THE IMPACT OF EXTERNAL SHOCKS ON ECONOMIC GROWTH AND WELFARE IN KENYA: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

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DECLARATION

This thesis is my original work and has not been submitted for a degree in any other university.

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DEDICATION

I dedicate my thesis work to my family and friends. Special dedications go to my parents who inculcated in me a spirit of hard work and tenacity to achieve set goals.

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LIST OF ACRONYMS AND ABBREVIATIONS

CB	Cobb- Douglas
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium
CPI	Consumer Price Index
CV	Compensating Variation
DCs	Developed Countries
EAC	East African Community
EPZ	Export Processing Zones
EV	Equivalent Variation
FDI	Foreign Direct Investment
FGT	Foster, Greer and Thorbecke
GAMS	General Algebraic Modelling System
GDP	Gross Domestic Product
GNI	Gross National Income
IFPRI	International Food Policy Research Institute
IO	Input-Output
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
LDCs	Less Developed Countries
LES	Linear Expenditure System
MAMs	Marquette for MDGs Simulations
MDGs	Millennium Development Goals
MNCs	Multinational Corporations
MUB	Manufacturing under Bond
O&M	Operations and Maintenance
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
R&D	Research and Development
RER	Real Exchange Rate

RH	Representative Household
ROK	Republic of Kenya
ROW	Rest of the World
SAM	Social Accounting Matrix
SSA	Sub Saharan Africa
TFP	Total Factor Productivity
TOT	Terms of Trade
VAR	Vector Autoregressive
VAT	Value Added Tax
WMS	Welfare Monitoring Survey
WPFOOD	World Price of Food
WPOIL	World Price of Oil
WTO	World Trade Organization

ABSTRACT

Kenya is fairly well integrated into the global economy; hence its economy is vulnerable to external shocks. The purpose of this study is to evaluate, from a general equilibrium perspective, the impact of these shocks on the Kenyan economy, which are transmitted via foreign trade and capital inflows. Thus, to analyse the data we employ two different computable general equilibrium (CGE) models that are calibrated on the basis of a social accounting matrix for Kenya. The first model is the International Food and Policy Research Institute (IFPRI) Standard CGE Model that we use to conduct shock simulations that entail changing the world price of food and oil. Further, we use a micro-simulation module linked to the CGE model to evaluate the welfare and distributional impacts of the price shocks. The second model is a supply-side model which we use to evaluate the effects of an up-surge in the inflows of foreign aid, remittances and foreign direct investment. To evaluate the welfare effects of the capital inflow shocks, we compute the equivalent variation based on an indirect Stone-Geary utility function.

Our simulations yield different outcomes, depending on the kind of shock the economy is subjected to. For instance, simulating a 100% increase in the world price of food, we find a negative albeit small effect on economic growth, which we attribute to Dutch disease effects. The food price shock is however welfare enhancing, explained by the increase in real incomes resulting from the export boom in the food sector. On the flipside, simulating a 20% increase in the world price of oil yields a major negative effect on economic growth: the spending effect of the oil price shock leads to an expansion of tradable sectors and a shrinking of nontradables, worsening the trade deficit. The welfare effects of this oil price shock are as expected, negative. Simulating a 20% increase in foreign aid, we find mixed outcomes, depending on how the aid is used. Consistent with the Dutch disease literature, we find that if aid is invested solely on the demand side, it results in slower growth and a reduction in welfare. However, if the aid is used productively (used to remove supply side bottlenecks), it is growth and welfare enhancing. Simulating an increase of remittances to a level equivalent to 5% of Kenya's GDP, our results indicate this to be inflationary, which brings about Dutch disease effects and a reduction in the country's global competitiveness. Nevertheless, an increase in remittances is welfare enhancing although this effect is dampened by the increase in inflation. Finally, our simulation involving a surge in foreign

direct investment spillovers generates a sluggish economic performance, although it's welfare enhancing. The resource movement effect of the spillovers positively affects non-tradable sectors, at the expense of tradables.

The findings of this study have important policy implications. That a positive food price shock improves welfare but brings about Dutch disease effects poses a policy dilemma: should government should encourage food exportation, which reduces poverty but face the risk of a rise in trade deficit in the long run? A way out of this dilemma is to put in place stabilisation measures that endogenize adjustment of domestic expenditure via a shift of resources from the booming food sector to the shrinking cash crop sector. To cushion the economy from the deleterious effects of a negative oil price shock, the government should diversify the energy portfolio by enhancing supply of green energy. To militate against the Dutch disease effects of aid, government should address some of the production constraints of the tradable sectors, for instance by providing extension services and promoting use of new technology to enhance productivity. Another way to militate against Dutch disease-related problems is for government to establish a sovereign wealth fund to reduce the volatility of government revenues and counter the 'boom-bust cycles' that adversely affect public expenditure. Aid should be invested in projects such as infrastructure development and using a proportion of the aid to finance operations and maintenance. Remittances, if well invested could be welfare enhancing. In this regard, an appropriate macro policy is a prerequisite, which could entail investing excess foreign exchange in a sovereign wealth fund that we have alluded to above. This would in turn control real exchange rate movements. Finally, since foreign direct investment is growth and welfare enhancing, Kenya's trade and investment policy should be geared towards boosting the ease of doing business.

CHAPTER ONE: INTRODUCTION

1.1 Study Background

Globalization, the process of continuing integration of countries into the world economy has brought about a paradigm shift in international relations; i.e. in world politics and economic relations. As a result, countries continue to make substantial gains from international trade and financial capital flows. On the one hand, countries have through international trade been able to benefit from specialization, enhanced productivity due to economies of scale in production of commodities, transfer of knowledge and new technology as well as a wide range of imported goods for local consumers. On the other hand, as economic development literature shows, official and private financial flows from industrialized countries have boosted developing countries' pace of economic development. On the flipside however, globalization has its demerits; countries, whether developed or developing have had to endure external economic shocks that are transmitted via international trade and capital flows. Broadly speaking, an external shock can be defined as an unexpected, unpredictable event which results in drastic economic changes (see http://www.businessdictionary.com). Changes can be either positive or negative. From the standpoint of the economic policy maker an external shock can be regarded as exogenous. Commodity price changes that have occured from time to time, large capital inflows, large interest rate and exchange rate fluctuations as well as most natural disasters and wars can be classified as shocks.

In this study our interest is to evaluate the effects on the economy of shocks that are brought about by changes in commodity prices (terms of trade) and large foreign capital inflows, using Kenyan data. Kenya, being a small open economy has had to endure debilitating external economic shocks. For instance in the 1970s the country endured two types of severe external economic shocks; the sharp increases in global oil prices in 1973 and 1979/80 and the coffee boom of 1977. These according to Karingi and Siriwardana (2002) caused major macroeconomic imbalances that had serious implications on economic performance and welfare. Recent studies on Kenya such as World Bank (2011) have shown that in the last few years the country has had to endure external shocks, whose cause can largely be traced to escalating global food and oil prices[1] and the economic upheavals brought about by the

[1] It is important to note however that beginning 2014, the world price of oil have been on a downward trend, so that by March 2016, the cost of a barrel of crude oil was $30 according to New York Times newspaper. This fall

global financial crisis that originated from the western world in the middle of 2007. Because of these shocks, Kenya has thus suffered macroeconomic instability, manifested by higher inflation, increase in the current account deficit, a weaker currency and a weakening of the stock market. A study to evaluate and quantify the impact of these exogenous shocks is therefore an imperative, as it would go a long way in informing policy makers in their endeavour to achieve the targets set out in *Kenya vision 2030*. It is in this backdrop that our study should be seen.

1.1.1 Overview of Kenya's External Trade Policy

A more detailed analysis of Kenya's trade experience is done in Chapter 4 of this thesis. In this section we take just a cursory look at the country's trade policy that has guided its external trade over the years. According to Bigsten (2002), Kenya at the dawn of independence in 1963 inherited from its colonial master Britain a trade and industrial policy that was biased towards import substitution. Kenya's manufacturing dates back to early twentieth century; however, according to Bigsten (2002), it remained relatively weak, only able to produce processed agricultural products and relying heavily on foreign capital and skilled management. Thus, after gaining independence, Kenya pursued a policy that aimed at attracting foreign investors to produce for the domestic and regional market an multinational corporations (MNCs) such as Union Carbide, Firestone, United Steel, Del Monte, Schweppes, and Lonrho began producing in Kenya (Kinyanjui, 2010). Our analysis of data from various government documents including Economic Survey and Statistical Abstract reveal that manufacturing industry performed quite well during the first decade after Kenya's independence. The sector grew at an average rate of 8 percent compared with rates below 5 percent in the 1980s and 1990s. According to Ikiara et al. (u.d.), this impressive performance of the industrial sector reflected the high economic growth rate that was credited to President Jomo Kenyatta administration's prudent management of the economy. Additionally the East African Community (EAC) provided a vent for Kenya's products thereby expanding the export base. Domestic investment was encouraged through high protection and provision of credit facilities, while a liberal attitude towards foreign investors enhanced foreign direct

in the price of oil is attributed to a supply glut in the world market that is to a large extent the result of doubling of USA's domestic oil production since 2008.

investment (FDI). Modernization and diversification of agricultural production for both export and domestic markets led to increased income, which raised domestic demand for manufactured goods and hence bolstered industrial development. This rosy picture of Kenya's trade and industrial policy however did not last long, owing to a number of factors. The country experienced a balance of payments crisis in 1970–1971, which was exacerbated by the first adverse oil shock two years later. To make matters worse, the Government by the end of the 1970s pursued an inward-looking industrial strategy that saw to the decline in production for export markets. The government's incentives in favor of production for domestic markets, coupled with the collapse of the EAC in 1977 negatively affected Kenya's trade and industry, and hence economic growth (Ikiara et al., u.d.; Gertz, 2010)[2]. The fluctuation in commodity prices in the world market during this period aggravated an already bad situation such that by 1979 the government had to initiate a series of trade and industrial policy reforms, which included gradually replacing the quantitative restrictions with equivalent tariffs that were in turn to be rationalized and reduced over time. According to Gertz (2010), Kenya became one of the first countries to sign a Structural Adjustment Loan with the World Bank in 1980, and over the next two decades, the country replaced the import-substitution policy with an open, liberalized trading regime. Tariffs were decreased, controls on imports were loosened, and the government encouraged trade through a series of export promotion platforms (Foroutan, 1993).

The following is a chronology of how the exchange rate policy has evolved since the mid-1970s in Kenya, as analyzed by Gertz (2010). First, in 1975 the government switched the peg for the exchange rate from the US dollar to the IMF's Special Drawing Rights (SDR), which, as it was based on a basket of currencies, was believed to be more stable than the US dollar. Secondly, in 1982 a crawling peg exchange rate was adopted based on the country's own composite basket of the currencies of its principal trading partners. Third, in 1990 a dual exchange rate policy was adopted and under this system the government tracked both the official exchange rate and the rate available in the market. Fourth and finally, in 1993 the currency was allowed to freely float, a situation that was preceded by a significant devaluation of the shilling. By the end of the 1990s, according to Ikiara et al. (u.d.), the government had succeeded in reorienting the economy towards export promotion away from

[2]According to Glenday and Ndii (2003), there are only two episodes when Kenya recorded a balance of payments surplus; the first being during the coffee boom of 1977 while the second was in 1993-1994 due to a combination of a weak shilling, abolition of exchange controls and a fall in the real wage.

import substitution. The export compensation scheme, Manufacturing under Bond (MUB), and import duty and value added tax (VAT) remission schemes became key features of the Kenyan economy (Glenday and Ndii, 2003). In order to attract foreign investment in the export sector, government in 1996 enacted an Export Processing Act that created the export processing zones Authority (EPZA) which was followed by the establishment of export processing zones in Nairobi, Mombasa, Athi River and Nakuru. Another scheme was initiated in 1991 to promote exports through duty and VAT exemption. In addition, the scheme introduced changes in the regulatory regime that aimed at attracting investment in MUB and EPZ (Ikiara et al. u.d.).

Trend in Unit Prices

An examination of the trend of unit prices of principal exports and imports for Kenya reveal that during the period between 2003 and 2014, most commodities recorded increases in export and import unit prices. Table 1 analyzes, in terms of index numbers the changes in price for selected commodities during the period under review.

Table 1: Unit Prices of Selected Principal Exports and Imports (Index Numbers with Base Year=1)

Commodity /Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Domestic exports												
Fish and fish preparations	1.0	1.1	1.2	1.3	1.2	1.2	1.4	1.4	1.6	1.5	1.4	1.4
Maize (raw)	1.0	0.3	0.3	0.7	0.4	0.5	0.6	1.7	2.7	3.6	2.6	-
Horticulture	1.0	1.4	1.4	1.5	1.3	1.6	1.8	1.8	2.2	2.1	2.2	2.1
Coffee unroasted	1.0	1.3	1.8	1.9	1.8	2.3	2.4	3.5	5.2	4.0	3.1	3.9
Tea	1.0	1.0	1.0	1.2	1.0	1.3	1.7	1.8	2.1	2.1	1.9	1.6
Margarine and shortening	1.0	1.0	0.9	0.9	1.1	1.4	1.3	1.4	1.9	1.9	1.9	1.8
Tobacco and tobacco manufactures	1.0	0.5	1.4	1.1	0.9	1.1	1.3	1.4	1.9	2.0	1.1	2.1
Soda ash	1.0	1.4	0.0	1.7	1.7	2.6	2.2	2.0	2.9	2.9	2.6	2.7
Cement	1.0	1.0	1.2	1.4	1.5	2.0	2.2	2.2	2.5	2.1	2.0	2.0
Imports												
Wheat, unmilled	1.0	1.4	1.1	1.0	1.4	2.1	1.5	1.7	2.6	2.3	2.4	1.4
Rice	1.0	1.2	1.2	1.3	1.3	1.6	1.8	2.0	2.7	2.6	2.5	2.4
Maize, unmilled	1.0	1.6	1.5	1.7	0.9	2.2	1.8	2.0	2.6	1.6	2.0	1.7
Wheat flour	1.0	0.8	0.8	0.6	1.2	0.9	2.3	1.2	1.3	1.2	2.0	1.6
Textiles, fibers and their waste	1.0	1.2	1.3	1.4	1.6	1.9	2.1	3.0	3.9	3.6	3.9	4.0
Crude petroleum	1.0	1.2	1.6	1.8	1.7	2.5	1.8	2.6	3.8	3.7	3.9	0.0
Petroleum products	1.0	1.4	1.8	1.9	2.1	3.2	2.1	2.7	4.1	4.0	3.9	3.7
Iron and steel	1.0	1.4	1.5	1.4	1.5	2.3	1.6	1.9	2.5	2.3	2.1	2.0
Road motor vehicles	1.0	1.8	4.0	10.8	9.0	9.4	10.4	9.8	13.0	13.6	12.3	13.4

Source: Republic of Kenya, Economic Survey, Various Years

As observed in Table 1, unit prices of some exports increased by more than 100 percent in 2014 when compared to the base year prices. These include unroasted coffee (290 percent), soda ash (170 percent) and horticulture (110 percent). In the case of imports, virtually all non-food products in Table 1 record a massive increase in unit prices in 2014 compared to base year prices. Road motor vehicles recorded the highest increase in unit prices at 1240 percent; followed by Textiles, fibers and their waste (300 percent) and petroleum products (270 percent). Price of food imports on the other hand recorded a moderate increase, with highest growth being recorded for rice (140 percent) followed by raw maize (70 percent) and wheat flour (60 percent).

Structure of Exports

Table 2 shows the structure of Kenya's domestic exports during the period between 2003 and 2014. As shown, traditional commodity goods such as food and beverage dominated domestic exports, accounting for about 41percent of total exports in 2014, a significant decline from 51 percent share recorded in 2003. This decline in the share of food and beverages to total exports, however, may be a sign of increasing export diversification. The share of fuels and lubricants increased from 0.3 percent in 2003 to about 0.7 percent in 2014 indicating a minimal change over the decade. That of non-food industrial supplies rose marginally from 25.4 percent in 2003 to 27 percent in 2014 while that of consumer goods (not elsewhere stated) increased from about 19 percent to about 28 percent during the same period.

Table 2: Kenya's Exports by Broad Economic Category (% share of Total Exports)

Description /Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Food and beverages	51.3	47.2	43.4	42.9	40.3	40.4	42.3	44.1	40.4	41.2	42.8	40.8
Industrial supplies (non-food)	25.4	24.8	24.4	23.5	25.5	28.7	27.0	28.1	30.3	29.6	27.7	27.0
Fuel and lubricants	0.3	0.7	3.3	3.0	3.4	1.4	1.4	1.9	2.1	0.8	0.4	0.7
Machinery and other capital equipment	0.7	1.2	1.1	1.5	1.7	1.7	2.1	2.3	2.3	2.9	2.1	1.6
Transport equipment	0.8	1.1	1.1	1.2	1.3	1.1	1.8	1.7	1.6	1.6	1.8	1.6
Consumer goods not elsewhere specified	19.3	21.2	26.7	27.8	27.8	26.7	25.4	21.8	23.4	23.7	24.9	27.9
Goods not elsewhere specified	2.3	3.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3
Total	100	100	100	100	100	100	100	100	100	100	100	100

Source: Republic of Kenya, Economic Survey, Various Years

Trading Partners

Tables 3 and 4 show Kenya's main trading partners (export destination and imports source). We observe that Europe (mainly European Union) and Africa remain key export destinations for Kenya, registering an average of 27.4 percent and 46.5 percent of total exports respectively. In 2014, exports to Africa and Europe were 44.9 percent and 25.9 percent of total exports respectively. During the same period, exports to America (USA and Canada) and Asia significantly stagnated at 8.5 percent and 18.6 percent of total exports respectively. It is interesting to note that while exports from Kenya to Asia have rather been minimal, imports from that continent are quite substantial. As seen in Table 4, during the 2003-2014 period imports from Asia were on average 57.4 percent of total imports, indicating a huge trade imbalance between Kenya and her Asian trading partners.

