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Impacts of China's Foreign Direct Investment in Sub-Saharan Africa

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Abstract

The paper examines the impacts of foreign direct investment, as well as China's FDI on GDP growth of Sub-Saharan African countries from a macroeconomic perspective. By using the data from 44 Sub-Saharan African countries from 2003-2010, our GMM results show that neither China's FDI nor FDI net inflow in SSA has significant effect on economic growth of SSA countries. The possible explanations about the insignificant results include crowding out effect of China's FDI on domestic investment, the declining in outward FDI in traditional sectors and rising in service sector which ignored in the current model, and the types of sectors in which Chinese FDI has been concentrated. We also test other economic growth determinants of SSA countries based on growth accounting theory. Our results also show that capital stock per labor has persistent and significant positive impacts on SSA's growth. In addition, capital per worker is another important determinant in growth.

JEL classification: F21; F30

Keywords: Foreign direct investment, Africa, China, Capital flows

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1. Introduction

The economic relations between China and SSA have grown phenomenally. In recent years, China has become a leading source of FDI in Sub-Saharan Africa among the developing countries and Chinese investment has geographically diversified reaching 44 countries in SSA. As shown in Table 1, China's FDI in SSA has increased greatly, especially in Southern Africa and Western Africa. In 2010, the total outward FDI of China in SSA reached $32075.8 million, which is twenty-three times more than that of in 2003. Also, China's FDI has taken more and more percentage shares of each SSA country's GDP since 2003. In some SSA counties, such as Zambia and Niger, China's FDI exceeded 5 percent of their GDP in 2010.

The increased FDI flows from China are expected to bring various potential benefits to SSA economies. The positive effects of FDI on domestic economics have been discussed in many of the previous studies. Directly, FDI increases productivity capacity of the host economy by adding to the capital stock, which encourages domestic savings and investments (e.g., Bosworth and Collins, 1999; Henry, 2003; Mody and Murshid, 2005), and hence contributes to the growth of the domestic countries (e.g., Gregorio and Lee, 1998; Harrison et al, 2004). Indirectly, FDI is an important source of valuable technology and business know-how. It helps lead to domestic economic growth through technology transferring, increasing skill of local labor, lowering the cost of production and generating a more competitive market (e.g., Ronald 1978; Findlay, 1978; Wang and Bloomstrom, 1992; Borensztein, De Gregorio and Lee, 1998; Gorg and Greenaway, 2004).

There is no doubt that SSA has been doing very well during last decade. The annual GDP growth of SSA was last reported at 4.12 percent in 2011 by a World Bank report, and the IMF forecasts that SSA's GDP will grow over 5 percent in 2012 with world economic growth of around 4 percent. Despite the rapid increase in China's outward FDI in SSA and economic growth in SSA, we know very little about the impact of China's FDI on the growth of SSA economies due to the lack of accurate data source (Mlachila and Takebe 2011). Does FDI, especially China's FDI actually contribute to SSA growth? If so, how much does SSA growth benefit from FDI as well as China's FDI?

This paper answers the questions above. We aim to contribute the literature by examining the impact of China's FDI on SSA economies given the available data source. Also, we test other possible determinants in the GDP growth of SSA countries, such as change of capital stock per labor, gross government debt, gross national savings, age dependency, terms of trade, deviation of M2 and current account balance.

Our work provides new evidence on the influence of China's FDI on the growth of SSA economies, which contributes to the literature of FDI on Africa, especially China's FDI on Sub-Saharan Africa. This study is one of the few literatures that analyze the impacts of Chinese FDI on the GDP growth of SSA countries. This paper also contributes to the literature of growth of SSA economies. There are very few empirical studies that analyze the growth of SSA economies from a macroeconomic perspective using partial equilibrium model. This paper tends to test the determinant of GDP growth using key macroeconomic variables and provides new insights on the determinants of GDP growth of SSA countries.

The remainder of the paper is organized as follows. Section 2 briefly reviews the related literature on the impact of capital flows especially FDI on host economies. Section 3 provides the characteristics of

China's FDI in SSA countries. Section 4 describes the econometric model and the data source. Section 5 presents the results from the regression and robust tests. Section 6 concludes the study.

2. Literature Review

Theories provide ambiguous predictions concerning the effects of FDI on economic growth. For example, Romer (1983) states that foreign investment can help transfer technology and business know-how from rich countries to poor countries. The transfer of technology may increase the productivity and hence benefit economic growth by its spillover effect. In contract, Boyd and Smith (1992) use a model with adverse selection and costly state verification and argue that FDI can affect the current allocation of investment capital and slow the growth. Some other models, however, suggest that FDI will lead to economic growth under certain policy conditions.

There are a number of macroeconomic studies on the impacts of international capital flows on domestic economies. Many of them have found that FDI has positive impacts on the domestic economy and therefore promote domestic economic growth. Among those studies, a few of them focus on the role of foreign flows in the large developed economies. For example, Warnock and Warnock (2006) analyze the impacts of foreign flows in the United States. They find foreign purchases of U.S bonds have contributed to the low yield of U.S. treasury bonds and help keep long-term U.S. interest rates relatively low. Eichengreen (2000) suggests both capital flows and financial fragility played important roles in financial crisis of Europe during 1992-1993.

