2	0	8	16				1		15	0.2	2	0.1	0.1
Alcoholic beverages	127	0	0	7	120					50	70	1.0	1	0.0	
Wine	4	0	0	0	4						4	0.1	0		
Beer	64	0	0	1	63						63	0.9	1	0.0	
Beverages, fermented		0		0	0						0	0.0	0		
Beverages, alcoholic	52	0	0	0	52					50	2	0.0	0		
Meat	1,435	299	0	1	1,734			0			1,734	25.1	108	9.3	7.6
Beef and veal	550	293	0	0	842						842	12.2	52	4.6	3.6
Mutton & goat meat	108	2		0	110						110	1.6	10	0.6	0.8
Pigmeat	3	0		0	3						3	0.0	0	0.0	0.0
Poultry meat	630	4		0	634						634	9.2	37	3.2	2.6
Meat, other	144	0	0	0	144			0			144	2.1	8	0.9	0.5
Offals, edible	105	25		0	131						131	1.9	6	0.9	0.2
Animal fats	117	52	9	0	178	0				10	167	2.4	50	0.1	5.6
Butter, ghee	97	45	0	0	142						142	2.1	42	0.0	4.7
Cream		0		0	0						0	0.0	0	0.0	0.0
Fats, animals, raw	21	6	9	0	36					10	25	0.4	8	0.0	0.9
Fish, body oil	0	0		0	0	0				0					
Fish, liver oil		0			0					0					
Milk – excl. butter	4,029	304	0	22	4,311	597		-15	201	1	3,526	51.0	74	4.4	4.9

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Eggs	200	0		0	200		32		8		160	2.3	9	0.7	0.6
Fish, seafood	771	553	0	2	1,322	267				0	1,055	15.3	27	4.3	1.0
Feshwater fish	500	0		0	501					0	501	7.2	14	2.2	0.5
Demersal fish	180	9		0	189						189	2.7	3	0.7	0.1
Pelagic fish	59	433	0	0	492	267					224	3.2	7	0.9	0.3
Marine fish, other	12	108	0	1	119	0					119	1.7	3	0.4	0.1
Crustaceans	12	2		0	14						14	0.2	0	0.0	0.0
Cephalopods	3	1		0	4						4	0.1	0	0.0	0.0
Molluscs, other	5	0	0	1	5						5	0.1	0	0.0	0.0
Aquatic products, other	0									0					
Meat, aquatic mammals															
Aquatic animals, other	0				0					0					
Aquatic plants															
Miscellaneous													2	0.0	0.0

Source: FAO, Egypt Country, 2001.

Food Balance Sheet: Egypt, 1995

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protein (grams)	Fat (grams)
Grand total													3,285	90.0	58.2
Vegetable products													3,067	75.5	41.6
Animal products													219	14.6	16.6
Cereals – excluding beer	14,503	7,934	-92	162	22,183	4,647	306	114	1,607	403	15,106	243.7	2,182	60.7	15.4
Wheat	5,722	5,424	200	3	11,344	1,226	185	0	752	250	8,932	144.1	1,200	37.7	6.8
Rice (milled equivalent)	3,194	1	-102	153	2,940	93	80		184	83	2,499	40.3	423	8.1	0.8
Barley– excluding beer	368	73	-190	0	251	208	7	7	10		19	0.3	2	0.0	0.0
Maize	4,535	2,435	0	6	6,964	2,764	30	87	621	70	3,391	54.7	520	13.7	7.3
Rye	22	0		0	22	2		20			0	0.0	0	0.0	
Oats		0			0						0	0.0	0	0.0	0.0
Millet		0		0	0						0	0.0	0	0.0	0.0
Sorghum	661	0	0	0	661	352	4		41		263	4.2	37	1.1	0.4
Cereals, other		1	0	0	1	1					0	0.0	0	0.0	0.0
Starchy Roots	2,888	78	-51	426	2,490	0	268		296	402	1,523	24.6	51	0.8	0.1
Cassava		0		0	0	0				0	0	0.0	0		
Potatoes	2,599	78	-51	419	2,208		260		267	402	1,278	20.6	42	0.7	0.1
Sweet potatoes	165	0		5	160				17		144	2.3	6	0.0	0.0
Yams															
Roots, other	124	0		2	122	0	8		12		102	1.6	3	0.1	0.0
Sugarcrops	15,025	0		5	15,020	50	1,410	11,869	141	0	1,550	25.0	19	0.2	0.1
Sugar cane	14,105	0		5	14,100		1,410	10,999	141		1,550	25.0	19	0.2	0.1
Sugar beet	920	0		0	920	50		870		0					
Sugar & Sweeteners	1,301	582	-5	13	1,866			0		87	1,779	28.7	287	0.0	
Sugar, non-centrifugal															
Sugar (raw equivalent)	1,230	577	-5	6	1,796			0		87	1,709	27.6	276		