Table 3: Exports by Destination, 2003-2014 (% Share of Total Exports)

Destination/Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average for period
Europe	30.9	28.4	25.5	28.5	28.9	28.6	29.3	26.7	26.8	24.4	24.6	25.9	27.4
America	2.1	2.8	5.1	8.6	7.5	6.4	5.5	5.9	5.4	5.6	6.7	8.5	5.8
Africa	46.2	47.4	46.4	43.2	45.2	47.1	47.2	46.1	48.6	48.8	46.3	44.9	46.5
Asia	15.2	15.4	14.9	15.1	16.8	16.6	17.2	19.9	18.8	20.5	21.5	18.6	17.5
Australia and oceanic	0.4	0.3	0.3	0.3	0.4	0.2	0.3	0.2	0.2	0.4	0.6	0.6	0.4
All other countries not elsewhere stated	3.6	5.7	7.8	4.4	1.2	1.0	0.6	1.1	0.2	0.2	0.3	1.4	2.3
total Exports	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100	100

Source: Republic of Kenya, Economic Survey, Various Years

Table 4: Imports by Source, 2003-2013 (% Share of Total Imports)

Source /Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average for period
Europe	27.5	27.0	23.9	26.0	23.3	21.6	21.8	21.5	19.6	18.2	19.1	17.7	22.3
America	6.4	6.7	11.7	6.2	9.2	5.7	8.2	5.9	6.1	8.7	6.0	11.6	7.7
Africa	13.2	14.4	14.1	12.2	11.9	11.2	13.3	12.1	11.6	10.2	10.5	9.0	12.0
Asia	52.0	51.0	49.4	54.9	55.2	60.8	56.1	60.0	62.2	62.3	63.4	61.2	57.4
Australia and oceanic	0.6	0.4	0.4	0.6	0.3	0.2	0.6	0.4	0.2	0.6	0.9	0.5	0.5
All other countries not elsewhere stated	0.1	0.4	0.4	0.1	0.1	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0

Source: Republic of Kenya, Economic Survey, Various Years

We can thus in a nutshell delineate several factors that have constrained Kenya's trade and industrial development and hence economic growth. First, according to Ikiara et al. (u.d) the government was not only slow in implementing liberalization but also did little to put in place an effective export promotion policy. Insufficient exchange rate adjustments in the 1980s frustrated import liberalization while inefficient fiscal adjustments worked against investment, which in turn hampered exports despite the fact that policy now favoured an outward-looking export strategy. High tariffs and onerous administrative procedures further discouraged exporters from pursuing export development programmes as industry found it more profitable to produce for the protected domestic market. Secondly, and to paraphrase Ikiara et al. (u.d), Exporters frequently experienced difficulties in obtaining foreign exchange to facilitate trade promotion trips and other activities while their export compensation claims were delayed. The private sector was often unwilling to take the steps necessary to raise their competitiveness in international markets.

In light of the foregoing, the Kenya Government has in recent times attempted to address some of the bottlenecks affecting the country's external trade. In 2003 the government, under the auspices of the *Economic Recovery Strategy for Employment and Wealth Creation* initiated a National Export Strategy whose focus was on export diversification (Republic of Kenya, 2003). As a result of this, exports grew at 11.4 percent between 2003 and 2006, surpassing the targeted annual growth of 5.7 percent. To build on this success, the government has set out to achieve "a formal sector that is efficient, multi-tiered, diversified in product range and innovative" as espoused in its Vision 2030 development blueprint that was launched in 2007 (Republic of Kenya, 2007).

1.1.2 Overview of Poverty and Income Distribution Dynamics in Kenya

Table 5 shows the level of the incidence of poverty in Kenya during different episodes between 1992 and 2006. As seen in the table, the level of poverty increased between 1994 and 2000, which coincided with poor performance in economic growth and a rapid population growth rate. Between 1997 and 2000 the Kenyan economy recorded a compound economic growth rate of 2.1percent which was lower than the population growth rate of 2.4 per cent registered in the same period. However the economic recovery strategy put in place in 2003 saw the economy registering impressive economic performance in the ensuing

period. The compound real growth rate between 2001 and 2005 was 6.7 per cent compared to a population growth rate of 2.7 per cent. Consequently, the incidence of poverty fell to 46 per cent in 2006 from 54 per cent in 1999. Table 5 also depicts the spatial dimensions of poverty in Kenya, indicating that poverty has consistently been more severe in the rural than urban areas of the country. In 2006 rural Kenya had a poverty incidence of 49.1 percent compared with 33.7 percent for urban areas during the same period.

Table 5: Incidence of poverty (Head Count Index) 1992-2006

Poverty incidence or headcount (P0).							
Year	1992	1994a	1994b	1997	1999/2000	2000	2005/06
	WMS I	WMS II	WMS II	WMS III	Census	Mwabu et al. (2002)	KIHBS
National		43.8	45.5	51.3	54.1	56.8	45.9
Rural	47.9	46.8	45.9	52.9	55.0	59.6	49.1
Urban	29.3	28.9	-	49.2	51.0	51.5	33.7
Poverty lines							
Urban (Kshs /month)	-	-	-	2,648	-	2,648	2,913
Rural (Kshs/ month)	-	-	-	1,239	-	1,239	1,562

Source: Adopted from Kiringai (2010) and Mwabu et al. (2002)

Note: WMS refers to welfare monitoring survey and KIHBS to Kenya Integrated Household Budget Survey

As is well established in the poverty literature, poverty can be decomposed into two main components; namely, economic growth and income distribution. In the foregoing we have explained economic growth and poverty trends, now we turn to analysing income inequality in Kenya. Bigsten et al. (2014) is one of the studies that have comprehensively studied income distribution in Kenya**.** Taking a long term perspective of the Kenyan economy, the authors measure and explain changes in, among other issues, inequality for the period between 1900 and 2012. The authors conclude that high overall inequality has been an overriding characteristic of the Kenyan economy over the last century and attribute this state of affairs to agro-climatic conditions, weak institutional and infrastructural developments, fragmented domestic markets, and ethnic politics[3]. In a survey of literature, Wambugu and Munga (2009) show that it is likely that high initial income inequality impedes growth and

[3]The authors observe that income inequality arising out of regional differences makes a substantial contribution to overall inequality.

hence poverty reduction efforts. According to the authors, although changes in poverty depend on economic growth and changes in income inequality, the responsiveness of poverty to these variables depends on the degree Poverty. The authors, while citing Bourguignon (2004) argue that given these relationships, the optimal economic growth-income distribution policy mix would have to vary across countries. Changing income distribution is more important for reducing poverty in better off and highly unequal economies, while economic growth is relatively more important for poverty reduction in countries with low average incomes and low inequality. Table 6 presents the trend in the Gini Coefficient[4] for Kenya for selected years derived from various authors.

Table 6: Income Inequality in Kenya, 1964-2007

Source	Reference year	Gini coefficient
Bigsten, 1986	1964	0.63
Jain, 1975	1969	0.48
Bigsten, 1986	1974	0.69
ILO, 1984	1976	0.60
Van Ginneken and Park, 1984	1977	0.57
Milanovic, 1994	1981-83	0.57
Deininger & Squire, World Bank, 2004	1992	0.60
Kenya Government, WMS, 1994	1994	0.43
Kenya Government, WMS, 1994	1997	0.53
Society for International Development, 2004	1999	0.56
Tegemeo Institute-Egerton University, Kenya	2000	0.49
	2004	0.49
Bigsten et al., 2014	2005	0.52
	2007	0.47

Note: Some of the Information in the table is derived from Wambugu and Munga (2009)

[4] The Gini coefficient is so named after an Italian statistician Corrado Gini, who developed it in 1912. It is defined as a measure of the inequality of a distribution, a value of 0 expressing total equality and a value of 1 maximum inequality. The Gini coefficient is based on the Lorenz curve, which compares the distribution of incomes across the entire population of an area. It is a useful measure because it incorporates all of the information available from a particular area.

As is observed in Table 6, income inequality has been substantially high in Kenya since the 1960s. Save for 1969, 1994, 2000 and 2007, inequality in the country has been above 50 percent. The highest inequality ever recorded was in 1974; at 0.69 while the lowest was 0.43 recorded in 1994. It remains to be seen whether the Government's goal of reducing inequality as is envisaged in its *Kenya Vision 2030* blueprint (see Republic of Kenya, 2007) will be achieved.

1.1.3 Trend in Kenya's GDP and Terms of Trade

Terms of trade has a major effect on the economy, as we shall see in Chapter 2. The Kenya National Bureau of Statistics (KNBS) calculates terms of trade as a ratio of exports and imports indices, which are computed using a Paascherized-Laspeyre formula with a selected base year (see Statistical Abstract, 2011). Laspeyres index is defined in text book economics as a market basket of goods in a base period, and then uses the prices for those goods to examine the change over space and time. This is simply the ratio of what those goods cost today to what they cost in the base period. On the other hand, Paasche index defines a market basket of goods in the current period, and then uses the prices of those goods from past periods. Table 7 presents time series data on Kenya's terms of trade for the period 1956 to 2013. It is important to note that official statistics did not include TOT of non- oil items until 1973.

Table 7: Trend in Kenya's GDP Growth Rates and Terms of Trade: 1955-2013

Year	Terms of trade (%)		GDP growth rate (%)		Year	Terms of trade (%)		GDP growth rate (%)		Year	Terms of trade (%)		GDP growth rate (%)	
	All items	Non-oil items	Constant prices	Current prices		All items	Non-oil items	Constant prices	Current prices		All items	Non-oil items	Constant prices	Current prices
1956	85	-	-	6.9	1976	91	95	6.1	22.9	1996	93	95	4.6	13.9
1957	81	-	-	6.5	1977	120	*131*	8.8	28.4	1997	102	108	2.3	14.7
1958	82	-	-	0.9	1978	103	106	6.7	9.0	1998	100	96	1.8	10.7
1959	80	-	-	3.0	1979	94	97	3.1	10.4	1999	88	90	1.4	7.7
1960	70	-	-	4.7	1980	97	95	2.4	12.2	2000	102	96	-0.2	7.4
1961	76	-	-	-0.4	1981	105	104	5.3	16.2	2001	79	79	1.2	12.0
1962	79	-	-	8.6	1982	100	100	3.4	12.9	2002	78	79	1.2	10.8
1963	77	-	-	6.1	1983	94	88	3.9	12.3	2003	81	84	1.8	13.9
1964	78	-	-	8.6	1984	110	108	0.9	11.3	2004	77	84	4.9	13.0
1965	81	-	-	2.2	1985	92	87	4.8	13.8	2005	72	84	5.8	12.4
1966	77	-	-	32.5	1986	103	93	5.5	18.2	2006	72	90	6.3	13.6
1967	91	-	4.5	5.8	1987	85	75	4.8	12.4	2007	70	88	7.0	12.7
1968	91	-	7.7	8.9	1988	88	79	5.2	14.6	2008	77	94	1.5	13.6
1969	91	-	6.7	9.3	1989	79	70	5.0	14.7	2009	82	99	2.7	9.4
1970	98	-	7.7	7.7	1990	71	62	4.5	16.3	2010	85	110	5.8	8.2
1971	86	-	7.0	11.2	1991	82	71	2.1	13.9	2011	84	83	4.4	18.6
1972	82	-	6.8	13.8	1992	79	71	0.5	15.0	2012	79	83	4.6	11.7
1973	97	97	7.0	11.8	1993	90	81	0.1	24.0	2013	81	85	4.7	11.6
1974	85	88	3.6	15.2	1994	101	91	3.0	19.2	2014				
1975	78	77	1.2	14.8	1995	96	97	4.8	16.6					

Source: Economic Survey, and Statistical Abstract, Various Years.

Note: Terms of Trade Figures for 1956-1959 are Author's Computations.

As Table 7 shows, TOT (both of all items and non-oil items) remained below the 100 percent mark for several years since 1956, until the late 1970s and early 1980s when the situation changed. For instance in 1977 TOT of all items was 120 percent while that of non-oil items were 131 percent, reflecting the effects of the coffee boom that had been experienced that year. Other years when both categories of TOT exceeded unity were 1984 and 1997, periods that incidentally saw the economy record relatively poor performance; at 0.9 percent and 2.5 percent respectively. The analysis in the foregoing reveals little about the relationship between TOT and GDP growth, hence; there is a need for a more detailed study of the two phenomena. We return to this issue in Chapter 4. Kenya's economic growth experience is as shown in Table 7 and as can be observed, data on real GDP was unavailable until 1967. Clearly, the Kenyan economy has recorded mixed results in its growth performance over the last five decades. During the decade between 1956 and 1966, the economy grew by 7.0 percent on average at current prices. This good performance was maintained in the later part of 1960s and the entire 1970s decade, although it was dampened by the negative effects of the global oil crisis of 1974. Thus, in real terms the economy expanded by an average of about 6 percent in the period between 1967 and 1979. During this period, the lowest rate of growth to be recorded was 1.2 percent in 1975 in the wake of the global oil crisis, while the highest was 8.8 percent in 1977 in the aftermath of the coffee boom that had materialized in the previous year.

As is clearly observed in Table 7, the Kenyan economy performed quite poorly in most of the 1980s, registering a real GDP growth rate of 4.1 percent on average for the decade. However, at an average growth rate of 2.5 percent the 1990s decade was, in terms of economic performance the worst period for Kenya since independence. This poor state of affairs was blamed on a number of factors, which were both political and economic. The 1980s was a period that was characterized by economic instability, itself a result of capital flight and donor withdrawal[5]. This, together with the balance of payments crisis that resulted from the second global oil shock; the weak industrial strategy and the collapse of the East African Community in 1977 was largely responsible for the decline in Kenya's economic fortunes. However, following the implementation of the economic recovery strategy that was launched in 2003 by the then newly elected National Rainbow Coalition (NARC) Government, things started

[5]The then President Daniel Moi had survived a coup d'état at the beginning of this decade, and this was followed by political unrest after the so-called dissidents and non-conformist Kenyans were rounded up and detained without trial. This put the government on a collision course with development partners, particularly from the western hemisphere who withdrew much of their support on grounds that the government had violated human rights of its citizens.

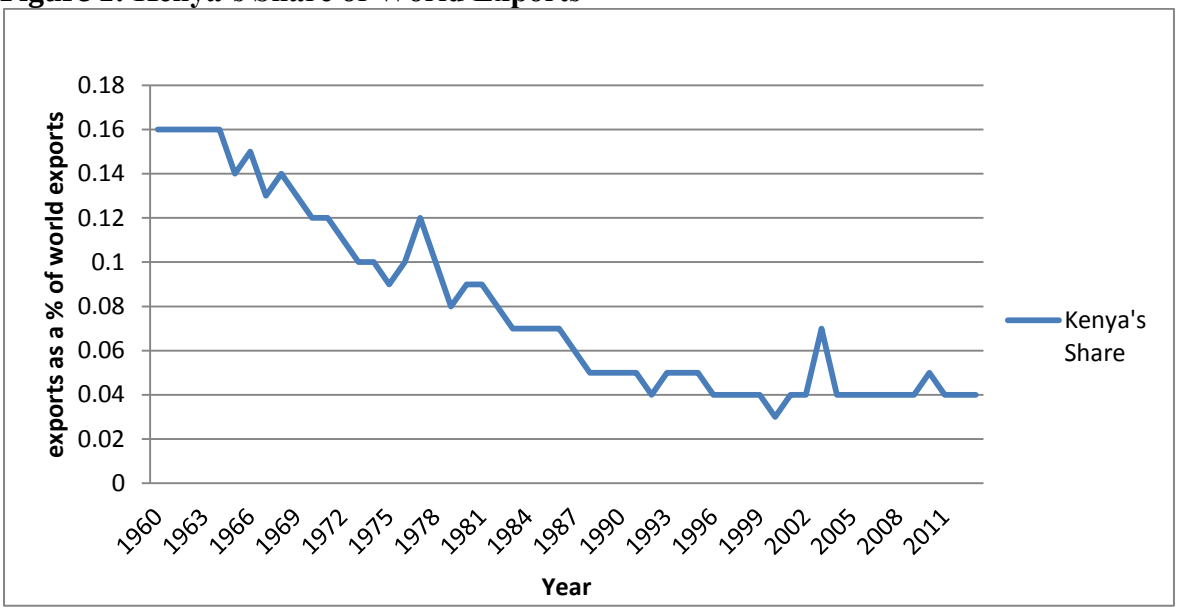
brightening up. Notwithstanding the adverse effects of droughts and increase in oil prices that ravaged the economy early in the 2000s decade, there was a steady growth in real GDP. It increased by 4.7 percent in 2004, 5.7 percent in 2005 and 7.1 percent in 2007. This upturn in economic performance was however interrupted in 2008 following the political instability that was witnessed in the aftermath of the General Elections held in December 2007. During this period therefore, the economy grew by a paltry 1.7 percent growth rate. The adverse effects of the political turmoil experienced in the better part of 2008 were short-lived, as we construe from data in Table 7. It is evident from the table that by 2009, the economy quickly regained its growth momentum; growing by 2.6 per cent. In the subsequent four years, the economy maintained a relatively good performance; growing by 5.6 per cent, 4.4 percent, 4.6 percent and 4.7 percent in 2010, 2011, 2012 and 2013 respectively.