Due to the emerging economies' attraction of FDI (Groh and Wich, 2012), many studies have been done in examining the role of foreign capital flows in the emerging markets and developing countries. Most researchers agree that the effect of foreign capital flows, especially FDI, contributes to domestic savings and investments. Bosworth and Collins (1999) explore the implications of capital flows by using a panel dataset consisting of 58 developing countries for years 1978-1995, and find strong effect of FDI on the increase in domestic savings and even stronger influence on domestic investments. Mody and Murshid (2005) examine the relationship between domestic investments and the three main types of capital inflows (FDI, loans and portfolio flows) in a panel of around sixty counties. Their results show although impact of foreign capital flows on domestic investment declined, there is still a strong link between inflows and investment, epically in the countries with better policies. Applying the same econometric techniques as in Mody and Murshid (2005), Mileva (2008) suggests FDI flows may produce small investment spillovers in countries with less developed financial markets and weaker institutions. Eller, Haiss and Steiner (2006) estimate a panel data model for 11 Central and Eastern European countries over 1996 to 2003 and find a hump-shaped impact of financial sector FDI on economic growth.

The positive aspects of capital flows have also been presented in the role in spreading crises and reducing systematic risk. Boyer et al. (2005) provide empirical evidence that stock market crises in the domestic countries are spread globally through asset holdings of international investors. Chari and Henry (2004) argue that capital flows to the emerging market can result in a reduction in systematic risk. Harrison et al. (2004) conclude that FDI eases the financing constraints of firms in developing countries and that this effect is stronger for low-income than for high-income regions.

In particular, FDI is found to play a positive role in generating economic growth depending on the particular environments and certain policies in domestic countries. Blomstrom, Lipsey and Zejan (1994) suggest the effects of is determined by wealth of the country. They find a strong effect of FDI on economic growth in higher income developing countries. Balasubramanyam, Salisu and Sapsford (1996) address the importance of trade openness in the effects of FDI on growth. Their results indicate that in developing countries pursuing outward-oriented trade policies, FDI flows were associated with faster growth than in those developing countries that pursued inward oriented trade policies. Borensztein, De Gregorio, and Lee (1998) suggest the importance of the stock human capital in effects of FDI on growth. Their results from 69 developing countries suggest that FDI contributes to growth by increasing technology and total capital accumulation in the host economy with highly educated workforce. Alfaro et al. (2003) indicate FDI benefit economic growth in the countries whose financial markets are sufficiently developed. Alfaro (2003) shows FDI in manufacturing tend to have a positive effect on growth.

However, some studies report there are insignificant or negative effects of FDI on economic growth. Microeconomic evidence from the firm level studies, for example, often shows there is no positive spillover of FDI, and FDI does not contribute to growth. Haddad and Harrison (1993) use firm-level dataset to test for FDI spillovers in the Moroccan manufacturing sector and find the productivity is smaller in sectors with more foreign firms. Similarly, Aitken and Harrison (1999) find no evidence of the positive spillover of FDI, and Hanson (2001) shows weak evidence that FDI generates positive spillovers for host countries. Manzocchi and Martin (1997) empirically test an equation for capital inflows derived from an open economy growth model on cross-section data for 33 developing countries and find relatively weak evidence. Carkovic and Levine (2002) use data of 72 countries from 1960 to 1995 and do not find an independent influence of FDI inflows on economic growth. Gorg and Greenwood (2002) conclude that the effects of FDI on growth are mostly negative. Prasad, Rajan and Subramanian (2007) suggest there is no evidence that an increase in foreign capital inflows directly boosts growth. The possible explanations discussed in their study include underdeveloped financial markets and overvalued capital inflows.

Existing literature provides us enough information on the magnitude and effects of FDI between China and SSA. It is very clear that China has an impact on SSA economies through trade and investment. Kaplinsky, McCormick and Morris (2008) examine the main channels of impact of China on SSA including trade flows, FDI flows and aid flows. Their analysis supports the growing realization that China's present and potential impact on SSA. Stevens and Kennan (2006) assess the gains by SSA countries from trade between China and conclude that all the SSA countries (except South Africa) gain primarily from lower import costs. Some other studies focus on the indirect effects (such as product price, and similarity in exports of SSA and China) of China's trade on SSA. Jenkins and Edwards (2006), for example, argue that imports and FDI from China and India can impact on poverty in SSA through their effects on production and factor markets, or through changes in the prices of consumer goods, or via effects on government revenues and expenditure.

Unfortunately, it has not been possible to carry out a detailed analysis on the impact of Chinese FDI on Africa countries due to the lack of accurate data source, as discussed in previous studies. See Kaplinsky, McCormick and Morris (2008); Mlachila and Takebe (2011). Mlachila and Takebe (2011) use the limited data from United Nations Conference on Trade and Development (UNCTAD). The results from case

studies demonstrate that the impacts of China's FDI on SSA have been broadly positive. However, they argue that the official data sources definitely underestimate the volume and scope of FDI flows as many small and medium-sized enterprises do not always register their investment, and it is difficult to estimate accurately the growth impact of FDI due to the available data source.

In this paper, we focus on the impacts of net FDI inflows on growth, as well as China's FDI on GDP growth of SSA countries. In addition, we test the determinants of growth of SSA countries in the past decade. Different from the previous work with OLS and fixed effect estimates, we use a dynamic GMM model. This model help us solve the potential problems that may associated with OLS and fixed effect estimators.

3. Characteristics of China's Investment in Sub-Saharan Africa

China's outward FDI in SSA has increased significantly since 2003. As showed in Table 1, the total China's outward FDI in SSA was $32075.8 million in 2010, which is twenty-three times more than that of in 2003 ($462.1 million). Also, the percentage share of China's outward FDI in SSA has remained more than 10 percent of China's global outward FDI volume from 2003 to 2010. The percentage share of China's outward FDI in SSA was 16.2 in 2003. Although there was a drop around 2005-2006, the percentage share has increased gradually after the financial crisis in 2008, and has reached back to 16.0% in 2010. Among all the SSA regions, South Africa and West Africa have absorbed the highest inflows of FDI from China over the years.