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Sweeteners, other	63	5	0	7	61			0		0	61	1.0	10		
Honey	8	0		0	8						8	0.1	1	0.0	
Pulses	459	174	46	17	662	111	29		33	0	489	7.9	76	5.7	0.4
Beans	14	11	20	7	37		4			0	33	0.5	5	0.3	0.0
Peas	2	3	0	0	5		2		0		3	0.0	0	0.0	0.0
Pulses, other	443	160	26	9	620	111	23		33		453	7.3	70	5.3	0.3
Treenuts	6	5	0	1	10				0		9	0.1	1	0.0	0.1
Oil crops	863	156	50	24	1,046	0	77	551	19	56	355	5.7	44	1.4	4.0
Soyabeans	63	55	41	0	159			147			12	0.2	2	0.2	0.1
Groundnuts (shellled eq.)	91	0	-14	8	69		2	23	3		41	0.7	11	0.5	0.9
Sunflowerseed	66	24		2	88		1	84	3						
Rape and mustard seed		0		0	0						0	0.0	0	0.0	0.0
Cottonseed	380	0	15		395		70	271	4	50					
Coconuts – incl. copra		30	0	12	18						30	0.5	2	0.0	0.2
Sesameseed	32	35	0	1	67		0		2		64	1.0	17	0.5	1.5
Palmkernels		0			0						0	0.0	0	0.0	0.0
Olives	208	0	0	0	208				6		202	3.3	12	0.1	1.3
Oil crops, other	23	12	8	1	42	0	3	25	2	6	6	0.1	1	0.0	0.1
Vegetable oils	121	747	68	4	933			0		481	452	7.3	177	0.0	20.0
Soyabean oil	26	81	0	0	107					35	72	1.2	28		3.2
Groundnut oil	10	0			10						10	0.2	4		0.4
Sunflowerseed	24	172	-10	1	186					20	166	2.7	65		7.3
Rape and mustard oil		0			0					0					
Cottonseed oil	52	96	12	0	160						160	2.6	63	0.0	7.1
Palmkernel oil		30	-16	0	15						15	0.2	6		0.6
Palm oil		300	90	0	390					390					

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Coconut oil		15	-5	0	10						10	0.2	4		0.4
Sesameseed oil		15		0	15					15					
Olive oil		0	0	0	0						0	0.0	0		0.0
Ricebran oil															
Maize germ oil		14	0	1	13						13	0.2	5		0.6
Oil crops oil, other	8	24	-3	2	27			0		21	6	0.1	2	0.0	0.2
Vegetables	10,268	19	9	238	10,059	0			1019		9,039	145.8	86	4.2	0.7
Tomatoes	5,034	18	0	19	5,033				503		4,529	73.1	36	2.0	0.4
Onions	386	0	0	116	271				39		232	3.7	4	0.1	0.0
Vegetables, other	4,847	2	9	103	4,755	0			477		4,278	69.0	45	2.1	0.3
Fruit – excluding wine	5,904	48	-3	91	5,858			4	589		5,265	84.9	132	1.7	0.6
Oranges, mandarines	1,966	1		43	1,924				197		1,727	27.9	23	0.5	0.2
Lemons, limes	308	0		13	294				31		263	4.3	2	0.1	0.0
Grapes fruit	2	0		1	1				0		1	0.0	0	0.0	0.0
Citrus, other	3	0		0	3				0		2	0.0	0	0.0	0.0
Bananas	499	5		0	503				50		453	7.3	12	0.2	0.1
Apples – excl. cider	438	19	0	0	457				46		411	6.6	9	0.0	0.0
Pineapples		0	0	0	0						0	0.0	0	0.0	
Dates	678	1	0	3	676				68		608	9.8	42	0.4	0.1
Grapes – excl. wine	739	6		1	744			4	74		666	10.7	20	0.2	0.1
Fruit, other	1,272	17	-3	30	1,255				123		1,132	18.3	25	0.3	0.1
Stimulants		95	0	0	95						95	1.5	2	0.4	0.0
Coffee		8	0	0	7						7	0.1	0	0.0	
Cocoa beans		8	0	0	7						7	0.1	0	0.0	0.0
Tea		80	0	0	80						80	1.3	1	0.4	
Spices	64	5	0	11	58				3		55	0.9	7	0.4	0.2