1.1.4 Trend in Kenya's Market Share of World Exports

Figure 1 shows Kenya's market share of world exports for the period 1950-2013. Export trade is an important linkage for the Kenyan economy with the wider global economy. The economy is relatively well integrated globally via trade and thus experiences external shocks from time to time.The export market is an important transmission channel for shocks into the economy. As demand for Kenyan exports flactuate in the global market, there is a differential impact on the various sectors in the economy, the effect of which is dependent on the extent to which the sector is protected from the external sector. It is expected that a larger impact would be felt in a sector like manufactruing since it is most sensitive to movements in exports. As observed in figure 1, the share of Kenyan exports in the world export market has had a downhill trend since the 1960s[6]. From 1960 to 1970, the share fell by more than one-third, from 0.16 percent to 0.12 percent. The market share was fairly stable in the 1970s decade, maintaining a level of roughly 0.1 percent and then dropped to a level of 0.05 percent in the late 1980s. The Kenyan share has oscillated between 0.04 percent and 0.05 percent in most of the 1990s and 2000s, a situation that has persisted since then up to 2014.

[6] Although not shown in figure 1.1, service exports have over time been more volatile and have dropped faster than that of merchandise exports, thus have been the major driver of the downward trend in overall exports.

Figure 1: Kenya's Share of World Exports



Source: World Trade Organization.

Note: Data Represents both Merchandise and Services Exports

1.1.5 Trend in Capital Flows

The International monetary Fund (IMF) in its sixth edition of the *Balance of Payments and International Investment Position Manual* defines capital flows as the cross-border financial transactions recorded in economies' external financial accounts. Inflows arise when external liabilities are incurred by the recipient economy (inflows with a positive sign) and external liabilities are reduced (inflows with a negative sign). Outflows are purchases of external assets from the viewpoint of the purchasing economy (outflows with a negative sign), as well as the deleveraging of its assets (outflows with a positive sign). Net flows are the sum of gross inflows and outflows, where outflows are recorded with a negative sign. Reserve asset accumulation, which may be influenced by non-market-driven factors, is excluded from the computation of net flows as defined in the IMF manual. Sources of foreign capital in Kenya include foreign direct investment, official development assistance and Diaspora remittances. Foreign exchange reserves is the transmission channel through which capital inflows affect the economy. A change in foreign exchange reserves affects the monetary base and hence the money supply in the economy. Table 8 compares the trend in Kenya's money supply and net capital flows. As is discernible, net capital flows had a continuously upward rising trend

although erratic, up to 2008/09 fiscal year when it declined sharply[7]. Clearly, changes in money supply moved in tandem with the net capital flows during the same period.

Table 8: Trends in net capital flows compared with money supply: 2003-2013

Year	2003/ 04	2004/ 05	2005/ 06	2006/ 07	2007/ 08	2008/ 09	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014
Net Capital flows* as a % of GDP	1.6	4.6	4.8	11.7	5.8	1.9	7.2	10.9	12.9	12.2	
Money supply** as a % of GDP	43.5	44.6	48.9	57.3	60.4	30.1	49.5	49.7	50.8	51.5	

Source: Central Bank of Kenya Statistical Bulletin and Economic Survey, Various Years

*capital account balance in nominal Kshs **Broad money M3 = (M2 + foreign currency deposits)

Note: GDP is at constant 2001 prices

Official Development Assistance

The Organization of Economic Cooperation and Development (OECD) defines official development assistance (ODA) as government aid designed to promote the economic development and welfare of developing countries, and excludes loans and credits for military purposes. ODA may be provided bilaterally, from donor to recipient, or channelled through a multilateral development agency such as the United Nations or the World Bank. It includes grants, "soft" loans and the provision of technical assistance. Soft loans are those where the grant element is at least 25% of the total. The OECD maintains a list of developing countries and territories; only aid to these countries counts as ODA. Table 9 depicts the pattern and evolution of the share of ODA to GDP for Kenya for the period 1970-2014[8]. As we observe, the share of ODA to GDP rose steadily from 3.6 percent in 1970 to a high of 15.9 percent in 1993. Thereafter it started its downward trend; declining through the rest of the 1990s to stand at a low of 2.4 percent in 1999[9]. The slackening of donor support during this period was as a result of the aid freeze and donor withdrawals that came about after the regime of President Moi reneged on various donor commitments (Mwega, 2009). There was a slight improvement in ODA flows beginning 2000 all the way to 2013, with the GDP share of ODA being 4.3 percent on average during this period. It is to be noted that despite its volatility, the level of

[7] This was largely due to reduced receipts of foreign loans, increased loan repayments and increased holdings of foreign assets by commercial banks in response to upheavals in the international capital market.

[8] According to Mwega (2004), 78 percent of aid to Kenya has been bilateral assistance, i.e. it has been on country to country basis.

[9] According to Mwega (2009), the slackening of donor support during this period was as a result of the aid freeze and donor withdrawals that came about after the regime of President Moi reneged on donor commitments.

ODA inflows to Kenya since the 1970s has been higher compared to the other inflows, with the exception of the period between 1999 and 2003 when it had been overtaken by remittances from Kenyans abroad.

Table 9: Trend in Capital Inflows as a share of GDP, 1970-2013

Year	Net ODA	Remittances	Net FDI	Year	Net ODA	Remittances	Net FDI
1970	3.6	0.5	0.9	1994	9.5	1.9	0.1
1971	3.8	0.4	0.4	1995	8.1	3.3	0.5
1972	3.4	0.7	0.3	1996	4.9	2.4	0.9
1973	3.8	0.5	0.7	1997	3.4	2.7	0.5
1974	3.9	0.6	0.8	1998	2.9	2.5	0.2
1975	3.8	0.4	0.5	1999	2.4	3.3	0.4
1976	4.4	0.3	1.3	2000	4.0	4.2	0.9
1977	3.6	0.4	1.3	2001	3.6	4.2	0.0
1978	4.6	0.5	0.6	2002	3.0	3.3	0.2
1979	5.6	0.3	1.3	2003	3.5	3.6	0.5
1980	5.4	0.4	1.1	2004	4.1	3.9	0.3
1981	6.5	1.1	0.2	2005	4.1	2.3	0.1
1982	7.5	1.1	0.2	2006	3.7	2.2	0.2
1983	6.6	1.0	0.4	2007	4.2	2.0	2.3
1984	6.6	0.9	0.2	2008	3.8	1.9	0.3
1985	7.0	1.1	0.5	2009	4.8	1.7	0.3
1986	6.1	0.7	0.5	2010	4.1	1.7	0.4
1987	7.0	0.8	0.5	2011	5.9	2.2	0.8
1988	10.0	0.9	0.0	2012	5.3	2.4	0.5
1989	12.8	1.1	0.8	2013	5.9	2.3	0.9
1990	13.8	1.6	0.7	2014			
1991	11.2	1.5	0.2				
1992	10.8	1.4	0.1				
1993	15.9	2.1	2.5				

Source: World Development Indicators, World Bank

Diaspora Remittances

The Central Bank of Kenya defines a remittance as money sent by a person in a foreign land to his or her home country. Time series data on remittances to Kenya for the period 1970-2013 is given in Table 9. The country has a wide Diaspora especially in North America and Europe, who continue to remit money back home for various reasons. As seen in Table 9, the share of

remittances to GDP remained low in the 1970s, with an average of less than 0.5 percent for that decade. The level of remittances increased marginally in the 1980s and 1990s, registering respectively an average GDP share of 0.9 percent and 2.3 percent during the two decades. There was an upsurge in the flow of remittances to Kenya by the advent of the 2000s, even overtaking ODA flows at some point as seen in Table 9. The average GDP share of remittances was 3.8 percent for the period between 2000 and 2013 indicating an upsurge despite the financial and economic crisis that hit the world towards the end of the decade[10].

Foreign Direct Investment

World Bank defines foreign direct investment (FDI) as the direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. The trend in FDI inflows to Kenya for the period between 1970 and 2013 is shown in Table 9. With the exception of the 1970s period, FDI to Kenya has been quite low when compared to other inflows. This is largely because of the restrictive investment climate in the country (see the detailed discussion of why FDI in Kenya has been on the decline in Chapter 5). The average share of FDI to GDP was about 0.8 percent in the 1970s, higher than that of remittances which was about 0.4 percent during the same period. The average share of FDI to GDP was respectively 0.46 percent, 0.78 percent and 0.55 percent for the 1980s, 1990s and 2000s.Three years into the current decade (2011-2013), the average share of FDI to GDP has slightly improved, rising to about 0.7 percent compared to that recorded during the previous decade.

1.2 Problem Statement

Globalization, as we have already noted, has both merits and demerits. The global economic crisis experienced recently (between 2007 and 2009) is a good example of the downside of globalization. The effect of the crisis, whose origins were the western world, was transmitted to the rest of the world via shocks in trade flows and capital inflows. The impact of the crisis

[10]Aggregated annual data analysis may be misleading. In chapter 3 we analyse monthly remittances data and show that indeed global recession could have affected remittances in 2009.

differed among countries depending on their level of global interconnectedness. Most Sub-Saharan African (SSA) countries including Kenya, are small open economies, hence were not spared the negative effects of the global crisis. However, the countries were able to recover quickly from the crisis because they had policy buffers that allowed for countercyclical measures (Sy, u.d). Although the crisis has since ebbed, the current global economic environment is still unfavourable to developing countries. These countries continue to face serious exogenous shocks that are inimical to economic growth and poverty reduction efforts. According to Sy (u.d), SSA countries are currently grappling with three types of external shocks. First is the adverse effect of the slowdown in China's economic growth[11] ; second is the substantial fall in commodity prices; and third is the increase in external borrowing costs brought about by higher interest rates in the United States of America. As suggested by World Bank (2011), external shocks have partly been responsible for the macroeconomic instability recently experienced in the country, manifested by higher inflation; increase in the current account deficit; a weaker currency and a weakening of the stock market. Thus, determining how this macro instability has affected economic growth, income distribution, poverty and welfare is an imperative, and it is in this backdrop that our study should be viewed.

As already stated, an important channel through which external shocks are transmitted into the economy is the terms of trade (TOT)[12]. The Prebisch-Singer hypothesis advanced separately by Prebisch (1950) and Singer (1950) is one of the first studies to place TOT as a key factor in economic development, and it also reignited debate on the merits and demerits of international trade. Paraphrasing Jhingan (1986), the hypothesis enunciates that the secular deterioration in the TOT has been an important factor inhibiting the growth of underdeveloped countries. The TOT between the peripheral (underdeveloped countries) and the cyclical centres (developed countries) have shifted in favour of the latter because monopolistic elements in their product and factor markets have allowed them to keep the benefit of their technological progress in the form of rising factor incomes, whereas in the former the gains in productivity have been distributed in price reductions. Since the publication of the Prebisch-Singer hypothesis, there has been an incessant debate among scholars, who as we shall see in Chapter 2 are sharply divided on the effects of TOT on the economy. While some authors argue that changes in TOT

[11] The economy of China is transiting towards a new growth model that relies more on innovation and productivity growth on the supply side, which has lessened the demand for its imports, including from Africa

[12] Funke et al. (2008) explain the transmission mechanism of terms of trade shocks across the economy, arguing that at the micro level, the transmission is best analyzed in terms of the private sector, the banking system, and the public sector.

have a negative effect on the economy, others argue that its effects are ambiguous and may be negative or positive. Our interest to examine the effects of TOT on the Kenyan economy is borne of this stimulating debate.

Another channel through which external shocks are transmitted into the economy is foreign capital inflows. Foreign capital can enter a country in the form of private and/or public capital. Private foreign capital may be in form of direct and indirect investments while public capital, or ODAcan be regarded as loans and grants from bilateral and multilateral agencies. Another form of capital flow is Diaspora remittances, sent by migrants to their mother countries. Large fluctuations in foreign capital flows may cause booms and busts in the receiving economy and thus lead to macroeconomic instability. As we shall see in the literature review chapter, the role of foreign capital inflows on economic development is an area of research that has aroused immense interest among scholars, who however are not unanimous on its effectiveness. Various authors have argued that an up-surge of foreign capital inflows may have a negative effect on economic growth and welfare, largely due to the Dutch disease effects arising from the appreciation of the real exchange rate. In the next section, we highlight how our study contributes to the body of knowledge and in filling of the existing gaps in the literature.

1.3 Contribution of the Study

This study's motivation to investigate the impact of external shocks on the economy is driven by a number of reasons. As we learn from the survey of literature (Chapter 2), there is a dearth of empirical literature focusing on the effects of TOT on SSA countries, Kenya included. As a matter of fact, the few studies examining the role of foreign trade on Kenya's economy have applied partial equilibrium models such as econometrics and have not explicitly factored in TOT as a major determinant of economic growth in their models [see e.g. M'Amanja and Morrisey (2005), Kimenyi et al. (2003) and Mohan and Nadwa (2007)]. Moreover, only three studies to our knowledge have investigated the effects of TOT shocks on the Kenyan economy in a general equilibrium setting, and these include Karingi and Siriwardana (2003), and Levin (1998,2010). Karingi and Siriwardana mainly focused on investigating the effects of an increase in oil prices (unfavourable TOT) and an increase in coffee prices (favourable TOT) on Kenya's agricultural sector and hence economic growth. The authors did not examine the poverty and welfare impacts of TOT, an area of particular interest to researchers and policy

makers given that poverty reduction is an overriding goal in Kenya, like in most other LDCs. Granted, Levin (1998) assessed the poverty impact of adverse TOT, focusing on coffee prices; while Levin (2010) investigated the effect of favourable TOT on economic growth and poverty, focusing on maize prices. This study extends Levin (2010) by incorporating wheat and rice in the analytical model. Besides, there has been an unprecedented fall in the global price of oil during the last couple of years, and evaluating its impact on the economy is important, given that no study in recent memory has attempted to do so using Kenyan data. In Chapter 2, our endeavour is to identify and discuss the gaps in the literature, while in Chapter 4 we investigate, using Kenyan data the effects of the TOT shocks on poverty, income distribution and welfare. Finally and importantly, only Levin (2010) to our knowledge has used microsimulation methods to measure the impact of terms of trade on poverty in the Kenyan context and thus our study adds to this strand of literature.

Another key objective of this study as already stated is to evaluate the impact of ODA, Diaspora remittances and FDI on economic growth and welfare in Kenya. As we shall see in the literature review chapter, majority of LDCs, Kenya included have over the years received large anounts of ODA, yet low levels of economic growth and high incidence of poverty remain key feaures of their economies. Exisiting literature is divided on the role of aid in development. On the one hand, aid 'optimists' argue that ODA has been beneficial to the economy, especially when it comes to economic growth. On the other hand, aid 'pessimsists' argue that it has done more harm than good to the recipient countries. This study is an attempt to contribute to this debate. Diaspora remittances have in recent years become a major source of capital for developing countries. In fact for the case of Kenya, the inflows even outstriped ODA flows at some point in the early 2000s. Unlike ODA, remittances are sent directly to households without entering the government budget. The pertinent question is thus what proportion of the remittances is saved or consumed by recipient households. As observed in our review of the literature, remittances inflows in many countries are invested in education and health as well as development of agriculture and small enterprises, among others. What then are the macroeconomic effects of remittances? this is an interesting question that we endouver to answer in this study, given the keen interest policy makers have recently shown on the subject[13]. On FDI, it is a widely held belief among policy makers that this type of capital

[13] Kenya's Diaspora Policy, developed in 2014 is a *Kenya Vision 2030* flagship project, which aims to inter alia mainstream the Kenyan Diaspora into national development process and particularly address the high costs of money remittance from host countries to Kenya.

inflow has several advantages over other types of capital flows; including having a greater stability and the fact that it would not create obligations for the host country. Apart from being a direct source of capital financing, FDI also benefits the host country in terms of employement creation as well as transfer of technology, managerial skills and market knowhow. However, as we shall see in Chapter 2, empirical evidence on the existence of such positive externalities is sobering. Most of the empirical literature finds weak support for positive FDI externalities on economic growth and indicate that a country's ability to benefit from FDI externalities depends on certain local conditions. Studies have also shown that FDI can be potentially harmful to the host country through resource over-exploitation, pollution and abuse of market power. To our knoweldege, no study todate has investigated the impact of FDI spillovers on economic growth and poverty in Kenya. The few studies on the subject have concentrated on examining the determinants of FDI flows into the country (see Kinyanjui, 2010 for a review of this literature). It is in this context that our study should be seen[14].