Table 2 lists the top 10 China outward FDI recipient countries in SSA from 2003 to 2010. We notice that China's FDI has focus on resource-rich areas. Among these top ten countries, six of them are oil rich countries. In 2010, South Africa received $4152.98 million direct investment from China and ranked as the top country that absorb China's FDI, followed by Nigeria and Zambia, respectively. Furthermore, the second panel in Table 2 reports the percentage share of China's FDI in each country's GDP for the 10 counties. China's FDI has taken more and more percentage shares of each SSA country's GDP since 2003. For most of the countries, China's FDI was lower than 0.5% in 2003 and the percentage went up to around 2 in 2010. In some counties, such as Zambia and Niger, China's FDI has exceeded 5 percent of their GDP in 2010.

Table 3 further indicates the sectoral distribution of China's outward FDI in SSA. Although our FDI on industry level is limited, available information allows us to draw a rough picture of China's investments in SSA. The biggest three sectors that China's FDI went to are alternative/renewable energy, automotive OEM and electronic components. This is quite different from the characteristic of China's outward FDI pattern at the global level, which focuses mainly on manufacturing sector and extraction sector. The confliction can be explained by the source of China's FDI in SSA. Different from Western and Japanese FDI in SSA, which comes from privately-owned corporations and concentrates on short-term profit maximization, most of China's FDI in SSA comes from firms who are either wholly or partially state-owned. The consideration of those firms is the access to resource and raw materials in SSA regions. Since their capital cost is also low relative to other private-owned firms, those firms can operate with their goals in long terms.

4. Data and Empirical Specification

4.1 Model specification

Our regression model is built on a growth accounting model. Suppose that output depends on capital, labor, and productivity term (technology) *A* according to an aggregate Cobb–Douglas production function:

$$Y_i\ (t) = A_i(t)K_i\ (t)^{\alpha}\ N_i(t)^{1-\alpha} \tag{1}$$

where *i* is country index and *t* is time index. $Y_i\ (t)$ is the total output in an economy is produced. $K_i\ (t)$ is the total capital in country *i* in time *t* and $N_i(t)$ is employment. $A_i(t)$ refers to the technology level.

We divide both sides by $N_i(t)$ and have the capita stock per worker:

$$y_i\ (t) = A_i(t)k_i\ (t)^{\alpha} \tag{2}$$

The technological progress, $A_i(t)$, is called total factor productivity (TFP). In equation (2), it is separated from capital accumulation and it tells us not only just how productive labor is, but also how productively the economy uses all the other factors of production.

By taking logarithms and differencing this equation, we get

$$\ln\ y_i(t) - \ln y_i(t-1) = \alpha[\ln\ k_i(t) - \ln k_i(t-1)] + (1-\alpha)[lnA_i(t) - lnA_i\ (t-1)] \tag{3}$$

Our measure of economic growth is the growth rate of output per person (percentage change of GDP per worker), which is the left hand side term in equation (3). It has two main components: the growth of capital per worker which measures the effect of capital accumulation, and the rate of total factor productivity growth which measures the effect of technological progress.

Growth accounting model helps us estimate TFP growth by using a 'residual' method. Based on equation (3), we further extend our regression model as follow to explore the economic growth determinants of SSA countries, especially the impacts of China's outward FDI on SSA economies:

$$Growth\_GDP_{it}\ =\ \alpha_0\ + \alpha_1 CHNFDI_{it} + \alpha_2 FDI_{it} + \alpha_3\ K_{it} +\ \alpha_4\ X_{it} +\ D_t + \varepsilon_{it} \tag{3}$$

where *i* refers to each of 44 SSA countries in our sample and *t* is year index. $Growth\_GDP_{it}$ denotes the annual labor productivity growth of each country *i* in SSA at year *t*. We use two variables to estimate foreign capital inflow to SSA: China's outward FDI (*CHNFDI)* and total FDI net inflow (*FDI*), and both of them are measured in terms of percentage of each host country's GDP. D_t is the year dummy and ε_{it} is the error term.

K_{it} is a matrix of endogenous variables that contribute to economic growth according to growth accounting theory. It includes the change capital stock per worker at current year and change of output per capital at last year.

The exogenous variables in X_{it} includes (1) gross government debt (2) gross national savings (3) age dependency, (4) terms of trade, (5) deviation of M2, (6) current account balance. Below is a brief discussion of the control variables used in the analysis.

Gross government debt and gross national savings are measured in terms of percentage of GDP. An increase in national saving is likely to increase domestic investment, and therefore domestic output. An increase in gross government debt will reduce domestic output.

Age dependency is the ratio of old and young share of working-age population to total population. This demographic factor estimates the composition of a country's labor force. The higher this ratio is, the less proportion of working-age population, implying shrinking of the labor force.

Terms of trade is measured by the ratio of price of exportable goods to price of importable goods. An improvement of terms of trade (increase of terms of trade) will allow a country to buy more imports for any given level of exports. Therefore, it may result in current account deficit, reduce demand for domestic goods and therefore lower domestic investment. It is expected a negative relationship between terms of trade and domestic investment.