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
													Calories (No.)	Protien (grams)	Fat (grams)
	- 1000 Metric tons -														
Pepper		3		0	3						3	0.0	0	0.0	0.0
Pimento	44	0		0	44				2		42	0.7	5	0.4	0.2
Cloves		0		0	0						0	0.0	0	0.0	0.0
Spices, other	20	1	0	10	11				1		10	0.2	2	0.1	0.1
Alcoholic beverages	90	0	0	5	85					44	40	0.6	1	0.0	
Wine	3	0	0	0	3						3	0.0	0		
Beer	36	0	0	0	36						36	0.6	1	0.0	
Beverages, fermented		0		0	0						0	0.0	0		
Beverages, alcoholic	46	0	0	0	46					44	2	0.0	0		
Meat	991	144	50	1	1,184			0			1,184	19.1	83	7.2	5.8
Beef and veal	394	144	50	1	587						587	9.5	39	3.6	2.6
Mutton & goat meat	91	0		1	91						91	1.5	9	0.6	0.8
Pigmeat	3	0		0	3						3	0.0	0	0.0	0.0
Poultry meat	396	0		0	396						396	6.4	27	2.2	2.0
Meat, other	107	0	0	0	107			0			107	1.7	7	0.8	0.4
Offals, edible	77	26		0	103						103	1.7	5	0.8	0.1
Animal fats	95	101	18	0	213	0				56	157	2.5	52	0.1	5.8
Butter, ghee	77	49	5	0	131						131	2.1	42	0.0	4.8
Cream		0		0	0						0	0.0	0		0.0
Fats, animals, raw	18	52	12	0	82					56	27	0.4	9	0.0	1.0
Fish, body oil	0	0		0	0	0				0					
Fish, liver oil		0			0					0					
Milk – excl. butter	2,732	309	-30	8	3,003	385		0	137	3	2479	40.0	56	3.4	3.7

Continued

Products	Domestic supply					Domestic utilization						Per capita supply			
	Production	Imports	Stock changes	Exports	Total	Feed	Seed	Processing	Waste	Others uses	Food	Kg/ year	Per day		
	- 1000 Metric tons -												Calories (No.)	Protien (grams)	Fat (grams)
Eggs	162	0		0	162		21		6		134	2.2	8	0.6	0.6
Fish, seafood	373	185	0	3	555	35				0	520	8.4	15	2.4	0.6
Feshwater fish	249	4		0	253					0	253	4.1	8	1.2	0.3
Demersal fish	66	1		0	67						67	1.1	1	0.3	0.0
Pelagic fish	24	161	0	1	184	35					149	2.4	5	0.7	0.2
Marine fish, other	11	18	0	1	29	0					29	0.5	1	0.1	0.0
Crustaceans	20	0		0	20						20	0.3	0	0.1	0.0
Cephalopods	2	0		1	1						1	0.0	0	0.0	0.0
Molluscs, other	1	0	0	0	1						1	0.0	0	0.0	0.0
Aquatic Products, other	0									0					
Meat, aquatic mammals															
Aquatic animals, other	0				0					0					
Aquatic plants															
Miscellaneous													1	0.0	0.0

Source: FAO, Egypt Country, 1995.

Appendix B

Measuring Expenditure Inequality for Rural and Urban Egypt, 1981/82- 1999/2000

Table 1 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Rural Egypt, 1981/82

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	6,084	6,384.40	6,084	74.05	6,384.40	16.40
250-	813	1,218.50	6,897	83.95	7,602.90	19.53
300-	718	2,569.90	7,615	92.69	10,172.80	26.13
400-	433	4,511.10	8,048	97.96	14,683.90	37.71
600-	96	3,851.60	8,144	99.12	18,535.50	47.60
800-	37	4,104.20	8,181	99.57	22,639.70	58.14
1000-	13	2,204.80	8,194	99.73	24,844.50	63.81
1200-	11	2,122.60	8,205	99.87	26,967.10	69.26
1400-	4	1,632.50	8,209	99.91	28,599.60	73.45
1700-	1	1,867.00	8,210	99.93	30,466.60	78.25
2000-	1	759.00	8,211	99.94	31,225.60	80.19
2500-	0	0.00	8,211	99.94	31,225.60	80.19
3000-	5	7,711.60	8,216	100.00	38,937.20	100.00
Gini Coefficient	0.75					

Source: CAPMAS, HIECS, 1981/82.