Concluding this section on a methodological note, it is important that we point out the fact that majority of studies that have attempted to evaluate the impact of capital inflows in the Kenyan context have by and large employed partial equilibrium in their analysis. This approach while appropriate to use especially in cases where data availability is an issue, is ill-suited to explain the indirect or unintended effects of capital inflows as it does not account for the inter-dependencies between different sectors, economic agents and markets. In addition, partial equilibrium models may not explicitly incorporate the price effects of external shocks. By employing a general equilibrium approach, our study avoids some of these pitfalls. Besides, the model that we apply in Chapter 5 is dynamic enough to capture the long-run supply-side effects of capital inflows. This, together with the use of microsimulation module (linked to the CGE model) will go a long way in bridging the existing gap in the literaure of the general equilibrium impacts of external shocks on economic growth and welfare in Kenya.

[14]Since the Kenyan SAM (2003) database that we use to calibrate our CGE model does not distinguish between foreign and domestic investment, our focus is on FDI spillovers and not direct FDI, and we model TFP spillovers due to FDI in the services sector.

1.4 Key Research Questions

This study endeavours to answer the following three key questions:

(i) How do terms of trade shocks affect the Kenyan economy?

(ii) How do capital inflows shocks affect the Kenyan economy?

(iii) What are the policy implications of the findings of this study?

1.5 Objectives of the Study

The broad objective of this study is to examine the effects of external shocks on the Kenyan economy, using a CGE approach based on the Kenya Social Accounting Matrix (SAM), 2003. The specific objectives of the study include the following:

(i) Investigate the impact of terms of trade shocks on economic growth, poverty, welfare and income distribution in Kenya;

(ii) Investigate the impact of capital inflows on economic growth and welfare in Kenya;

(iii) Identify policy implications based on the research findings and come up with recommendations.

1.6 Structure of the Study

This study comprises four chapters. Chapter 1 introduces the study while Chapter 2 reviews the literature. Chapter 3 looks at the modelling theory of CGE while Chapter 4 examines the effects of TOT on Kenya's economic growth, poverty, income distribution and welfare. Furthermore, Chapter 5 examines the effects of capital inflows on economic growth and welfare while Chapter 6 summarises, concludes and presents policy recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In the previous chapter we noted that due to globalization, international trade and investment has expanded, resulting in increased external shocks. These shocks have had a major impact on the global economy, especially developing economies. In this study our focus is on two mechanisms that transmit external economic shocks to the economy; namely, terms of trade and foreign capital inflows. The present chapter critically examines the theoretical and empirical literature on the effects of these two sources of external shocks on the economy.

2.2 The Impact of Terms of Trade Shocks on Economic Growth, Poverty and Welfare

2.2.1 Theoretical Literature

Harberger (1950) and Laursen and Metzler (1950) were among the first studies to investigate the effects of a TOT shock on the economy. In what was later to become known as the Harberger-Laursen-Metzler (H-L-M) effect, the authors suggested that deterioration in the TOT reduces a country's real income consequently decreasing savings, through consumption smoothing behavior. Obstfeld (1982) and Kent and Cashin (2003) while extending the H-L-M effect showed that the duration or persistence of TOT shocks were important when determining the effect on an economy. A longer or more persistent shock may result in lower investment and potentially higher saving in anticipation of lower future output. Much of the current literature examining the link between a secular trend in the TOT and economic growth has focussed more on elucidating cross-country differences between developing and developed countries. As already mentioned, the Prebisch-Singer hypothesis proposed that the South (developing countries) had experienced a downward trend in their TOT relative to the North (developed countries) and that over time, the price of primary goods should in essence decrease, relative to the price of manufactured goods. The hypothesis claimed that historically foreign trade had led to international inequality whereby the rich countries became richer at the expense of poor countries. The worsening of TOT has, according to the hypothesis been an important factor in hampering the growth of developing countries and TOT is the most

important channel for transmitting efficiency gains from the North to the South. Fluctuations in the TOT affected resources to countries in the South for capital accumulation, and hence economic growth. Additionally changes in the volume and value of international trade matter a lot for developing countries, since they depend on export revenues to finance their development projects and programmes. The Prebisch-Singer hypothesis argued the basic nature of primary and manufactured goods is such that in the long run the price of primary goods would fall relative to those of manufactured goods. Thus, countries specializing on production of primary goods would see a worsening in their TOT. As a consequence, both producers of primary products and consumers of manufactured goods experience a relative fall in incomes. Prebisch and Singer argued that manufacturing sectors generated monopoly profits, and that these profits would eventually translate into real wage increases. Commodity markets, on the other hand, would see productivity gains translated into a decrease in prices, rather than a rise in wages. This is because most commodity markets are perfectly competitive, and demand for commodities is income-inelastic. Adopting a Keynesian approach, the Prebisch-Singer hypothesis argued that during upswings, excess total demand would increase prices while excess total supply leads to a reduction of prices during downswings. Upswings increase wages in the industrialized countries because of competition between producers and trade unions' pressure. In downswings on the other hand, wages are sticky. Prebisch-Singer hypothesis posit that weak trade unions in developing countries hinder workers from getting higher wages in upswings and maintaining them in downswings. Thus, prices of manufactured goods rise more than prices of primary products in upswings and decline less than the prices of primary products in downswings. In a nutshell, this prevents the TOT from improving in underdeveloped countries.

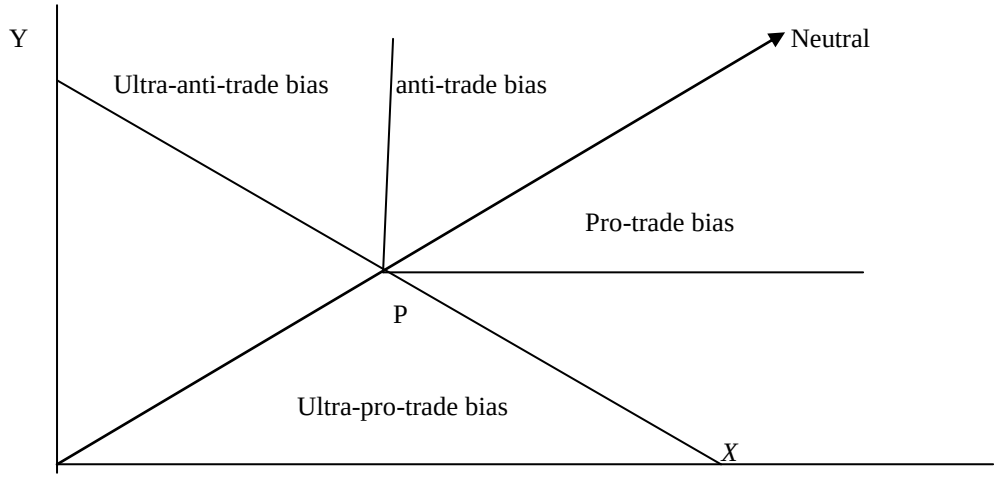
Some studies such as Lutz (1999) and Cashin and McDermott (2002) have found evidence supporting the Prebisch-Singer hypothesis, while others disagree. Among those who disagree is Powell (1991) who in an econometric study found that after allowing for three breaks in time-series data, non-oil commodity prices and manufactured goods prices are cointegrated, implying that the commodity TOT is stationary and therefore does not decline over time. Another econometric study by Kellard and Wohar (2006) allowed for two structural breaks and found little evidence in support of the Prebisch-Singer hypothesis. They found that for most goods, a single downward trend is not the best representation; rather a "shifting trend" which often changes sign over the sample period is more suitable. They thus suggest as too simplistic the studies that support the Prebisch-Singer hypothesis on the basis of a single downward

sloping trend. Kellard and Wohar (2006) suggest that the downward trend may in fact include several trends and therefore simplifying the result to a single downward trend may be misleading to policy makers. Another group of economists, the so-called neo-Kaldorian theorists led by Sarkar (2001) have shown that the hypothesis of asymmetric changes in the price of primary goods is insufficient to explain the worsening, if any, in TOT that occurred during periods of upswings and downswings. Álvarez-Albelo and Perera-Tallo (2008) have shown that theoretically, the effects of trade on economic growth could be so dominating as to remove an economy from stagnation. This, according to the authors occurs whenever the TOT becomes increasingly favourable to the stagnant country, which benefits from foreign efficiency gains. Furthermore, a favourable TOT is likely to bring about a convergence in the income of countries if trade involves incomplete specialization. Álvarez-Albelo and Perera-Tallo (2008) therefore suggest that TOT should be explicitly taken into account when studying the effects of trade on economic growth.

Findlay (1980) presented a model in which the TOT was a mechanism linking output growth in the North and the South. To paraphrase Findlay, trade is an engine of growth for the South; however the fuel that drives that engine is generated by the exogenously determined natural growth rate in the North. Thus, the natural growth rate in the South is endogenous, depending upon the value of the TOT. The steady state TOT must be whatever is necessary to make the endogenous growth rate in the South equal to the fixed natural growth rate in the North. Improvements in the production function in the North, or increases in its propensity to save, leave the TOT unchanged in the long run and increase its per capita income. In the South, on the other hand, these shifts lead to a proportional fall in the long-run TOT and per capita income. The major point of departure between Findlay's model and the Prebisch-Singer thesis is the former's assumption of perfectly competitive markets. Findlay (1980) has attracted criticism on grounds that he is contradictory when he suggests that a long-run convergence in per capita income would result when trade equates the pace of economic growth between rich and poor countries. A more recent study by Gillitzer and Kearns (2005) explains why developing countries suffer poor TOT. They argue that manufactured goods are more heterogeneous compared to primary goods, hence producers of manufactured goods have more price setting power. The authors argue that since manufactured goods are harder to produce while primary goods generally have low barriers to entry, the latter will most likely experience relatively more competition than the former, with the attendant price pressures and tight margins.

In the foregoing review of literature we have concentrated on examining the effects of TOT on economic growth. It is possible also that economic growth affects the volume of trade and hence TOT of a country as we subsequently show. Whether trade increases or decreases depends largely on the form of the shift in the production possibility curve and the change in the consumption pattern as incomes change. How this happens can be illustrated in Figure 2, focusing only on the production scenario.

Figure 2: Bias in the Growth of Production



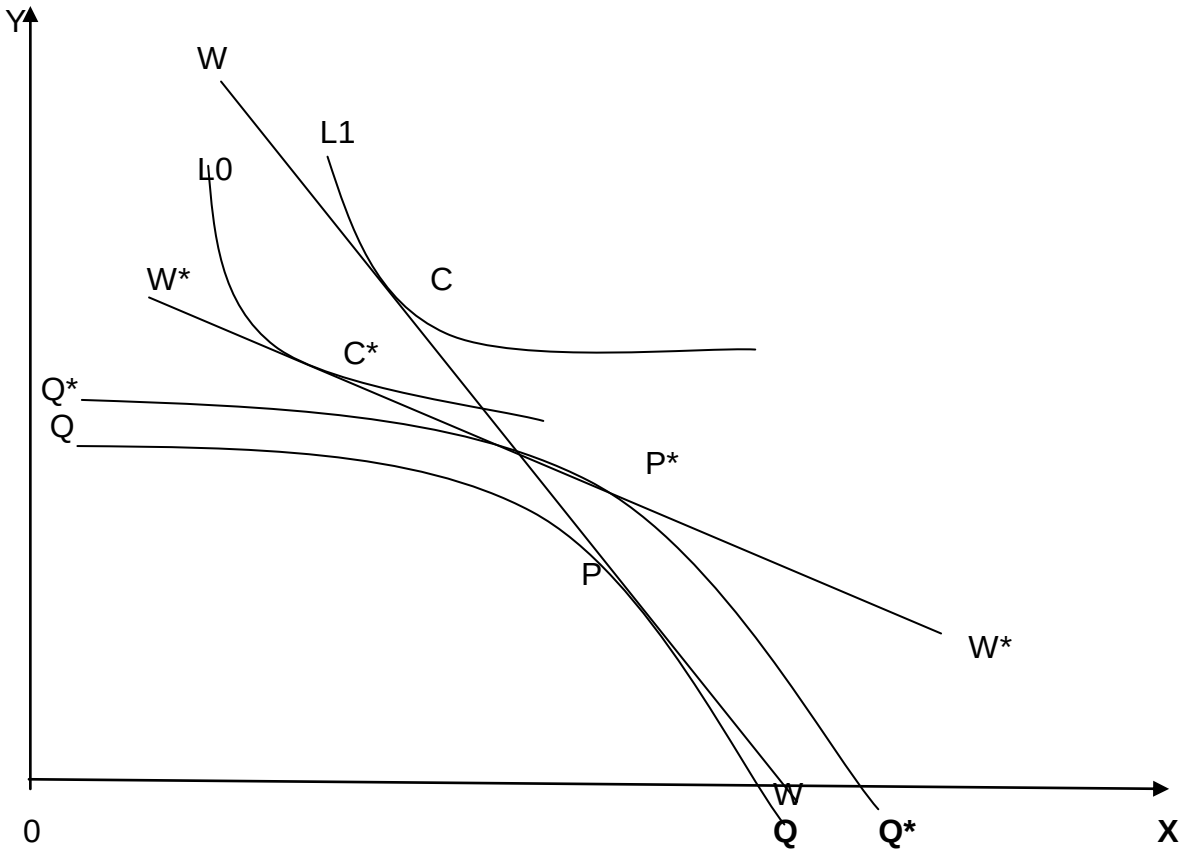
Source: Adopted from Sodersten and Reed (1994)

In the figure, X is assumed to be the exported good and Y as the imported good. The original production point is at P. If the production point after growth (relative prices assumed fixed), lies to the left of the "neutral" line but the right of the vertical line through P then the production of the export good has increased, but by proportionately less than has production of import-competing good. Such an outcome shows anti-trade bias in production growth. If the new production point lies to the left of the vertical line through P then output of the export good has fallen in absolute terms, resulting in ultra-anti-trade bias in the growth of production. Similarly, points to the right of the "neutral" line but above the horizontal line through P show pro-trade bias in production while points below the horizontal line through P show ultra-pro-trade bias since the output of the import-competing good has decreased in absolute terms.

Bagwati (1958) introduced the concept of "immiserising growth" in the international trade literature. It refers to the case when gains from growth are out-weighed by the loss from worsened TOT due to the presence of distortions in the domestic and international economies, thus leading to a reduction in the welfare of a country-a possibility that does not exist under autarky. The trade biases resulting from a change in production presented in figure 2 are

possible under assumptions of constant relative prices, a case that is applicable in a small country. For a large country that has a monopoly/monopsony power in the world market, then the growth of its economy would lead to a change in its volume of trade and hence its TOT. If the trade volume decreases, then the TOT will move in favour of the growing country, increasing its welfare and the converse is true. The paradoxical case of a country's economy growing to the extent that its TOT adversely affects its welfare is what is referred as immiserising growth as shown in Figure 3.

Figure 3: Immiserising growth for a large country



Source: Adopted from Sawada (2003)

As seen in Figure 3, initially the country's production-possibility curve is QQ, and its TOT is given by the slope of line WW. It therefore produces at point P, exports X and imports Y, and consumes at C on indifference curve L1. Growth then shifts its production-possibility curve to Q*Q*. As it is a large country, the increase in its exports will reduce their price in the world market, while the increase in its demand for the import good will lead to an increase in that price. The country's TOT falls to the level shown by the slope of line W*W*. At those TOT, the country produces at P*, and will consume at C* on the indifference curve L0. The country

has suffered a loss in welfare (the movement from L1 to L0) despite the outward shift in its production-possibility curve. Its growth has been immiserising. Notably, the final outcome of growth on TOT largely depends on the supply and demand conditions in the rest of the world, for example an inelastic demand for its exports, and/or an inelastic supply of its imports will exacerbate the deterioration of its TOT. Premising their arguments on the facts as discussed in the foregoing, some economists in the 1960s and 1970s advocated that less developed countries should plan their development so that growth is concentrated in the import-competing sectors[15]. However for this argument to be valid a country must be large enough to affect its TOT (Sodersten and Reed, 1994). Following Bagwati (1958), several other writers have examined the phenomenon of immiserising growth. For instance Johnson (1967) gave another example of immiserising growth, where a small open economy facing an external tariff could become worse off as a result of economic growth. Sawada (2003) observes that there are 77 articles on immiserising growth in ECONLIT[16] published between 1969 and 2003. He points out however that none of the studies has examined the empirical validity of the phenomenon, though quite important[17]. In an attempt to fill this literature gap, Sawada (2009) uses cross-country macroeconomic data to examine the reality of immiserising growth. It is clear from the literature that a deep country-specific analysis of immiserising growth has not been done for Kenya. However, it is important to point out that this kind of analysis is beyond the scope of this study.