Deviation of M2 *(%* of GDP) measures the three year moving average of money and quasi money. It catches the variation of long run trend of money supply. An increase in money supply tends to lower interest rate, increase domestic investment and consumption; lower interest rate would also lead be depreciation of national currency, which would increase exports and lower imports. If we assume government fiscal balance is unchanged, an increase in money supply would increase output (GDP). However, increase the spread of long run money supply trend does not necessary mean increase money supply. Therefore, if increasing spread is due to increase money supply, and GDP growth is also in the upward trend, then there is a positive relationship between Deviation of M2 and GDP growth. Otherwise, we would expect a negative relationship between these two variables.

Current account balance is measured as the net export to GDP ratio. Net export can be positive or negative depending on the difference between exports and imports. Given a large portion of countries in SSA is running current account deficit, we would expect a negative relationship between current account balance and GDP growth[1].

4.2. Data

The data sets used in this analysis are mainly from United Nations Conference on Trade and Development (UNCTAD) statistical data base. We collect the annual macroeconomic data on 44 SSA countries from 2003 to 2010. The data sets of China's outward FDI and China's FDI in SSA countries are collected Ministry of Finance, Department of Commerce of P. R. China. Most macroeconomic variables are compiled from the World Bank and International Monetary Fund. Further detailed information related to the source of variables can be found in Appendix A.

4.3. Estimation procedure

[1] There is no consensus of any relationship between current account balance and GDP growth rate. However, some studies show that expansion of export can promote growth (Hausmann, et al., 2007; Frankel et al. 1999).

To examine how economic growth of SSA countries are affected by total FDI, especially China's FDI we begin with estimating our regression model (3) for all 44 SSA countries by using China's FDI and total FDI net inflow as the main explanatory variables. We test the effect of each of them separately in the model, and then estimate the model with other exogenous variables.

We use three estimators: OLS, fixed effect and dynamic GMM (Roodman, 2006). OLS model and fixed effect estimates are used in most previous related studies (e.g. Arezki, et al 2009). However, there are some problems with those to estimates. First of all, the OLS or fixed effect model is under the assumption of the exogeneity of the past and future independent variables. If the assumption of the exogeneity does not hold, the OLS and fixed effect estimators are biased. More importantly, the error terms are assumed to be uncorrelated with all independent variables under the OLS or fixed effect model. Some unobserved variables which are not considered in the model may be correlated with any of the explanatory variable in our regression. Therefore, OLS or fixed effect estimator are likely to be bias. Consider the specification of our regression, we use the Arellano-Bond (1991) difference GMM estimator, which is proposed by Holtz-Eakin et al. (1988) and Mileva (2008). GMM estimates also help us avoided the other potential problem caused by fixed effect estimates. For example, the time-invariant country characteristics may be correlated with the explanatory variables. GMM model can transform the regressors by first or second (or higher) differencing so that the fixed country-specific effect is removed. The presence of the lagged dependent variable (change of capital stock per worker) may cause autocorrelation in the regression. Using differencing method in GMM can solve this problem.

Three specification tests are used to verify the validity of instruments: Sargan test, the Arellano-Bond test, and the first-order and the second-order autocorrelation test. Sargan statistic test (also called Hansen J statistic in robust estimation report) of over identifying restrictions is to test overall validity of instruments and the model specification. Sargan test has a null hypothesis of "the instruments as a group are exogenous". The Arellano-Bond test for autocorrelation has a null hypothesis of no autocorrelation and is applied to the differenced residuals. The first-order and the second-order autocorrelation tests are used to check whether residuals are auto-correlated and assess the validity of lagged instruments. Rejecting both or either one of null hypothesis of these two tests means that the model suffers autocorrelation problem.

5. Modeling Results and Robustness Test

The GMM results are reported in Table 4. As presented in Column 1, the coefficient of China's FDI is -0.0114 and it is insignificant at 10% level, implying that China's FDI has no effect on each country's economic growth in SSA. By controlling gross government debt and gross national savings (Column 3), the coefficient of China's FDI reduced to -0.000786 and it is still insignificant at 10% level. There is no impact of China's FDI on SSA economic growth.

We consider possible reasons for the insignificant effect of China's FDI. First, China's direct investment in SSA may crowding out some of the domestic investment in those countries. Decreasing domestic investment may lower the output per worker, which leads to a lower economic growth. Second,

according to official Chinese statistics, China's outward direct investment has shifted from the traditional sectors (such as manufacturing) toward the service sector and green field (such as merge and acquisition) at the global level. (See Mlachila et al., 2011). The declining in investment of China in the traditional sectors and rising in service sector or green field may not be reflected in our model. Our model do not include other capital flows types such as loans and portfolio investment in capital account and any other items in financial account in the balance of payment work sheet. Third, some outflows of FDI from China have been directed or targeted towards developing extractive industries and associated infrastructure or natural resource rich countries in SSA. Given the types of sectors in which FDI has been concentrated, it is unlikely to have a positive impact on the majority of SSA countries.

For the effect of total FDI net inflow on growth of SSA, the findings are similar. Columns 2 and 4 of Table 4 report the results if we use total FDI net inflow instead of China's FDI in the regression. Both of the coefficients of FDI net inflow are negative and insignificant, suggesting that the FDI net inflows to SSA countries does not contribute to the economic growth of that area.

We find that physical capital accumulation has persistent and significant impacts on the economic growth. The persistent effects of output per capita is caught by the dynamic GMM model. As shown in Table 4 Column 1 and 2, on average, one percentage point increases in physical capital stock per worker would induce about a 0.2 percentage point increase in output per worker (or labor productivity). By controlling for gross government debt and gross national savings, one percentage point increases in capita per worker would generate a 0.3-0.4 percentage point increase in output per capita on average (Column 3 and 4). Capital per labor is another one of the most important factors that determine economic growth. One percentage point increase of capital per labor would lead to around 0.06 to 0.15 percentage point increase of output per capita (Column 3 and 4).