Table 2 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Urban Egypt, 1981/82

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	4,542	5,789.40	4,542	49.56	5,789.40	9.69
250-	1,177	1,350.70	5,719	62.41	7,140.10	11.95
300-	1,431	3,053.60	7,150	78.02	10,193.70	17.06
400-	1,148	5,486.00	8,298	90.55	15,679.70	26.24
600-	400	4,532.40	8,698	94.91	20,212.10	33.83
800-	173	5,423.70	8,871	96.80	25,635.80	42.90
1000-	112	3,569.60	8,983	98.02	29,205.40	48.88
1200-	63	3,501.40	9,046	98.71	32,706.80	54.74
1400-	45	3,980.80	9,091	99.20	36,687.60	61.40
1700-	20	3,641.10	9,111	99.42	40,328.70	67.49
2000-	14	5,247.90	9,125	99.57	45,576.60	76.28
2500-	10	6,287.70	9,135	99.68	51,864.30	86.80
3000-	29	7,888.50	9,164	100.00	59,752.80	100.00
Gini Coefficient	0.74					

Source: CAPMAS, HIECS, 1981/82.

Table 3 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Rural Egypt, 1990/91

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	324	1,829.44	324	5.51	1,829.44	2.28
250-	226	2,510.69	550	9.35	4,340.13	5.42
300-	522	2,974.19	1,072	18.23	7,314.32	9.13
400-	1,346	3,801.13	2,418	41.12	11,115.45	13.87
600-	1,125	4,618.77	3,543	60.24	15,734.22	19.63
800-	676	5,160.64	4,219	71.74	20,894.86	26.07
1000-	480	5,744.83	4,699	79.90	26,639.69	33.24
1200-	295	6,052.37	4,994	84.92	32,692.06	40.80
1400-	292	6,526.99	5,286	89.88	39,219.05	48.94
1700-	156	6,789.70	5,442	92.54	46,008.75	57.41
2000-	151	7,977.54	5,593	95.10	53,986.29	67.37
2500-	85	8,180.39	5,678	96.55	62,166.68	77.58
3000-	54	7,542.59	5,732	97.47	69,709.27	86.99
3500-	149	10,427.84	5,881	100.00	80,137.11	100.00
Gini Coefficient	0.54					

Source: CAPMAS, HIECS, 1990/91.

Table 4 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Urban Egypt, 1990/91

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	30	2,053.13	30	0.36	2,053.13	2.50
250-	58	2,232.33	88	1.05	4,285.46	5.23
300-	272	2,694.31	360	4.31	6,979.77	8.51
400-	1,129	3,452.46	1,489	17.82	10,432.23	12.72
600-	1,547	4,197.30	3,036	36.34	14,629.53	17.84
800-	1,301	4,788.15	4,337	51.92	19,417.68	23.68
1000-	961	5,304.44	5,298	63.42	24,722.12	30.14
1200-	749	5,886.62	6,047	72.38	30,608.74	37.32
1400-	727	6,448.93	6,774	81.09	37,057.67	45.19
1700-	430	7,349.67	7,204	86.23	44,407.34	54.15
2000-	462	825.62	7,666	91.76	45,232.96	55.15
2500-	224	9,418.72	7,890	94.45	54,651.68	66.64
3000-	152	11,677.30	8,042	96.27	66,328.98	80.88
3500-	312	15,682.23	8,354	100.00	82,011.21	100.00
Gini Coefficient	0.41					

Source: CAPMAS, HIECS, 1990/91.

Table 5 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Rural Egypt, 1995/96

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	1	1,136.30	1	0.01	1,136.30	1.37
250-	8	2,095.74	9	0.11	3,232.04	3.89
300-	52	2,654.93	61	0.75	5,886.97	7.08
400-	669	3,608.33	730	8.92	9,495.30	11.42
600-	1,595	4,738.78	2,325	28.41	14,234.08	17.12
800-	1,776	5,354.92	4,101	50.12	19,589.00	23.56
1000-	1,333	5,792.50	5,434	66.41	25,381.50	30.53
1200-	943	6,190.20	6,377	77.93	31,571.70	37.98
1400-	764	6,605.51	7,141	87.27	38,177.21	45.92
1700-	455	6,594.99	7,596	92.83	44,772.20	53.85
2000-	287	7,335.59	7,883	96.33	52,107.79	62.68
2500-	151	8,365.58	8,034	98.18	60,473.37	72.74
3000-	51	6,801.79	8,085	98.80	67,275.16	80.92
3500-	98	15,861.23	8,183	100.00	83,136.39	100.00
Gini Coefficient	0.44					

Source: CAPMAS, HIECS, 1995/96.