2.2.2 Empirical Literature Review

Several empirical analyses find TOT shocks having an effect on the economy, including Mendoza (1997), Deaton and Miller (1996), Hadass and Williamson (2003), Bleaney and Greenway (1991) and Kose and Reizman (2001) among others. The common thread among these studies is that the secular improvement in the TOT leads to higher levels of investment and hence long-run economic growth, while higher instability in the TOT reduces investment and hence reduces growth because of aversion to risk. For instance, Bleaney and Greenway (1991) showed that there is a statistically significant downward trend in the ratio of the prices of primary products to those of manufactures of about 0.5 percent per annum. They estimated

[15] In the case of Kenya, tourism has been seen as the bedrock of economic take-off, courtesy of *Kenya Vision 2030*. Thus a lot of government efforts are geared towards uplifting the sector.
[16] www.library.gc.cuny.edu
[17] Kaplisnky, Morris and Readman (2002) have however done a study using a sectoral approach on the furniture industry and immiserising growth in South Africa.

that a 1 percent fall in the relative price of primary commodities is translated into a 0.3 percent decline in the TOT of non-oil developing countries, which obviously impacts negatively on economic growth. Hadass and Williamson (2003) found that the growth performance of developing nations was reduced by TOT shocks between 1870 and World War I. Corden (1984) opines that worsening TOT leads to a decline in the relative price of exportable to importable goods and thus to a spending effect and a resource-movement effect. Lower export prices, for example as a result of a decline in the world market price for the export good, leads to a decline in national wealth and hence lower demand for both tradables and nontradables. A number of cross-country studies have also supported the view that TOT has a major impact on growth. For instance, Easterly et al. (1993) evaluated long-run growth discrepancies in a large panel of countries and found that TOT shocks play a large role in explaining variance in economic growth across countries. Mendoza (1997) used a sample of 40 developed and developing countries and found that higher TOT volatility had a negative impact on economic growth. The author argued that the channel through which TOT volatility affects growth is in changes in savings. Becker and Mauro (2006) used a multivariate probit model on a dataset that covered developed and developing countries for 1970–2001. They found that for developing countries the largest output costs are associated with TOT shocks. Broda and Tille (2003) tested the theoretical prediction that a flexible exchange rate was superior in coping with TOT shocks. The authors used a sample consisting of seventy-five developing countries to examine their experience with different exchange rate regimes. They found the TOT shock having little impact on growth under a flexible exchange rate system, concluding that the exchange rate's own movements absorbed the effects of the shock. Under a fixed exchange rate, however, the authors argued that this buffer was absent and the adjustment would fall primarily on growth: as a result, deterioration in the TOT leads to a shrinking of output. The authors thus conclude that the effectiveness with which countries cope with TOT shocks depends primarily on the nature of their exchange rate regime.

In a study on Pakistan, Ahmed and O'Donoghue (2009) found that among other shocks, external oil price shocks have the highest potential to impact the economy. They found that when the import price of petroleum was increased, it led to a reduction in imports and exports (the magnitude of the former being greater). In addition the crop sector and the competitiveness of domestic manufacturing were adversely affected while agricultural wage earners, non-agricultural skilled labour and non-agricultural unskilled labour were the main losers. Return to land and profits to farm owners increase showing a change in favour of agricultural asset

owners[18]. Ahmed and O'Donoghue (2009) thus concluded that rising international oil prices have caused a reduction in welfare and economic growth in oil-importing countries. According to the authors, rising international prices of oil pose a threat to the production costs in developing countries, since these countries have poorly developed or no alternative sources of energy. Although a positive TOT shock is generally viewed as beneficial to the economy while a negative shock is seen as deleterious, there are certain instances when a positive TOT shock may cause "Dutch disease"[19], as various authors have shown (see e.g. Corden and Neary, 1982 and Neary and Van Wijnbergen, 1986). The disease is said to begin when the real exchange rate[20] appreciates as a result of the massive increase in revenues from the booming natural resource sector, leading to a reduction in worldwide demand for other exports in the country. Furthermore, assuming a market-determined exchange rate regime, the booming sector leads to a rise in domestic inflation, which becomes greater than the world inflation rate; consequently, profits for exporters decline as wages and other input prices rise more quickly than the world price of exports. This discourages producers of exports, who reduce production and this causes a fall in incomes and employment. Put another way, the currency appreciation and rise in domestic prices reduces the competitiveness of the country's other non-resource tradable goods, which decreases production. In addition, the rise in domestic inflation causes an increase in the cost of inputs, which impacts negatively on the tradable goods sector. This situation as Rudd (1996) asserts, has been experienced in some oil and gas-exporting countries such as Nigeria, Indonesia and Netherlands.

According to Neary and Van Wijnbergen (1986) there are two components of Dutch disease, namely; a spending effect and a resource movement effect. The spending effect is caused by the higher domestic incomes due to the increased revenues arising from the boom in the resource sector. The higher incomes lead to increased expenditures on both traded and non-traded goods and since the price of traded goods is determined in the international market (small country assumption), increased incomes in the country has no effect on the traded goods price. However, prices of non-traded goods are determined in the domestic market and thus

[18] Stolper-Samuelson theorem states that a rise in the relative price of a good will lead to a rise in the return to that factor which is used most intensively in the production of the good (and a fall in the return to the other factors)

[19] The term was devised to describe the adverse impact on Dutch manufacturing of the increase in income associated with the discovery of natural gas in the Netherlands in the 1960s, essentially through the appreciation of the Dutch real exchange rate. It is used with reference to adverse structural changes that economies undergo as a result of sectoral booms associated with factors such as positive external terms of trade shocks and large aid flows.

[20] Defined as the ratio of import price to domestic price

would rise due to the surge in demand brought about by the increase in income and expenditures. Ultimately, forces of demand and supply interact to raise the price of non-tradable goods, which increases the relative profitability in this sector and as a result contract the traded goods sector (excluding the boom sector). The resource movement effect on its part occurs if the booming sector shares domestic factors of production with the other sectors of the economy. If so, the price of the factors is bid up, further squeezing the traded sector. The export boom increases the marginal product of factors in the resource sector, drawing the factors out of other sectors. This leads to a decline in production of traded goods as a result of higher costs of production which ultimately contracts the traded goods sector.

Various authors have found changes in TOT having a significant effect on SSA countries. For instance, Cashin and Pattilo (2000) argue that movement in the TOT of SSA countries is a major determinant of the macroeconomic performance and has an important impact on real incomes. Also, according to some World Bank estimates, between 1970 and 1997, declining TOT cost non-oil exporting countries in Africa the equivalent of 119 percent of their combined annual gross GDP in lost revenues. Using data from 1985 to 2010, Mohammed (2012) found that the net barter TOT and income TOT growth has positive and significant effect on economic growth in SSA countries. Bleanway and Greenaway (2001) estimate the impact on investment and growth of the level and volatility of the TOT for a panel of 14 SSA countries and find that TOT instability negatively impacts growth while investment is negatively affected by real exchange rate instability resulting from the TOT movements. Kalumbu (2014) uses Namibian data, running between 1980 and 2012 and finds a negative relationship between TOT and economic growth. Soderling (2005) found Gabon being vulnerable to changes in world oil prices. This according to the author is because a fall in oil revenue negatively affects public investment, which ultimately crowds out private investment in the country.

Focusing on Kenya, Levin (2010) is one of the few studies in this area that examined the effects of domestic and external prices of maize on poverty in Kenya by conducting simulations based on different shock and policy scenarios, using both general equilibrium and net benefit ratio (NBR) approaches. In the general equilibrium approach, the author found that if external TOT improved for Kenya, welfare would be improved, albeit in different magnitudes in terms of rural and urban populations. The study also found that if the world price of fertilizer increased, it could have a significant impact on the economy, particularly in the agricultural sector. A 100 per cent increase in fertilizer prices according to the author

would result in GDP falling by 2.8 percentage points, compared with the baseline growth. In addition, there would be increased incidence of poverty in the country, whereby urban poverty would rise by about 1.0 percentage point compared with the baseline, while rural poverty would increase by 4.3 percentage points. The author concludes that an improved export price of maize has positive welfare effects where poverty would be reduced and income distribution improved among Kenyan households. We extend Levin's (2010) study by not only studying maize, but also other cereals including wheat and rice whereby they are lumped together as one item (food) in the model to determine the impact changes in its price would have on economic growth and welfare in Kenya. Mwau (1994) found that the worsening of TOT reduced demand for exports and therefore had a major influence on the current account in Kenya since the early 1970s. Gerrard and Lucas (2003) in a study of Kenya's growth experience (1965-1997) found the tremendous decline in TOT to have affected the country's economic growth in a big way. The authors found that one of the largest (and negative) influences of Kenya's economic growth was the decline in the TOT from 100 in 1965 to an average of 79.5 over the period 1966-1997. However, in a survey of literature the study by Mwega and Ndungu (2008) found TOT shocks to have a small impact on economic growth in Kenya. Karingi and Siriwardana (2003) analysed the effects of adjustment to terms of trade shocks on agriculture and income distribution in Kenya. The authors had a joint TOT simulation where the negative TOT shock arising from the oil-price increases was captured through a 12 per cent increase in world manufacturing import prices and the positive TOT shock captured through a 25 per cent increase in world agricultural export prices (the export boom). The results of this study showed that the boom in the agricultural sector offset the contraction that would have been expected to occur due to prevailing high world manufactured import prices.

In a study to test the phenomenon of immiserising growth resulting from a worsening of the TOT, Sawada (2009) finds twenty six episodes of immiserising growth in the post-war world economy, mostly in Africa and Latin America. It is noteworthy that the study finds Kenya, which is included in the sample of African countries as not suffering from immiserising growth[21]. Karingi and Siriwardana (2003) also used a CGE approach to look at the effects of two important terms of trade shocks facing Kenya in the mid-1970s; namely the oil shocks in 1973 and 1980, which resulted in TOT falling by 24 percent and 28 percent respectively, the coffee boom (in 1976) which resulted in a positive TOT shock. The authors analysed the

[21] The author however points out the need for country-specific case studies to test the validity of the study's conclusions.

effects of adjustment to TOT shocks on agriculture and income distribution in Kenya and concluded that the Kenyan economy is very vulnerable to external shocks, which invariably created internal and external imbalances, triggering a balance of payments crisis that dampened the country's economic growth prospects. Levin (1998) used an extension of the Salter-Swan CGE model to assess the impact on poverty of some adjustment policies pursued by the government in the 1980s. One of the simulations that Levin (1998) conducted was a tariff reduction combined with adverse terms of trade through a 20 percent reduction in coffee prices. The author finds the adverse TOT leading to a further depreciation of the real exchange rate, in comparison with the case when the simulation involves only tariff reform. Also, according to the author the adverse TOT shocks leads to a decline in overall income, wiping out or delaying the benefits of tariff reforms.

2.3 The Impact of Capital Inflows on Economic growth, Poverty and Welfare

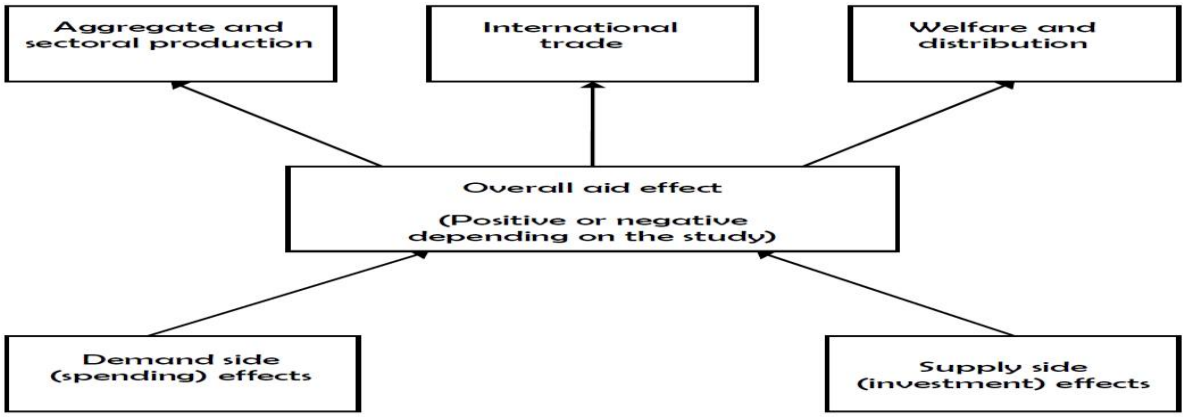
In Chapter 1, we had a cursory look at the three forms of capital inflows into Kenya; namely ODA, FDI and remittances from Kenyans in the Diaspora. In this section, we review in more details the theoretical and empirical literature on each of the three capital inflows, beginning with ODA, followed by the other two.

2.3.1 Theoretical literature Review

(a) Effects of Foreign Aid on the Economic Growth, Poverty and Welfare

Foreign aid effectiveness is a topic of incesant debate among scholars and policy makers, and each side to the debate has marshalled strong arguments in favor of their respective position. But how is aid effectiveness determined? Most studies on aid measure its effectiveness in terms of economic growth (for instance Roodman, 2007; Doucouliagos; and Paldam, 2008). However as shown in Figure 4, aid effectiveness can be decomposed into different components, with distinction made between demand and supply side effects.

Figure 4: Decomposition of aid effects



Source: Adopted from Clausen and Schürenberg (u.d)

According to Clausen and Schürenberg (u.d), demand side effects are mainly direct effects from the spending of aid in the recipient country. Governments tend to use aid mainly for the purchase of non-tradable goods. The first and most direct effect from aid will be increased demand for non-tradables. This increase in domestic demand leads under normal circumstances to rising domestic prices of non-tradables relative to tradables, i.e. to an appreciation of the real exchange rate. The receiving government can use aid either for recurrent or for capital expenditure, the share of imported goods increases with the importance of capital investment in the aid-financed expenditure. Alternatively, the government could transfer the aid to the private sector where it allows for higher consumption or higher investment. The resulting increase in imports again depends on the type of spending. The supply side effects mostly arise from productive investment and increased capital accumulation. The government may use the additional funds for public capital accumulation, or may as well invest it in health and education programs which increase labour productivity. Aid may also be used for infrastructure investment which increases total factor productivity and could also be transferred to private investors and hence add directly to private capital accumulation. In general the spending of additional aid incurs sectoral shifts in production. The direction of these reallocations depends on differences in factor intensity, the share of imported intermediates and productivity effects from aid. Distributional effects from aid result from changes in relative goods and factor prices. Undesirable distributional effects might occur as increased demand and prices might lead to a rise in the return to high-skilled labour which is mainly an income source of wealthy households. The rise in domestic prices on the other hand could be to the detriment of the poor.

Various studies have historically attempted to model the relationships between aid and economic growth (see Sindzingre, 2012 for a survey of the literature). Harrod (1939) and Domar (1946) are two such authors who developed the so-called Harrod-Domar model that put a case for foreign aid in the process of development. This model is based on the assumption that developing countries are characterised by capital shortage, hence require aid to foster growth by enabling the country to finance more rapid accumulation of capital, supplementing private savings. Effectiveness of aid depends, according to the Harrod-Domar model on the productivity of capital (the Incremental Capital Output Ratio) whereas a sustainable growth path may generate a financing gap filled through aid or other forms of financing. The model assumes a stable linear relationship between investment and growth over the short to medium run.

The 'two-gap' model developed by Chenery and Strout (1966) extends the Harrod-Domar model, addressing some of its inherent weaknesses, such as the capital-output ratio (Sindzingre, 2012). The 'two-gap' model assumes that developing countries are characterised by a savings gap and a trade gap, arguing that foreign aid may help filling these gaps. The model is derived from the national accounts identity: I-S= M-X, where I is for investment, S for savings, M for imports and X for exports. While these two gaps are equal ex post, they may differ ex ante, as the expected savings gap (I-S) deviates from the expected foreign exchange gap (M-X). In case private financing is absent, foreign aid fills the gap to achieve a target growth rate, via investment through growth. Foreign aid thus supplements domestic savings or export earnings depending on whether investment or imports are the binding constraints to economic growth, respectively (Mwega, 2004). The Harrod-Domar model and the two-gap model have been marginalized by the neoclassical growth model[22] and endogenous growth theory (Sindzingre, 2012). The neoclassical growth model argues that physical capital investment is a less important factor of growth than education and research. Endogenous growth models were developed in the 1980s and attempted to address the weaknesses of the Harrod-Domar model, specifically in the case where the model had failed to explain the persistence of international differences in per capita incomes and growth rates. Endogenous growth models thus explain growth by increasing returns to scale, human capital accumulation and positive externalities (learning by doing), and path-dependent equilibriums; aid influences growth when it contributes to enhance human capital (education, health) and institutions as the

[22] An example is the Solow-Swan model associated with Robert Solow and Trevor Swan who independently developed it in 1956

latter influence total factor productivity (Sindzingre, 2012). Sachs (2005) strongly puts a case for aid, arguing that a "big push" paragdim on aid can be a panacea for investment and hence economic growth and development in developing countries. Like other proponents of aid, Sachs (2005) argues that developing countries require foreign aid to provide essential public goods, since to quote him, "the economic rate of return of these goods is so uncertain that private investors would be unwilling to provide them on a large scale". ODA thus supplements government budget in financing investment in public goods. On the flipside however, some literature argues that foreign aid does not contribute significantly to economic progress in developing countries [see e.g Griffin and Enos (1970), Bauer (1971), Boone (1996), White (1998), Easterly (2001)]. At certain levels and in certain circumstances, foreign aid can bring about structural changes that may be undesirable. In that context, large aid flows, like other resource booms, have been associated with upward pressures on inflation and real exchange rate (RER) appreciation in recipient countries. An appreciation of the RER and the likely decline in exports that large aid flows can induce have been compared with symptoms of the Dutch disease, which leads to RER appreciation and shrinkage of the tradables sector. A boom resulting from large aid flows may lead to the public sector as a recipient of aid crowding out the private sector through its increased spending due to aid (Fielding and Gibson, 2002).