In Columns 1 and 2, the coefficients of age dependency ratio are negative and significant, indicating one percentage point increases in age dependency ratio may result in a decrease of labor productivity by 0.02 percentage point. This results is unexpected, since SSA in fact has a large portion of young population which would be potentially a large labor force and fast growing continent in the world in the next few decades. By factoring in gross government debt and gross national savings, the effects of age dependency on growth is dampened and insignificant. In addition, the deviation of M2 has slightly negative impacts on growth of SSA countries. However, with gross government debt and gross national savings, the impact goes away.

To investigate whether the effects of FDI on the Sub-Saharan Africa are robust, we also use OLS model and fixed effect model for sensitivity analysis. The results are reported in Table 5. Consistent with what we find in GMM model, China's FDI in SSA has no impact on the growth of SSA countries. The coefficients of total FDI net inflow to SSA are positive and significant for both OLS and fixed effect estimates. However, the effect is quite small. As showed in Columns 2, 4, 6 and 8, on average, a one percentage point increases in total FDI net inflow in SSA would lead to an increase of that country's GDP growth rate by about 0.001 percentage point. Similar to what we find in GMM model, capital stock per labor has positive effects on SSA's economic growth in OLS and fixed effect results. Deviation of M2 also has significant impacts of SSA growth.

6. Concluding Remarks

China's foreign direct investment has increased significantly in Sub-Saharan Africa in the past decade. Since 2003China's FDI has taken more and more percentage shares of each SSA country's GDP. To examine the impacts of foreign direct investment, especially China's outward FDI on GDP growth of Sub-Saharan Africa countries, we use a dynamic GMM model under a growth accounting framework. By using the data set of 44 SSA countries from 2003-2010, our GMM results shows neither China's FDI nor total FDI net inflow has significant effect on GDP growth of SSA countries. We discuss possible explanations about the insignificant findings. They are crowding out effect of China's FDI on domestic investment, the declining in outward FDI in traditional sectors and rising in service sector which ignored in the current model, and the types of sectors in which Chinese FDI has been concentrated.

We also test other economic growth determinants of SSA countries, including change of capital stock per labor, gross government debt, gross national savings, age dependency, terms of trade, deviation of M2 and current account balance. Our results show that the change of capital stock per labor has significant positive impacts on SSA's growth. In addition, age dependency and the deviation of M2 has slightly negative impacts on growth of SSA countries. By accounting for gross government debt and gross national savings, those impacts go away.

We use OLS model and fixed effect model for robust test and sensitivity analysis. Consistent with our findings in GMM estimates, China's FDI in SSA has no impact on the growth of SSA countries. Different from GMM results, the effect of total FDI net inflow to SSA are positive and significant for both OLS and fixed effect estimates. However, the effect is quite small.

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Table 1. China's Outward Foreign Direct Investment in Sub-Saharan Africa (Million of US$)

Region	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Eastern Africa	88.6	153.8	256.3	416.1	547.7	872.4	1326.8	1715.7	5377.3
Central Africa	39.0	70.3	111.7	252.7	384.5	456.9	988.0	1516.6	3819.7
West Africa	106.4	190.6	270.8	441.8	1059.4	1313.2	1860.8	2307.8	7550.7
South Africa	228.3	250.7	335.3	521.2	1249.1	3853.4	3424.3	5465.8	15328.1
Total	462.1	665.4	974.1	1631.7	3240.7	6495.9	7600.0	11005.9	32075.8
China's total Global Outward FDI (flows)	2850	5500	12260	21160	26510	55910	56530	68810	249530
Share of China's Outward FDI in SSA (%)*	16.2%	12.1%	7.9%	7.7%	12.2%	11.6%	13.4%	16.0%	12.9%

Source: Author's calculation based on Ministry of Commerce, P.R.C. (MOFCOM)
Note: Share of China's outward FDI in SSA is the percentage ratio of total OFDI volume divided by China's total global outward FDI volume (flows).

Table 2. Top 10 China's FDI Host Countries in the Sub-Saharan Africa (million USD)

Country	2003	2004	2005	2006	2007	2008	2009	2010	Region
South Africa	44.77	58.87	112.28	167.62	702.37	3048.62	2306.86	4152.98	Southern Africa
Nigeria	31.98	75.61	94.11	215.94	630.32	795.91	1025.96	1210.85	Western Africa
Zambia	143.7	147.75	160.31	267.86	429.36	651.33	843.97	943.73	Southern Africa
Congo, D.R.	0.24	15.69	25.11	37.61	104.4	134.14	397.43	630.92	Central Africa
Niger	12.5	14.03	20.44	32.99	134.53	136.5	184.2	379.36	Western Africa
Ethiopia	4.78	7.87	29.82	95.6	108.88	126.45	283.44	368.06	Eastern Africa
Angola	0.3	0.47	8.79	37.23	78.46	68.89	195.54	351.77	Central Africa
Tanzania	7.46	53.8	62.02	111.93	110.92	190.22	281.79	307.51	Eastern Africa
Mauritius	12.59	12.63	26.81	51.16	115.9	230.07	242.84	283.29	Eastern Africa
Madagascar	28.13	40.63	49.94	54.34	76.01	146.52	196.22	229.87	Western Africa