Table 6 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Urban Egypt, 1995/96

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	0	0.00	0	0.00	0.00	0.00
250-	1	2,463.40	1	0.02	2,463.40	2.82
300-	9	2,224.11	10	0.15	4,687.51	5.36
400-	123	3,493.11	133	2.04	8,180.62	9.36
600-	411	4,212.65	544	8.34	12,393.27	14.18
800-	560	5,010.76	1,104	16.96	17,404.03	19.91
1000-	777	5,587.12	1,881	28.84	22,991.15	26.30
1200-	670	6,169.02	2,551	39.11	29,160.17	33.36
1400-	952	6,835.65	3,503	53.71	35,995.82	41.18
1700-	700	7,479.50	4,203	64.44	43,475.32	49.74
2000-	799	8,067.87	5,002	76.69	51,543.19	58.97
2500-	478	9,067.66	5,480	84.02	60,610.85	69.34
3000-	298	10,338.15	5,778	88.59	70,949.00	81.17
3500-	744	16,458.36	6,522	100.00	87,407.36	100.00
Gini Coefficient	0.13					

Source: CAPMAS, HIECS, 1995/96.

Table 7 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Rural Egypt, 1999/2000

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	0	0.00	0	0.00	0.00	0.00
250-	4	2,457.84	4	0.02	2,457.84	2.06
400-	221	4,301.54	225	1.17	6,759.38	5. 67
600-	1,108	5,289.11	1,333	6.94	12,048.49	10.10
800-	2,252	5,995.45	3,585	18.68	18,043.94	15.13
1000-	2,933	6,579.55	6,518	33.96	24,623.49	20. 65
1200-	3,003	7,090.23	9,521	49.60	31,713.72	26.60
1400-	2,494	7,707.62	12,015	62.59	39,421.34	33.06
1600-	3,204	8,197.90	15,219	79.29	47,619.24	39.94
2000-	2,062	8,783.64	17,281	90.03	56,402.88	47.30
2500-	916	9,170.39	18,197	94.80	65,573.27	55.00
3000-	404	10,025.68	18,601	96.91	75,598.95	63.40
3500-	255	11,079.96	18,856	98.23	86,678.91	72.70
4000-	185	12,826.96	19,041	99.20	99,505.87	83.45
5000-	154	19,728.10	19,195	100.00	119,234.00	100.00
Gini Coefficient	0.43					

Source: CAPMAS, HIECS, 1999/2000.

Table 8 The Number of Households and Total Annual Expenditure by Per Capita Expenditure Categories in Urban Egypt, 1999/2000

Expenditure categories	Number of households	Total of expenditure	Cumulative number of households	% Cumulative number of households	Cumulative total of expenditure	% Cumulative total of expenditure
-250	0	0.00	0	0.00	0.00	0.00
250-	6	3,356.83	6	0.02	3,356.83	2.45
400-	89	4,267.96	95	0.33	7,624.79	5.56
600-	413	4,888.38	508	1.77	12,513.17	9.13
800-	954	5,566.95	1,462	5.08	18,080.12	13.19
1000-	1,515	6,345.60	2,977	10.35	24,425.72	17.81
1200-	1,906	7,006.50	4,883	16.98	31,432.22	22.92
1400-	2,191	7,539.61	7,074	24.60	38,971.83	28.42
1600-	4,434	8,407.71	11,508	40.02	47,379.54	34.55
2000-	4,597	9,569.30	16,105	56.01	56,948.84	41.53
2500-	3,377	10,745.52	19,482	67.75	67,694.36	49.37
3000-	2,254	12,116.19	21,736	75.59	79,810.55	58.20
3500-	1,591	13,230.69	23,327	81.13	93,041.24	67.85
4000-	1,960	15,357.90	25,287	87.94	108,399.10	79.05
5000-	3,467	28,724.00	28,754	100.00	137,123.10	100.00
Gini Coefficient	0.11					

Source: CAPMAS, HIECS, 1999/2000.

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