(b) Effects of Foreign Direct Investment on Economic Growth and Welfare

FDI is crucial in the process of economic development in recipient countries since, unlike other capital flows, it usually entails a long-term commitment to the host country. It is a widely held brief that FDI contributes considerably to gross fixed capital formation in the host country. As was noted earlier in this thesis, FDI has several advantages over other types of flows, in particular its greater stability and the fact that it would not create obligations for the host country. Thus in theory, FDI has both direct and indirect effects. Directly, FDI could have an impact on employment and income generation by supplementing the accumulation of the stock of physical capital in the recipient country[23]. Indirectly FDI affects the economy through spillovers. There is an extensive literature on the theories that attempt to explain the various aspects of FDI. Kinyanjui (2013) categorizes these theories into five groups, as follows; (i) old growth and old trade models, (ii) business school models, (iii) old growth and "new" trade

[23] According to Adam et al. (2007), direct effects of FDI, unlike the indirect (spillovers) last only if the foreign companies stay in the host economy.

theories, (iv) new growth and new trade theories and finally ((v) uneven development theories.In the subsequent section, we follow this categorization by Kinyanjui (2013) to present an overview of the theories[24].

Old growth and old trade models

Brems (1970) is one of the earliest growth-trade models focusing on FDI (Kinyanjui, 2013). Brems' model is a two-country, four-sector FDI framework, which presupposes that in each country there was both a domestic and foreign-owned sector**.** The model defines FDI as a movement of a bundle of money capital and technology as well as managerial knowledge from a parent firm to its foreign subsidiary. Moreover the model relaxes the assumption of factor price equalization of the Heckscher-Olin model and assumes that entrepreneurs in each of the countries produce a unique good, using the Solow (1956) type neoclassical production function with exogenous technology. This good is produced in the foreign country using labour employed in the home country and the capital stock of that good. Investment by the home country then entails entrepreneurs of the home country setting aside part of their output for installation there, hence occurrence of FDI. According to Brems, entrepreneurs allocate their investment between the parent firm and foreign subsidiary in such a way as to maximize the present worth of all their future profits. The author argued that technology progress made at home would be applied in the foreign subsidiaries and this would add to physical capital formation and hence economic growth. Another theory in this category of old growth and old trade theory is by Findlay (1978) who, according to Kinyanjui (2013) employed the ideas of Veblen (1915) and Gerschenkron (1962) in developing his model.This is a simple dynamic model that consists of two regions, a relatively backward and an advanced region. It assumes that the greater the backlog of available opportunities to exploit, measured by the distance between the advanced and the backward region's current levels of development, the greater the pressure for change within the backward region and the faster its rate of growth.

Furthermore, Findlay's model assumes presence of a production function where foreign and domestic capital are distinct factors of production, each with its own separate rates of return. Also, technological change in the backward region is expressed as a function of the degree to

[24]We have already reviewed some of these trade and growth theories in an earlier section, however in this section attempt is made to show the relevance of the theories to the subject of FDI. This is presented in a summarized form and the reader is referred to Kinyanjui (2013) for an extensive review of the literature.

which it is exposed to foreign capital. Findlay also assumes that the economy in the relatively backward country is characterized by 'surplus labour', in line with Lewis (1954). The author further assumes that the foreign sector within this economy has superior technology than the domestic sector and that the foreign sector pays a higher wage than the domestic sector. On this basis, technological progress benefits this economy by increasing efficiency in production in both sectors at the early stages of development. This leads to domestic capital accumulation, which is partly financed by a tax on foreign profits (Kinyanjui, 2013). As the country progresses, capital accumulation in the domestic sector becomes sufficiently high and this in turn raises the domestic rate of technological progress. This continued increase in relative domestic efficiency is, however not favorable for foreign presence in the economy and hence diminishes as the economy approaches the steady state. Thus, according to Findlay, the necessity for self-reliance influences rapid technological borrowing and the presence of FDI retards rather than accelerates the process.

Findlay (1978) draws analogy from the spread of a contagious disease, in line with the theory by Gerschenkron (1962). Considering diffusion of technology, Findlay states that "the more backward an economy was at the outset of development, the more certain conditions were likely to occur during growth". This he calls "backwardness" and argues that consumption would be squeezed in favour of investment in countries starting from farther behind, and there was likely to be a greater reliance on banks, state entities, and other means of directing investment, among other conditions. Findlay thus argues that not only could a backward country's firm learn the advanced multinational corporations (MNCs) technology by imitation but also can be forced to "try harder", where relative backwardness can translate into more externalities. Findlay (1978) therefore states that "the larger the share of MNCs in the backward country, the faster the increase in the efficiency of backward firms in that country". In other words, the change of backward country's efficiency becomes an increasing function of foreign presence, and decreasing function of relative technical efficiency of backward country to foreign country (inverse technology gap). Burgastaller & Saaverdra-Rivano (1984) extend Findlay's model by introducing a link between the North and the South, where they assume perfect mobility of capital, continuous equality of profits and flow of goods across regions. The authors observe that full participation in the world economy through free trade and capital mobility may entail severe costs for a Southern labour surplus region, at least from a long-term growth perspective. As capital moves from the North to the primary sector in the South, where the capital-labour ratio is dependent on the size of the subsistence wage, the per-worker output

will not change in the long run. However, part of that output will now be produced by and paid out to foreign capital, resulting in a decline in the per-worker income in the South, while the reverse is true for the North. Thus capital mobility leads to long-term deterioration of the income gap between the South and the North. Similarly, technology progress in primary goods production in the South results in a decline in the Southern per-worker income, as well as in a deterioration in the South's total income position relative to the North. As part of the South's capital stock is owned by the North, repatriation of earnings negatively affects the South.

Business School Models

Business School models, also known as the Industrial Organization theories of FDI endeavor to answer the questions of why, where, how, and when with respect to MNCs activities. The Eclectic Paradigm Theory was developed by John Dunning (see e.g. Dunning, 1977) and according to Kinyanjui (2013) is the most dominant of the Business School models. The theory is a mix of three different theories (also called paradigms) of FDI, which Dunning regards as O-L-I, where O stands for ownership-specific advantages, L for location-specific advantages and I for internalization advantages. According to Dunning, the precise design of the OLI parameters facing a particular firm and the response of the firm to that design reflects: (i) the economic and political features of the country or region of the MNC and of the host country or region; (ii) the industry and the nature of the business activity in which the MNCs are engaged; (iii) the characteristics of the individual investing MNC, including its objectives and related strategies; and finally (iv) the reason for the FDI which may be market-seeking, resource-seeking, rationalized or efficiency-seeking, and strategic-seeking. Paraphrasing Dunning, none of the eclectic (OLI) paradigm theories may individually offer a comprehensive explanation of the MNCs' business activity, however when taken together as a group they do. Next we briefly examine each of the three paradigm theories. Ownership theories (e.g. Hymer, 1960; 1976 and Kindleberger, 1969) hold the view that the greater the competitive advantages of the investing firms relative to those in host countries, the more they are likely to engage in foreign production. These theories criticize the neoclassical theory of perfect competition (a notion held by the Hecksher-Ohlin type of trade models); arguing that what was needed to explain FDI was a flourishing of structural market imperfections. Thus, product differentiation arising from imperfect goods markets; managerial know-how; new technologies and exclusive rights in imperfect factor markets; existence of internal or external economies of scale, and government regulation are some of the examples of the factors contributing to ownership

advantages and compensate for the myriad bottlenecks of investing abroad (Kinyanjui, 2013). In a pioneering study focusing on the Locational advantage, Vernon (1966) extended the Technology Gap Model by Posner (1961) to develop his own Product Cycle Model, which he used to explain certain types of American FDI in Western Europe after World War II. According to Vernon (1966), the decision to invest was a choice between exporting and investing, as goods moved through a life-cycle that was divided into three stages; new, mature, and standardized products. This then gives a cost-based rationale for the switch from exporting to foreign-based production. Some of the other scholars that support Locational theories are discussed extensively in Kinyanjui (2013) and include Krugman (1991), Venables (1998), Storper (1995), Scott (1996), Knickerbocker (1973), Rugman (1979), Frost and Stein (1991), Enright (1991) and Porter (1994). The common thread running through these studies is that the more immobile, natural, and created endowments favor investment in a foreign location, the more the firms will choose to augment or exploit their O-specific advantages by engaging in FDI. The Internalization theory explains the growth of MNCs and their motivations for investing abroad. The theory was first formalized by Buckley and Casson (1976) and then modified by Hennart (1982) and Casson (1983). In support of the theory, Hymer (1976) demonstrated that MNCs organize their activities in such a way as to exploit some specific advantages. According to the author, FDI takes place only if the firm-specific advantages of investing abroad outweigh the relative costs of the operations. Therefore, paraphrasing Denisia (2010), FDI is a firm-level strategy decision rather than a capital-market financial decision.

Old Growth and "New" Trade Theories

According to Kinyanjui (2013), these models are called "old growth" because they don't explicitly subscribe to endogenous growth theory. Additionally, they are regarded as "new trade theories" because they factor in aspects of increasing returns to scale, product innovations and the product cycle. Krugman (1979) was the first scholar to formally design such a model which was later extended by Dollar (1986)[25]. Krugman's model is built around two important assumptions: first, consumers' preferences revolve around a diverse choice of brands, characterized by a CES utility function and secondly, production favours economies of scale. Krugman (1979) also takes into account transportation costs, which is a key aspect of the "home market effect", which states that, ceteris paribus, the country with the larger demand for

[25]For an elaborate analysis of this model see Kinyanjui (2013)

a good shall, at equilibrium, produce a more than proportionate share of that good and be a net exporter of it. Paraphrasing Krugman (1979), "when there are economies of scale in production, it is possible that countries may become locked into disadvantageous patterns of trade. Trade remains beneficial in general, even between similar countries, because it permits firms to save on costs by producing at a larger, more efficient scale, and because it increases the range of brands available and sharpens the competition between firms". Krugman (1979) and later Dollar (1986) consider imitation as the only channel of international technology transfer from an "innovating North to an imitating South". In addition, the rate at which an individual firm discovers and successfully markets new products is treated as exogenously given. This is tantamount to implying that from an individual firm's perspective; successful product innovation is either effortless or guaranteed by large expenditure on new product development (Kinyanjui, 2013).

New Growth and New Trade Theories

New growth theories emerged in the mid-1980s when some economists began to question the neoclassical growth theory in the Solow-tradition that argued that the exogenous growth variable or the unexplained technical progress was the key determinant of economic growth[26]. These economists argued that economic development is principally due to endogenous rather than exogenous factors. Endogenous growth theory does away with two key assumptions of the Solow model, that (i) technological change is exogenous, and (ii) the same technology is available in all countries. The endogenous growth theory basically holds that investment in human capital , innovation, positive externalities and spillovers effects of a knowledge-based economy are what matters for economic growth. Furthermore, the theory holds that the long run growth rate of an economy depends on policy measures, and increased public expenditure on research and development or education increases economic growth by increasing the incentive for innovation.The new growth theory also drops the neoclassical assumption of decreasing returns to physical capital and replaces this with the assumption of constant returns to a broader measure of capital, including human capital and infrastructure. New growth models treat technology and knowledge as economic goods and argue that long-term growth is largely determined by learning-by-doing or human capital development and new technologies. The simplest form of the endogenous model is the AK Model. The central tenet of this model is the assumption that the saving rate is constant and exogenous, and that there is no

[26]Romer (1986) is the pioneer of the endogenous growth theory. Authors who have built on Romer's model include inter alia Lucas (1988), Rebelo (1991), Perreto (1999) and Glass and Saggi (1998).

diminishing returns to scale in production. Thus, based on the latter assumption, technological progress is modelled as a single parameter (denoted by letter A) and is premised on the fact that positive externalities accrue from investment in capital and technological progress leading to further improvements (i.e. learning-by-doing). It should be noted however that there are other authors within the endogenous growth theory (see e.g. Aghion and Howitt, 1992; and Grossman and Helpman, 1991) who hold the view that economic agents efficiently determined their consumption and saving, optimizing the resources allocated to R&D and thus leading to technological advancement. A number of writers have attempted to apply the new growth theory to explain MNCs activity. For instance, Glass and Saggi (1998) in their model dubbed, "quality ladders product cycle model" investigate how the type of technology transfer through FDI is linked to innovation and imitation when the absorptive capacity of LDCs is limited. According to the authors, successful imitation reduces the technology gap. A subsidy to imitation or a tax on low quality FDI production encourages imitation relative to innovation, thus releasing the constraint faced by MNCs to invest in the LDCs. These forces stimulate high-quality FDI and raise LDCs' welfare through lower prices and increased innovations and wages. Paraphrasing Kinyanjui (2013), the quality of ladder growth model is easily extended to a trade framework with two equivalent countries under certain assumptions, and the results are identical to those of "increasing varieties models".

Another new growth and new trade theory model is that developed by Grossman and Helpman (1991). The authors build on the product cycle model for an open economy, which hold that "new innovative goods are developed and produced in the North and exported to other countries, North or South". The model assumes that the South will eventually develop the ability to imitate many of these activities, and production shifts to this region. However, trade between nations engaged in producing innovative goods in the North and the imitating South does not exhaust all the possible trading patterns. The model by Chui et al. (2001), yet another framework in the category of new growth and new trade theory, allows for a copying phase in the different stages of economic development in the South. The authors introduce skilled labour as a factor of production in a high technology sector, producing a variety of differentiated goods. They also factor in a traditional sector with low technology levels in both regions. According to Chui et al.(2001), if the output produced by the high technology sector is regarded as one good, the model takes the form of a two-factor, two-goods, Hecksher-Ohlin framework, which can be used to model free trade (Kinyanjui, 2013). In this scheme, the South is allowed to differ from the North in three ways. First, it is less efficient at adopting the new

technology available on a worldwide level. Second, the speed with which the South learns from the North is less than in the opposite direction. Third, the endowment of skilled labour is less in the South than in the North. Various authors have attempted to empirically test the validity of these models, the work of which we review in the section on empirical literature of this thesis.

Uneven Development Theories

The Uneven Development Theories emerged in the early twentieth century and are rooted in Karl Marx's ideas. Also known as Theories of Unequal Exchange (or imperialism) the theories were first presented by Hobson (1902) and Lenin (1916) and focused on explaining the spectacular growth of the Western colonial empires in the late nineteenth century (Kinyanjui, 2013). The theories attributed the rapid colonial expansion not only to political factors, but also to export of capital by the colonial powers. Lenin was of the idea that the more developed a country is, the lower the rate of profit and the greater the 'overproduction' of capital, and, consequently, the lower the demand for capital and the stronger the expulsion process. Hobson (1902) on his part believed that excessive savings and inadequate consumption in the core countries was the taproot of imperialism problems that resulted from labour constraints in developed countries. The economic recessions that were the order of the day in the late nineteenth century particularly pushed capitalists in the developed countries to be more and more tempted to annex and protect some distant undeveloped country. According to Oneal & Oneal (1988), the periphery (South) lacked adequate capital, while labour was abundant and unorganized; hence markets could be shaped by economic and political power. Moreover, many expenses for social overheads, administration, and the maintenance of order were borne by the colonized people or the imperial nation as a whole, not just the bourgeoisie. For this reason, it was believed that 'super profits' through access to natural resources and the control of trade in the periphery were the principle attraction of the colonial power to the periphery. Kinyanjui (2013) while alluding to dos Santos (1970) avers that the dissolution of the formal empires led to the perception of MNCs as the primary tool in explaining neo-colonialism. Today these MNCs dominate the primary and extractive industries in the South, resulting in a form of incorporation into the international system that tends to inhibit industrialization and relegate these countries to less dynamic forms of growth. All in all, it is noteworthy that scholars such as Findlay (1980); Krugman (1979); Prebisch (1950) and Singer (1950) were all inspired by the work of Hobson (1902) and Lenin (1916).

Effects of FDI spillovers on economic growth, Poverty and welfare

In the previous section we have reviewed in general terms the theoretical literature that focuses on the determinants of FDI and MNCs activity in an economy. In this section we delineate and summarize the various theories that specifically examine the indirect effects of FDI on economic growth and welfare. This is important since the question of FDI spillovers is a major area of focus in Chapter 5 of this thesis, where we are interested in investigating the effects of FDI spillovers on Kenya's economic growth and welfare. FDI spillovers can be defined as the positive (or negative) external effects of the technology transfer and diffusion from foreign to domestic firms, which can lead to a greater (or less) productivity efficiency and competition (Massingue da Costa, 2012). Table 10 analyses the channels and determinants of FDI Spillovers effects in an economy.