Country	share of China's OFDI in countries' GDP								Region
South Africa	0.03%	0.03%	0.05%	0.06%	0.25%	1.11%	0.82%	1.14%	Southern Africa
Nigeria	0.05%	0.09%	0.08%	0.15%	0.38%	0.38%	0.61%	0.62%	Western Africa
Zambia	3.29%	2.72%	2.23%	2.50%	3.73%	4.46%	6.59%	5.83%	Southern Africa
Congo, D.R.	0.00%	0.24%	0.35%	0.44%	1.05%	1.15%	3.55%	4.78%	Central Africa
Niger	0.46%	0.46%	0.60%	0.90%	3.14%	2.54%	3.50%	6.84%	Western Africa
Ethiopia	0.06%	0.08%	0.24%	0.63%	0.56%	0.48%	0.89%	1.24%	Eastern Africa
Angola	0.00%	0.00%	0.03%	0.08%	0.13%	0.08%	0.26%	0.42%	Central Africa
Tanzania	0.06%	0.42%	0.44%	0.78%	0.66%	0.92%	1.32%	1.33%	Eastern Africa
Mauritius	0.22%	0.20%	0.43%	0.79%	1.49%	2.39%	2.74%	2.91%	Eastern Africa

Madagascar	0.51%	0.93%	0.99%	0.98%	1.04%	1.56%	2.31%	2.64%	Western Africa

Source: Author's calculation based on UNCTAD data; Ranking is based on 2010's value.

Table 3. China's FDI in SSA by Sector and by Year (million USD)

Sector	2003	2004	2005	2006	2007	2008	2009	2010*	2011
Alternative/Renewable energy	2744	0	0	727.7	2338	5716	2173	5740	300
Automotive OEM	0	0	0	0	2.6	0	202.4	249.6	140.8
Electronic Components	0	0	164.4	0	664.4	432.6	0	221	151.2
Ceramics & Glass	7.6	190	0	0	0	461.6	0	183.9	0
Paper, Printing & Packaging	0	0	0	0	0	0	0	67	0
Chemicals	0	11.3	373.5	1505	20	14.2	28.1	21	0
Communications	0	0	0	0	0	0	9.2	9.2	0
Coal, Oil and Natural Gas	0	0	0	0	0	400	0	0	0
Financial Services	20	0	0	0	0	0	0	0	0
Real Estate	0	0	0	0	0	0	3.3	0	0
Building & Construction Materials	0	0	0	0	0	523.6	0	0	0
Software & IT services	0	0	1.5	0	19	0	0	0	0
Beverages	0	0	0	0	0	0	0	0	17.4
Textiles	0	0	0	0	0	0	0	0	1.1
Business Services	0	0	0	0	0	47.4	0	0	0
Consumer Electronics	0	0	0	0	0	0	0	0	0
Engines & Turbines	450	1.3	19.6	423.1	323.1	3455.1	4011.1	0	700
Food & Tobacco	0	0	0	0	396.3	0	0	0	0
Medical Devices	0	0	0	0	5.4	0	0	0	0
Metals	9.9	0	0	0	0	0	0	0	0
Minerals	0	0	0	0	49.8	3735	0	0	0
Non-Automotive Transport OEM	0	0	0	0	0.5	0	0	0	1.9
Transportation	0	227.9	0	0	0	0	0	0	0

Source: Author's calculation based on fDi Intelligence, Financial Times.
Note: the Outward FDI value includes both actual value and estimated value. The table ranking is based on values in 2010. The whole data set is extracted from FDI intelligence of China's outward FDI in SSA from January 2003 to August 2011.

Table 4. Dynamic GMM Estimation of Economic Growth of SSA, (annual, 2003-2010)

	(1)	(2)	(3)	(4)
VARIABLES	GMM1	GMM2	GMM3	GMM4
Change of ln(Y/L) (t-1)	0.210*	0.165*	0.294***	0.395***
	(0.107)	(0.0892)	(0.0981)	(0.109)
Change of ln(K/L) (t)	0.0395	0.00730	0.153***	0.0679***
	(0.0348)	(0.0285)	(0.0482)	(0.0213)
Age dependency	-0.0181***	-0.0247**	-0.00593	-0.0135
	(0.00641)	(0.00956)	(0.00745)	(0.0116)
Change of terms of trade	-0.000222	-0.000133	0.000214	-0.000213
	(0.000282)	(0.000281)	(0.000404)	(0.000431)
Deviation of M2	-0.00850***	-0.00679**	-0.00219	-0.00294
	(0.00291)	(0.00324)	(0.00361)	(0.00440)
Current account balance	0.00204*	0.00195	0.00176	0.00522**
	(0.00108)	(0.00121)	(0.00253)	(0.00239)
Gross government debt			-0.000447	-0.00037
			(0.000291)	(0.000308)
Gross national savings			-0.00164	-0.00440**
			(0.00289)	(0.00211)
FDI		0.000813		0.00273
		(0.00196)		(0.00171)
China's OFDI in SSA	-0.0114		-0.000786	
	(0.0157)		(0.00883)	
2004	0.112***	0.117***	0.108**	0.125***
	(0.0155)	(0.0163)	(0.0537)	(0.0391)
2005	0.0485***	0.0375***	0.0923*	0.110***
	(0.0120)	(0.0143)	(0.0531)	(0.0408)
2006	0.0313***	0.0245**	0.0825	0.108***
	(0.0105)	(0.0124)	(0.0548)	(0.0394)
2007	0.0470***	0.0333**	0.0864	0.110***
	(0.0123)	(0.0142)	(0.0552)	(0.0413)
2008	0.0267	0.0166	0.0628	0.0978**
	(0.0165)	(0.0158)	(0.0557)	(0.0409)
2009	0.0203	-0.00248	0.0562	0.0832**
	(0.0232)	(0.0109)	(0.0563)	(0.0421)
2010	0.0385	0.0144	0.0728	0.121***
	(0.0301)	(0.0118)	(0.0602)	(0.0452)
AR(1) test (p-value)	0.28	0.10	0.00	0.00
AR(2) test (p-value)	0.09	0.43	0.38	0.07
Sargan Test (p-value)	0.74	0.75	0.17	0.34
Observations	253	279	245	271
Number of countries	40	42	39	41