Table 10: Spillovers Effects-Channels and Determinants

Spillovers channels: drivers	Source of productivity gain
Imitation	• Adoption of new technology • Adoption of new production methods • Adoption of new management practices
Completion	• Reduction in efficiency
Human capital	• Increase productivity of new complementary labour • Tacit knowledge
Market access or exports	• Scale economies • Exposure to technology frontier
Allocative efficiency	• Removing of barrier and monopolistic distortion
Linkages (forward and backward)	• Knowledge for local suppliers and distributors • Development of local industry
Determinants of spillovers	
Supply	• Value of underlying technology • Intellectual property protection • Cost of absorption • Organizational and managerial skills • Commercial benefits
Demand	• Absorption • Skills capacity • Trade regime • Protectionism

Source: Adopted from Massingue da Costa (2012)

To paraphrase Jacob and Sasso (2015), industrialization has been recognized as an important engine of economic growth since the first industrial revolution and the role of technology in this respect remains undisputed. In view of this, various studies have looked into opportunities for developing countries to catch up technologically through acquisition of technologies via MNCs from industrialized countries. As already noted in an earlier section, early ideas on technological spillovers could be traced back to Gerschenkron (1962) who developed a theory of relative backwardness and technological contagion, and which Findlay (1978) employs. While building on Findlay (1978), Das (1987) argues that costless transfer of technology from MNCs to local firms would show FDI to be welfare-improving in a host country and suggests that the benefits accrue as a result of spillovers emanating from the MNCs subsidiary, which possesses and employs better technology, thereby increasing efficiency of native firms.More recent theories that focus on spillovers and which we have already reviewed include the new trade theory associated with Krugman (1979) and Dollar (1986) as well as the endogenous growth model associated with Romer (1986), Lucas (1988) and Rebelo (1991). The endogenous theory holds that FDI benefits the economy through externalities. Baldwin et al. (2005) uses an endogenous growth approach to show two types of spillovers from MNCs; interaction and observation. While interaction spillovers is through 'osmosis', observation spillovers happens when local firms observe knowledge from home based MNCs and thereby increase the varieties in the domestic economy. Wang and Blomstrom (1992) show a positive relationship between the rate and modernity of technology transfer through MNCs and the learning investment of native firms. According to the authors, unless domestic firms are devoting enough resources and efforts to learn MNCs' technology, the latter will be transferring to their subsidiaries outdated technologies at a slower rate.

Fosfuri et al. (2001) theorise that MNCs transfer technology only after training domestic workers and spillovers take place when the workers are later hired by domestic firms. According to Fosfuri et al. (2001), when MNCs increase the wages of their workers, the outcome is welfare gains in the domestic economy through higher earnings. Borensztein et al. (1998) argue that increased variety of capital is costly, which requires the adaptation of technology developed in advanced countries. Paraphrasing the authors, "fixed set up cost of producing new capital goods is a decreasing function of the ratio of the number of foreign firms in the host country to the total number of firms". Therefore, additional FDI minimizes the costs of production of new capital. Klein et al. (2001) argue that FDI, through efficient transfer and adoption of "best practices" is a key factor determining economic growth in LDCs.

Authors such as Blake and Pain (1994), Barry and Bradley (1997) and Krautheim (2008) argue that FDI can bestow export spillovers to the host country. According to the authors, FDI can directly boost trade of the host economy through their own exporting activity. Export spillovers may be transmitted via two channels: one, spillovers may occur through learning from exporting activities of foreign subsidiaries in the host country through information externalities. As part of the MNC, subsidiaries are able to easily access foreign market know-how. Two, export spillovers can be transmitted via what the authors' term the "competition effect". Gorg and Greenway (2004) observe that "unless an incoming firm is offered monopoly status, it will be in competition with indigenous firms. If indigenous firms are unable to imitate the MNC's technology and production processes, the entry of the foreign firm puts pressure on them to use existing technology more efficiently, yielding productivity gains". Additionally, competition may increase the speed at which local firms adopt new technology, thereby increasing efficiency, hence exporting. This notwithstanding, foreign firms can yield negative spillovers in case the domestic firms are unable to learn to compete with them. Another channel for export spillovers is the demonstration effects whereby imitation by firms of technical knowledge that MNCs possess may benefit them (Greenway et al., 2004; Fosifuri et al., 2001). These studies in a nutshell represent numerous other studies theorising that FDI is crucial in improving efficiency of the domestic economy and which ultimately leads to increasing the host country's total factor productivity.

Effects of Remittances on Economic Growth, Poverty and Welfare

The International Organization for Migration (IOM) defines remittances as "those funds that are transferred by migrants to their home country and are the private savings of workers and families that are spent in the home country". Remittances supplement ODA and FDI as sources of capital flows and act as a compensating mechanism for the LDCs' loss of human capital due labour migration to DCs. In most cases remittances are utilized for consumption, investment in areas such as real estate, education among other investments and hence produce a positive impact on the economy by stimulating demand for other goods and services. Remittances may thus have developmental impacts on recipient countries. These impacts, which may be financial, social, cultural, political and/or economic, can be examined at both the micro level (e.g. in the case of households) and macro level (e.g. the impact on GDP growth, poverty and development). As remittances are usually received directly by poor households, they are likely to reduce poverty (Kiiru, 2010). According to Stark (1991) there is no universal model of remittances. The OECD (see www.oecd.org/els/mig) explains that studies analysing

remittances "provide useful descriptive evidence and results from empirical research, but they only explain it partly, and are characterised by certain geographical, socio-cultural and temporal limitations". There are several factors influencing the level of remittances flows. For instance, both the remitters' willingness and ability to remit their savings back home matter a lot. Willingness to remit is influenced by the duration of time the migrant plans to stay in the host country, their family situation and network effects. Literature distinguishes different models examining the motivation behind remittances; namely, Pure Altruism; Pure Self-Interest; Informal Agreements with Family Members; and Portfolio Management Decisions. Paraphrasing Poirine (1997), the Portfolio Model "sees remittances as a self-interest controlled capital transfer to diversify the migrant's savings". The portfolio motive arises from the investment opportunities and saving differentiation while the Altruistic Model sees remittances as a "transaction that benefits the receivers who were left behind by the migrant without any demand on the receiver from the remitter". With regard to the Informal Agreements with Family Members Model, the remitters support family members back at home, who are in turn expected to support other family members especially the young and those in school. When the young beneficiaries grow up and when school goers complete their schooling and are employed, they are expected to pay the 'debt' by supporting other deserving cases. These 'loans' are based on informal agreements, and according to Poirine (1997), "society values and perceptions about those who do not honour their debts act to reinforce debtors to honour their debts".

It is worth noting that the various hypotheses that attempt to explain the ability and motivation of migrants to send money home are not mutually exclusive. In the words of El-Sakka and McNabb (1999), "It may be the case that remittances can be driven by all of the aforementioned motives at the same time, each one explaining a part of the remittance amount or period of remitting practice. One of the elements can predominate over the others for a period or for a sample of migrant workers, and their roles can be later interchanged". This thus explains the challenges of developing a universal model of the remittance phenomenon. The Altruistic Model on its part assumes that "recipients receive remittances as an altruistic gesture", to quote OECD. The migrant derives satisfaction by enhancing the welfare of their relatives who receive the remittances. The altruistic approach itself is built around a number of hypotheses. To paraphrase OECD, the first hypothesis is that "the amount of remittances should increase with the migrant's income, while the second is that the amount of remittances should decrease with the domestic income of the family". The third and final hypothesis states

that “remittances should decrease over time as the attachment to the family gradually weakens. The same should happen when the migrant settles permanently in the host country and family members follow”. Under the altruistic model, the recipient is assumed to “maximize utility by selecting an optimal mix of their labour-leisure choice. Since remittances will accrue regardless of the recipients’ labour efforts, they may choose more leisure and less work in order to maximize their utility”. The model assumes the “presence of asymmetric information; the remitter cannot observe the receivers’ work effort. As such the remitter continues to supply more and more income regardless of whether the recipients have put more efforts to work or not and hence there may be decreased productivity”.

2.3.2 Empirical Literature

(a) Effects of Foreign Aid on Economic growth, Poverty and Welfare

Empirical literature focusing on the role of foreign aid on economic development is relatively scarce. Some of the studies in this literature which have concentrated on the role of foreign aid in LDCs include Fosu (1996); Lancaster (1991); Danso (1990) and Greene (1989). Majority of the studies have not directly measured the impact of aid on growth; rather they have focused on saving and investment. This notwithstanding, the studies have concluded that foreign aid is generally deleterious to economic development. In a study on Sri Lanka, Bandara (1995) showed that the effects of aid depended on the flexibility of production in the receiving economy. The author considered different levels of sector-specific factor mobility across sectors that explain different output and price responses across sectors. In assessing the impact of aid on macroeconomic management in Ghana, Younger (1992) found that the large increase in aid to the country from an annual average of 3 percent of GDP during 1981–83 to 6 percent of GDP during 1984–87 gave rise to macroeconomic management problems that were associated with high inflation, an appreciating RER, and tight credit to the nonbank private sector. Adam and Bevan (2006) conducted a study on Uganda and found evidence of Dutch disease in certain circumstances. To paraphrase the authors, “beyond the short run, where conventional demand-side Dutch disease effects are present, the relationship between enhanced aid flows, RER, output growth and welfare is less straightforward than simple models of aid suggest”. The authors show that investment in public infrastructure “generates a productivity bias that impacts different sectors of the economy differently and affects welfare as well”.

Burnside and Dollar (2000) argue that good institutions matter if aid is to support economic growth. Easterly (2003), Easterly et al. (2004) and Rajan and Subramanian (2005) however dispute this, they find no evidence of the impact of aid on economic growth even in countries where the quality of institutions is high. Brautigam and Knack (2004) and Knack (2004) hold the view that aid can in fact, negatively affect the quality of democratic institutions in receiving countries. María et al. (2006) reinforces this observation, they find aid not having a statistically significant effect on income distribution and poverty, even after factoring in the quality of institutions in their model. Hansen and Tarp (2001) conduct a critical examination of the empirical literature on three generations of empirical cross-country work on aid effectiveness, including Harrod-Domar models; reduced form aid-growth models; and new growth theory reduced form models. They find evidence of a positive link between aid and economic growth in all the models, and posit that aid enhances total savings and investment, thus improving economic performance. The authors conclude that there is absence of micro-macro paradox as held by many writers, even in countries hampered by an unfavorable policy environment[27].

Arndt et al. (2011) use a structural causal model[28] to measure the effectiveness of foreign aid on development. They conclude that in the long-run, aid generally reduces poverty and leads to rapid economic growth. The authors argue that based on their findings, it is more prudent for policy makers to invest foreign aid in public physical capital, as well as in human capital development. Cassimon and Campenhout (2007) use a vector autoregressive framework to examine the fiscal effects of granting aid to a panel of Highly Indebted Poor Countries (HIPCs). The authors find that an increase in debt relief does not affect the fiscal position of government in terms of revenue collection. Furthermore, to paraphrase the authors, "debt relief seems to perform better than grants or loans, especially in the longer run, as it seems to increase revenue collection". According to the authors, "countries that receive debt relief are able to significantly reduce their external borrowing in the next year, which provides support for the defensive lending hypothesis". In a study using data obtained from 69 districts in Kenya, Odour and Khainga (2009) got results that generally show that ODA has significantly reduced poverty in the country. World Bank (2008), also focusing on Kenya found that foreign aid relaxes the budget constraint of the government, permitting increases in domestic consumption and investment. Additionally, the study found welfare effects to be more positive

[27]This is contrary to the so called Washington consensus that advocates aid to only those recipient countries with sound economic management.
[28]See Pearl (2009) for an explanation of how this model works.

than when growth is driven primarily by an increase in the domestic savings rate or FDI. The study by Ojiambo et al. (2015) found that increased aid unpredictability reduces economic growth in Kenya. In addition, aid unpredictability is found to improve economic growth during periods of macroeconomic instability implying that aid unpredictability forces governments to be more prudent in managing the limited uncertain resources at their disposal during periods of macro instability.

(b) Effects of Foreign Direct Investment on Economic growth, Poverty and Welfare

In an earlier section of this thesis, we saw that FDI is at least in theory beneficial to host countries, both directly (by increasing capital stock) and indirectly (through spillovers). However, as we subsequently show, empirical studies on the subject of FDI usually present mixed results. It is important to note that majority of studies that examine the effects of FDI on the economy are micro based, using firm-level data in their analyses, as discussed below.

de Mello (1999), one of the few macro based studies on the subject used time series data from OECD and non-OECD countries to investigate the effects of FDI. For OECD countries the author found no evidence of economic growth or capital accumulation arising from FDI, while for non-OECD countries such as Ecuador and Ivory Coast the study found evidence of a linear endogenous relationship between growth and FDI. As mentioned in the foregoing, majority of the empirical studies that focus on FDI effects use firm-level data hence their analyses focus on sector or industry productivity. Some of these studies show evidence of technological spillovers due to FDI, for example Caves (1974), Liu et al. *(*2000) and Bitzer and Gorg (2009). Other studies find no evidence that domestic firms' productivity rose due to FDI, for example Haddad and Harrison (1993), who while using Moroccan data, found that advanced foreign technology hindered spillovers, thus disapproving the theory of relative backwardness. Kokko (1994) opines that what matters for FDI externalities to be felt in an economy depends upon the intricacy of the technology that is transferred by MNCs, and the technological gap between the MNCs and domestic firms. The author thus argues that "technological diffusion" from MNCs to local firms it influenced by the level of the technology gap[29] and high foreign shares in the industry. Using firm-level micro data from Mexico, Kokko (1994) finds no evidence of spillovers in industries where MNCs have highly intricate technologies. On their part, Kokko et

[29] This is measured as the difference between the firm's labour productivity and the average labour productivity in foreign firms.

al. (1996) use Uruguayan industry-level data and find some evidence of efficiency spillovers to domestic firms with moderate technology gaps. Aitken and Harrison (1999) find that enhanced FDI in the same industry reduces the efficiency of domestic firms when MNCs "crowd out the latter by market stealing effect". Keller and Yeaple (2009) studied US firms and found FDI positively affecting productivity. They also found, contrary to the findings by Haddad and Harrison (1993) that technological spillovers were much stronger in sectors with high technology and absent in their lower technology counterparts. Boom et al. (2007) used a panel of data on US firms between 1980 and 2001 found evidence of both technology and product market spillovers, however, according to the authors, technology spillovers quantitatively dominate. Further according to Boom et al. (2007), firm performance is affected by two countervailing research and development spillovers; positive spillovers due to technological progress and negative spillovers arsing from the 'market stealing' effect. Girma et al. (2001) used firm-level data to analyse productivity spillovers in United Kingdom's manufacturing. The authors found evidence of spillovers to firms with a low technology gap. Using Chinese data, Liu (2008) investigates the impact of FDI on the manufacturing sector. The author finds presence of two types of impacts; an adverse effect manifested by the decline in the efficiency of the firm, and a positive impact whereby the long-term productivity growth rate increases.

Blalock and Gertler (2005) found FDI to have raised firm productivity in Indonesia while de Mello (1999) suggests that the extent to which FDI positively affects growth depends on the degree of complementarities and substitution between FDI and local firms. Urata and Kawai (2000) used data from Japanese firms and found high intra-firm transfer through FDI. Chuang and Lin (1999) for Taiwan found a significant increase in TFP due to FDI inflows. Barrel and Pain (1997) also found FDI having a positive effect on labour efficiency in West Germany and United Kingdom. Bwalya (2006) is one of the few studies that have analysed FDI spillovers in Africa. Using data from Zambia the author found a positive effect from FDI on the country's firms. Balistreri et al. (2015) summarise the literature that suggests that FDI that leads to supply of services improves TFP. Adams (2009) argues that FDI impacts on the economy by stimulating domestic capital formation and also enhances efficiency through positive externalities. To paraphrase the author, "the impact of FDI is determined by country-specific conditions in general and the policy environment in particular, in terms of the ability to diversify, the level of absorption capacity, targeting of FDI, and opportunities for linking FDI with domestic investment". The author thus concludes that FDI is a necessary but not a sufficient condition for economic growth. Furthermore, Adams (2009) argues that FDI

improves the macroeconomic framework because it releases countries from the binding constraint of domestic savings, through a couple of channels. First, FDI augments low domestic savings in the process of capital formation and thus stimulates domestic investment, which in turn enhances total investment in the country (Ajayi, 2006). Secondly, by bringing new knowledge and investment especially in physical infrastructure, MNCs may assist, in the words of Romer (1993) "in reducing idea gaps and object gaps between developed and developing countries". FDI may thus enhance efficiency of all firms including those not receiving the flows. Third, FDI can generally improve growth by encouraging competition for raw materials (inputs) in the local market and hence enhance efficiency of local firms. Forth and finally, the mobility of capital at the global level could discourage governments from pursuing policies that are inimical to economic growth.Woo (2009) in an analysis covering over 90 countries finds FDI flows boosting TFP growth of a country whereas the absorptive capacity does not affect the impact of FDI, a conclusion that runs contrary to the findings by Adams (2009). Massingue da Costa (2012) while citing Cockcroft and Ridell (1991) suggests that the impact of spillovers particularly the skill transfer is very weak in the African setting. This is because wages earned are very low for formal sector workers and the number of managerial posts held by local workers is also low. Besides FDI inflows to Africa are typically in natural resources industries which are more capital intensive and require highly skilled workers (Jenkins and Thomas, 2002 as cited by Massingue da Costa, 2012). In a study on Nigeria, Akinlo (2004) finds some evidence of technology transfer due to FDI inflows into the country. Ajayi (2006) has a rich review of literature on the effects of FDI on African development. Using country case studies including Kenya, Tanzania and Uganda, the author shows MNCs playing a considerable role in local development, through various ways. This includes contributing to revenue collection via payment of taxes, creation of employment opportunities, increasing value added per worker, generating more investment in infrastructure, providing formal training programs and health insurance or on-site medical care to workers, and increased exports.