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Note: Dependent variable is ln[(Y(t)/L(t))- ln[Y(t-1)/L(t-1)]

Table 5. Estimation of Economic Growth Model of SSA, (2003-2010, annual)

VARIABLES	(1) OLS1	(2) OLS2	(3) OLS3	(4) OLS4	(5) FX1	(6) FX2	(7) FX3	(8) FX4
Change of ln(Y/L) (t-1)	0.346***	0.369***	0.354***	0.402***	0.205***	0.208***	0.130**	0.151**
	(0.0417)	(0.0438)	(0.0525)	(0.0558)	(0.0466)	(0.0508)	(0.0595)	(0.0637)
Change of ln(K/L) (t)	0.0766***	0.0228**	0.0707***	0.0224**	0.0603***	0.0153*	0.0605***	0.0289***
	(0.0132)	(0.00919)	(0.0133)	(0.00943)	(0.0132)	(0.00916)	(0.0143)	(0.00969)
Change of terms of trade	0.000215	0.000170	0.000145	0.000108	0.000135	0.000119	0.000137	0.00009
	(0.000135)	(0.000143)	(0.000134)	(0.000144)	(0.000134)	(0.000147)	(0.000135)	(0.000144)
Age dependency	-0.000239	0.000801	0.000928	0.000726	0.0165	0.0158	0.0136	0.0135
	(0.00171)	(0.00184)	(0.00171)	(0.00185)	(0.0143)	(0.0150)	(0.0148)	(0.0150)
Deviation of M2	-0.00658***	-0.00612***	-0.00670***	-0.00662***	-0.00669***	-0.00638***	-0.00617***	-0.00647***
	(0.00153)	(0.00164)	(0.00152)	(0.00165)	(0.00143)	(0.00160)	(0.00146)	(0.00158)
Current account balance	0.00052	0.000120	-0.000129	0.000269	0.00093	-0.000251	0.000190	0.00141**
	(0.000223)	(0.000240)	(0.000331)	(0.000337)	(0.000365)	(0.000405)	(0.000659)	(0.000631)
Gross government debt			-0.0005	-0.0006			-0.000220**	-0.000112
			(0.00012)	-0.00011			(0.00094)	(0.00086)
Gross national savings			0.000466	-0.000127			-0.000120	-0.00195***
			(0.000301)	(0.000273)			(0.000738)	(0.000535)
FDI		0.00128***		0.00133***		0.000997*		0.00147**
		(0.000391)		(0.000462)		(0.000585)		(0.000616)
China's FDI in SSA	0.00282		-0.000301		0.00345		0.000773	
	(0.00197)		(0.00213)		(0.00367)		(0.00403)	
2004	0	0.0220***	0	0		0.0168*		
	(0)	(0.00828)	(0)	(0)		(0.0101)		
2005	-0.0105	0.00669	-0.0117	-0.0173**	-0.00308	0.00891	-0.00520	-0.00667
	(0.00770)	(0.00841)	(0.00758)	(0.00793)	(0.00727)	(0.00970)	(0.00735)	(0.00769)
2006	-0.0172**	0.00362	-0.0179**	-0.0200**	-0.00894	0.00757	-0.0134*	-0.00978
	(0.00777)	(0.00847)	(0.00769)	(0.00797)	(0.00766)	(0.00934)	(0.00793)	(0.00811)
2007	-0.00688	0.00936	-0.00914	-0.0165**	0.00168	0.0141	-0.00587	-0.00490
	(0.00778)	(0.00854)	(0.00782)	(0.00819)	(0.00799)	(0.00900)	(0.00863)	(0.00897)
2008	-0.0343***	-0.0110	-0.0347***	-0.0352***	-0.0230***	-0.00551	-0.0291***	-0.0225**
	(0.00792)	(0.00862)	(0.00796)	(0.00825)	(0.00859)	(0.00871)	(0.00922)	(0.00936)
2009	-0.0401***	-0.0222**	-0.0410***	-0.0490***	-0.0301***	-0.0185**	-0.0395***	-0.0384***
	(0.00813)	(0.00857)	(0.00835)	(0.00850)	(0.00961)	(0.00845)	(0.0105)	(0.0102)

2010	-0.0236***	0	-0.0206**	-0.0233**	-0.0140		-0.0248**	-0.0176
	(0.00807)	(0)	(0.00870)	(0.00904)	(0.0108)		(0.0121)	(0.0116)
Constant	0.0424***	0.0235***	0.0403***	0.0539***	0.0535***	0.0387***	0.0774***	0.103***
	(0.00573)	(0.00679)	(0.0103)	(0.00873)	(0.00869)	(0.0145)	(0.0190)	(0.0154)
Observations	253	279	245	271	253	279	245	271
R-squared	0.445	0.374	0.468	0.382	0.385	0.290	0.380	0.331
Number of countries	40	42	39	41	40	42	39	41

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Appendix 1-A. Country Name List in Sub-Saharan Africa			
1	Angola**	23	Lesotho
2	Benin	24	Liberia
3	Botswana	25	Madagascar**
4	Burkina Faso	26	Malawi
5	Burundi	27	Mali
6	Cameroon**	28	Mauritius
7	Cape Verde	29	Mozambique
8	Central African Republic	30	Namibia
9	Chad**	31	Niger
10	Comoros	32	Nigeria**
11	Congo, Dem. Rep.**	33	Rwanda
12	Congo, Rep.**	34	Sao Tome and Principe
13	Cote d'Ivoire**	35	Senegal**
14	Equatorial Guinea**	36	Seychelles
15	Eritrea	37	Sierra Leone
16	Ethiopia	38	South Africa**
17	Gabon**	39	Swaziland
18	Gambia, The	40	Tanzania
19	Ghana	41	Togo
20	Guinea	42	Uganda
21	Guinea-Bissau	43	Zambia
22	Kenya**	44	Zimbabwe

Western Africa(15)	
Central Africa (9)	
Southern Africa (7)	
Eastern Africa(13)	

Appendix 1-B. Variables and Data Sources		
Variable	Description	Data Source
China's OFDI	China's outward foreign direct investment	MOFCOM (China) fDi Intelligence , Financial Times
Current account balance (% of GDP)	Current account balance (% of GDP)	World Development Indicators(2012) & Global Development Finance (2012)
Deviation of M2	Deviation of "Money and quasi money (M2) as % of GDP" from three-year moving average; Indicator code: FM.LBL.MQMY.GD.ZS	World Development Indicators(2012) & Global Development Finance (2012)
FDI (net inflows, % of GDP)	Foreign direct investment, net inflows (% of PPP GDP) Indicator Code: BX.KLT.DINV.WD.GD.ZS	World Development Indicators(2012) & Global Development Finance (2012)
China's FDI in SSA	China's FDI in SSA	Ministry of Finance, Department of Commerce, P. R. China. (MOFCO M)
GDP per capita	GDP per capita (constant 2000 US$); Indicator Code: NY.GDP.PCAP.KD	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
GDP Growth rate	GDP growth (annual %); Indicator code: NY.GDP.MKTP.KD.ZG	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
Gross fixed capital formation (GFCF)	Gross fixed capital formation; indicator code: NE.GDI.FTOT.ZS	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
China's OFDI Investment	Gross fixed capital formation (% of GDP) ;Indicator code: NE.GDI.FTOT.ZS	Ministry of Commerce, P.R.C. (MOFCOM)
Real effective exchange rate (REER)	Real effective exchange rate (2005=1); Indicator Code: PX.REX.REER	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
Real interest rate	Real interest rate % ; Indicator Code: FR.INR.RINR	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
Uncertainty	The uncertainty measure is the mean absolute value of GDP growth one step ahead forecast error average over 3 years; Indicator Code: NY.GDP.MKTP.KD.ZG	World Development Indicators(2012) & Global Development Finance (2012); IMF/IFS
Deviation of M2	Deviation of "Money and quasi money (M2) as % of GDP" from three-year moving average; Indicator code for M2: FM.LBL.MQMY.GD.ZS	Global Development Finance (2012), World Bank; International Financial Statistics, International Monetary Fund
General government gross debt	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Indicator code: GGXWDG_NGDP	World Economic Indicator (2012)
Exports of Goods and Services	Merchandise exports, Million USD.	Direction of Trade (DOTS);International Monetary Fund
Gross National Saving	Expressed as a ratio of gross national savings in current local currency and GDP in current local currency. Gross national saving is gross disposable income less final. Indicator code: NGSD_NGDP	World Economic Outlook (2012); International Monetary Fund

Appendix A. Region Definitions and Country Mapping for Developing Countries

Region	**MENA**	**S. Asia**	**EAP ex HKG**	**ECA**	**LAC**	**AFR**	**High Income economies**
code	(14)	(6)	(12)	(22)	(16)	(21)	(25)
1	Algeria	Afghanistan	Cambodia	Armenia	Argentina	Angola	Australia
2	Bahrain	Bangladesh	Fiji	Azerbaijan	Bolivia	Botswana	Belgium
3	Egypt	India	Indonesia	Belarus	Brazil	Ethiopia	Brunei
4	Iran	Myanmar	Laos	Bulgaria	Chile	Gabon	Canada
5	Iraq	Nepal	Korea (DPRK)	Croatia	Colombia	Ghana	Cayman Islands
6	Jordan	Pakistan	Micronesia	Czech Republic	Costa Rica	Kenya	Cyprus
7	Kuwait		Malaysia	Georgia	Cuba	Liberia	Denmark
8	Oman		Mongolia	Hungary	Ecuador	Madagascar	France
9	Qatar		Papua New Guinea	Kazakhstan	Guyana	Mozambique	Germany
10	Saudi Arabia		Philippines	Kyrgyzstan	Honduras	Namibia	Israel
11	Syria		Thailand	Latvia	Mexico	Niger	Ireland
12	Tunisia		Vietnam	Lithuania	Panama	Nigeria	Italy
13	UAE			Moldova, Rep.	Paraguay	Rwanda	Japan
14	Yemen			Poland	Peru	Senegal	Korea, Rep.
15				Romania	Uruguay	South Africa	Macau, China
16				Russia Fed.	Venezuela, RB	Sudan	Netherlands
17				Slovak Rep.		Tanzania	Portugal
18				Tajikistan		Togo	Spain
19				Turkey		Uganda	Singapore
20				Turkmenistan		Zambia	Sweden
21				Ukraine		Zimbabwe	Switzerland
22				Uzbekistan			Taiwan, China
23							United Kingdom
24							United States