Phillips et al. (2000) while studying Mauritius, Uganda and Kenya posit that there may be limited technology transfer and spillovers to local firms in SSA. The authors find a 1.0 percent increase in the share of FDI to GDP leading to a 0.8 percent increase in future domestic investment in SSA compared to 1.17 percent for Latin America. Fauel (2012) while using industry-level panel data studied the effects of FDI on certain sectors in sub-Saharan African countries including Kenya and found that FDI presence benefited all the sectors albeit

differently. The author found a more significant spillover effect on the manufacturing sector, compared to the primary and services sectors. Adam and Bevan (2006) while juxtaposing learning-by-doing spillovers and ODA inflows in their model on Uganda found spillovers having fairly strong adverse effects, especially if the ODA inflows were not put to productive use. Biggs et al. (1995) in a study focusing on three African countries including Kenya, Ghana and Zimbabwe found FDI to have enhanced productivity on manufacturing firms in the early 1990s. Todd et al. (2004) studied FDI in Kenya, Uganda and Tanzania and concluded that there are important positive effects from FDI for both the host economies and the workers in MNCs. These benefits include increased firm productivity, improved management skills, higher investment in infrastructure and widening of global scope for the firms. Kinyanjui (2010) has an extensive survey of the literature on FDI studies focusing on Kenya, including Langdon (1981), Jenkins (1990), Gershenberg (1987), Kamau et al. (2009), Graner and Isaksson (2009) and Were and Mugerwa (2009). These studies according to Kinyanjui (2010) find evidence of spillovers being transmitted to the Kenyan economy through the various channels already mentioned above; demonstration effects, competition effect, learning-by-doing effects among others. World Bank (2008) used a MAMS (Maquette for MDG Simulations) model to conduct simulations on the likely effects of FDI in Kenya from 2006 to 2030. According to this study FDI may increase (and decrease) more rapidly than more slow-moving domestic financing sources and may lead to more rapid technological progress than investment by domestic firms. Without considering possible direct technological gains from FDI, World Bank (2008) gradually increases FDI from a very low level in 2006 to 4 percent of GDP through to 2030. The study's simulated effects are a strong increase in private investment growth coupled with a smaller growth increase for GDP and other national account aggregates. Initially, private consumption and welfare fares better since there is no need to switch private income to savings. However, over time, growth in profit repatriation forces more export growth while reducing imports and this leads to dampening of the long-run positive impact on absorption and welfare.

Nyamwange (2009) on Kenya finds FDI to be beneficial, although its effects on the overall economy may be insignificant. Mwega and Ngugi in Ajayi (2006) find FDI not playing an important role in the Kenyan economy despite the country's efforts at attracting foreign investors. The authors show a declining trend in the share of net FDI to gross capital formation, from 2.02 percent in the 1980s to 1.13 percent in the 1990s. Gachino (2007) in a study on the effects of FDI on Kenyan manufacturing analyzed productivity determinants and found a

statistically significant role played by foreign presence on firm level TFP, hence supporting spillover occurrence argument. However, according to the author, results based on recent methodologies showed no effect of foreign presence on firm level TFP hence failing to support a spillover occurrence dictum. Gachino (2007) therefore advocates for a "paradigm shift" in the spillover analysis techniques and recommends a broader approach with particular emphasis on technological innovations which takes into consideration learning, capability building and innovation. A number of studies have not directly established a link between FDI and TFP for Kenya. For instance, Njikam et al. (2006) in a study of 27 sub-Saharan African countries found that a 10 percent increase in gross investment/GDP ratio leads to a 9.6 percent increase in TFP growth for Kenya. Although Kumar and Pacheco (2010) find TFP to have a small contribution to economic growth in Kenya, they fall short of quantifying the magnitude of the contribution. In an investigation of sources of growth in Sub-Saharan African countries, Tahari et al. (2004) found TFP spillovers to be contributing nil to Kenya's real GDP growth for the period 1960-2002 which was at an average of 4 percent per annum, driven by factor accumulation. Mwega and Ajayi (2007) attribute productivity growth in Kenya's manufacturing sector to labour and capital in the first two decades of independence (1965–1983) and by labour and TFP in the third decade. According to the authors, TFP declined substantially in the second decade from about 2.7 percent in 1965–1973 to 0.7 percent in 1974–1983, but recovered to 1.5 percent in 1984–1993. Onjala (2002) finds TFP growth to have contributed to overall economic growth in Kenya only during two periods; between 1961 and 1970 (1.3 percent) and 1985-1995 (1.8 percent). Between 1971 and 1985 TFP played no role in productivity growth in Kenya, according to Onjala. Kalio et al. (2012) on their part found TFP accounting for a meager 3.6 percent of growth in Kenya, while factor (capital and labour) accumulation accounts for 71.4 percent, hence replicating the findings by Mwega and Ajayi (2007) and Onjala (2002).

(c) Effects of Remittances on Economic growth, Poverty and Welfare

Remittances have become significant private financial resources for households in many countries, Kenya included. Data from the World Development Indicators show that in 2014 alone, personal remittances received globally totalled about US$ 528 billion, in current prices, and more than three-quarters of the flows went to LDCs. According to World Bank (2010) top recipients of remittances in SSA include the following countries, listed in descending order: Lesotho (25 percent); Togo (10 per cent); Cape Verde (9 per cent); Guinea-Bissau (9 per cent); Senegal (9 per cent); Gambia (8 per cent); Liberia (6 per cent); Sudan (6 per cent); Nigeria (6

per cent), and Kenya (5 per cent) [30]. There is a plethora of empirical literature on the subject of remittances. The early literature on migration had focused primarily on understanding and explaining migration and the microeconomic impact of remittances. This literature had a pessimistic view of remittances and migration in general and was dominated by the idea that remittances could not contribute to recipient countries growth, because these funds are mostly used to meet basic consumption needs or subsistence (Baldé, 2009). According to this literature, there are drawbacks to remittances as they can bring about a dependency syndrome and can be prone to vulnerable changes in economic, political and social conditions of source countries. Reinforcing this view are authors such as Rempel and Lobdell (1978), Lipton (1980) and Massey et al. (1987) who find remittances being insignificant in promoting local development, since, to quote Massey et al. (1987), "they are used for consumer subsistence spending rather than productive investment, and households spend the largest portion of funds received for the purchase or construction of houses, purchase of food, clothes and consumer goods or even to repay debts while very few of these funds are invested in productive activities". Moreover, the authors suggest that remittances distort social development since only households that have a member abroad benefit from it, which creates disparities in household wealth and increased social inequalities. Further, other authors such as Russell and Teitelbaum (1992) argue that "remittances are often used for unproductive uses, such as satisfying basic consumption needs, buying medicines, building a house for the migrant's retirement, or spending on conspicuous consumption in festivals and funerals as well as daily life". According to the authors, when remittances are invested in businesses, "these are usually seen as small-scale, at the margins of profitability, and concentrated in the retail and services sectors". Another study by Beja (2010) finds evidence of Dutch disease due to remittances in middle-income countries. However, the author finds no evidence of the disease in upper and low-income countries.

Nonetheless, it is now increasingly accepted that this pessimistic view was based on limited empirical analysis conducted with unreliable data in most developing countries. Moreover the studies ignore the often indirect and multiplier effects that can arise from remittances within the entire community, including households with no members abroad. They do not take into account the fact that apart from direct investment made by migrants or recipients of funds, the productive use of remittances can be done through several other channels, for instance

[30] Figures represent remittances as a percentage of GDP

managing remittances by banks and development of the financial system that may result; extension of credit for investment made possible by the gain in household credit and increasing the liquidity of banks due to deposits of remittances; increasing the demand and hence production through consumption of remittances; human capital development programmes in education and health care provision and buying of more property and technologically content goods abroad (Baldé, 2009). Recent studies have used more advanced econometric methods and found more optimistic results. Several of these studies include, as cited by Baldé(2009),Taylor et al. (1996), Faini (2002, 2007), Giuliano and Ruiz-Arranz (2008), Chami et al. (2003), Catrinescu et al. (2008), Mundaca (2005), Pradhan et al. (2008), as well as Zazzaro and Bettin (2008) among others. The common view of these studies is that remittances impact positively on economic growth. There are just a few studies as far as we know that have analysed remittances to SSA. One of these studies, Adams et al. (2008) used household data from Ghana to evaluate how households spend at the margin. The authors find that "households receiving remittances do not spend more at the margin on food and consumer goods than households that receive no remittances". According to the authors, households consider income from remittances as any other income; hence "do not spend more or less at the margin on consumption or investment than households with no remittances". Osili (2004) on Nigeria found that older migrants and those with higher incomes are more likely to invest in housing. To paraphrase Osili, "at the mean, a 10 percent increase in migrants' income increases the probability of investing in housing by 3 percentage points". From the standpoint of the migrant, this spending on housing represents an important form of local investment. In conclusion, there is likelihood that the remittances-receiving household, just like the non-receiving household spends a big proportion of its proceeds on food and consumer goods. However, as Adams et al. (2008) put it, "identifying the conditions under which remittance-receiving households spend more at the margin on investment goods like education, housing and business, and the impact of these investments on local economic development, remains an important area for further research".

2.4 Overview of the Literature Review

The review of the literature in the preceding sections of the present chapter is important for several reasons. First, it provides us with information on the research area, highlighting the

relationship between external shocks and economic growth, poverty and welfare. Secondly and most importantly, the review provides the context under which our research is conducted and also reveals gaps in the existing body of knowledge. As we have already seen, numerous authors have examined the effects of TOT on economic growth, poverty and welfare. Harberger (1950), Laursen and Metzler (1950), Prebisch (1950) and Singer (1950) were among the first studies to investigate the effects of a TOT shock on the economy, providing a theoretical base for contemporary studies [e.g. Obstfeld (1982), Powel (1991), Mendoza (1997), Deaton and Miller (1996), Lutz (1999), Kose and Reizman (2001), Sarkar (2001), Cashin and McDermont (2002), Kent and Cashin (2003), Kellard and Wohar (2006) and Alvarez-Albelo and Perera-Tallo (2008)]. As can be discerned from the literature, some of these studies agree with the Prebisch-Singer hypothesis, which claimed that historically foreign trade had led to the enrichment of developed countries at the expense of developing countries. However, other studies oppose the hypothesis, arguing that the effects of TOT on the economy are ambiguous. The survey of literature has shown that although generally a positive TOT shock is viewed as beneficial to the economy while a negative shock is seen as deleterious. Rudd (1996) argues that there are certain instances when a positive TOT shock may cause "Dutch disease" and gives examples of countries that have experienced this phenomenon. Other authors that have investigated the cause of Dutch disease include Corden and Neary (1982) and Neary and Van Wijnbergen (1986) who explain two components of Dutch disease: a spending effect caused by higher domestic incomes due to the increased revenues arising from the boom in the resource sector and a resource movement effect which occurs if the booming sector shares domestic factors of production with the other sectors of the economy.

The review of literature reveals a dearth of empirical literature focusing on the general equilibrium effects of TOT on the economy in Sub-Saharan African countries, including Kenya. As a matter of fact, only three studies to our knowledge have investigated the effects of TOT shocks on the Kenyan economy in a general equilibrium setting. These studies include Karingi and Siriwardana (2003), Levin (1998) and Levin (2010). Karingi and Siriwardana mainly focused on investigating the effects of an increase in oil prices (unfavourable TOT) and an increase in coffee prices (favourable TOT) on Kenya's agricultural sector and hence economic growth. The authors did not examine the poverty and welfare impacts of TOT, an area of research that remains crucial for policy makers given that poverty reduction is an overriding goal not only for Kenya but for most developing countries. The review of literature also outlines numerous studies examining the effects of foreign capital inflows on the

economy. A pertinent question that begs an answer is why, despite receiving large amounts of ODA over a long period of time, most developing countries, especially those in SSA continue to experience high incidences of poverty and low economic growth. In an attempt to measure aid effectiveness, a number of authors have modelled the relationship between aid and economic growth (see Sindzingre, 2012 for an extensive review of the literature). Exisiting literature is divided on the role of aid in development. On the one hand are aid 'optimists' [e.g. Harrod (1939), Domar (1946), Chenery and Strout (1966) and Sachs (2005)], who argue that ODA has been beneficial to the economy, especially when it comes to economic growth. On the other hand are aid 'pessimsists' [e.g. Griffin and Enos (1970), Bauer (1971), Younger (1992), Boone (1996), Fosu (1996), White (1998), Easterly (2001) and Adam and Bevan (2006)] who argue that at certain levels and in certain circumstances, foreign aid can bring about undesireable structural changes in the economy. The authors argue that large aid flows, like other resourse booms may cause an appreciation of the real exachange rate which may in turn inflict 'Dutch' disease effects on the economy. Thus, based on what we learn from this literature, It is our endouver in this study to shed light on the question earlier posed as to why African countries and Kenya in particular continue to record low levels of development despite receiving large inflows of ODA over the years.

Diaspora remittances as we noted earlier have become an important source of capital for developing countries, acting as a compensating mechanism for the "brain drain" of these countries due to migration. The literature tells us that we can study remittances at the micro level (e.g. in the case of households) or at the macro level (e.g the impact on GDP growth, poverty and welfare). The literature also gives the theoretical underpinning under which studies of remittances are based: pure altruism model, pure self-interest model, informal agreements with family members left behind in the home country and portfolio management decisions. As already noted, scholars are divided on the effectiveness of remittances in boosting development. The early literature held a pessimistic view of remittances and migration in general, arguing that remittances posed a risk of creating a dependency sydrome on the part of receivers in home countries. A number of authors, including Rempel and Lobdell (1978), Lipton (1980), Massey et al. (1987) and Rusell and Teitelbaum (1992) seem to agree with this notion, arguing that since remittances are used for consumer subsistence spending rather than productive investment, they have little impact on econnomic development. On the contrary however, several other studies have found a positive economic effect of remittances in recipient countries [see Balde (2009) for a survey of the literature]. These studies argue that

remittances have direct and multiplier effects in the economy, which leads to an increase in aggregate demand. Additionally acording to Balde (2009), remittances are effective if invested in human capital and real estate development. Our survey of literature has revealed that little research has been done on the economic effects of remittances inflows to Sub-Saharan Africa. It is instructive to note that the few studies focussing on remittances inflows to Africa [see e.g. Adams et al. (2008) for Ghana, Osili (2004) for Nigeria and Kiiru (2010) for Kenya] are micro level studies, and might have fell short of capturing the indirect (multiplier) effects of the inflows. This therefore underscores the importance of our study, which uses an economy-wide approach to study remittances. Unlike ODA, remittances are sent directly to households without entering the government budget. The pertinent issue here is to investigate what proportion of the remittances is saved (invested) or consumed by recipient households and also determine their impact on aggregate demand. This is what we set out to do in Chapter 5 of this study.We have also in the survey of literature outlined the important role that FDI plays in economic development, which explains the extensive research that has been done on the subject. Theoritically, FDI is beneficial to the host economy, both directly (by increasing capital stock) and indirectly (through positive spillovers). However, empirical evidence on the existence of such positive externalities is mixed. Most of the empirical literature [see e.g. Caves (1974), Liu et al. (2000), Bitzer and Gorg (2009), Alfaro et al. (2006), Gorodnichenko (2015), Kokko (1996), Girma et al. (2001), Liu (2008), Urata and Kawai (2000), Chuang and Lin (1999), Barrel and Pain (1997), Blalock and Gertler (2005), Balistreri et al. (2015), Adams (2009), Woo (2009) and Jacob and Sasso (2015)] found presence of positive FDI externalities on economic growth in developed and developing countries.

On the flip side however, a few authors [see e.g. Haddad and Harrison (1993), Djankov and Hoekman (2000), and Aitken and Harrison (1999) found results that suggest that FDI can be potentially harmful to the host country through resource over-exploitation, pollution and abuse of market power. Empirical literature focussing on FDI in Africa is scanty. Some of the studies in this area include Haddad and Harrison (1993), Bwalya (2006), Ajayi (2006), Massingue da Costa (2012), Akinlo (2004), Phillips et al. (2000), Fauel (2012) and Adam and Bevan (2006). The common thread of these studies is that FDI spillovers are beneficial and contribute to economic growth in Africa. We have also learnt, in the course of reviewing the literature that no study todate has investigated the impact of FDI spillovers on economic growth and poverty in Kenya. The few studies on the subject have concentrated on investigating the factors determining FDI flows into the country. This study attempts to fill this gap in the literature.

CHAPTER THREE: METHODOLOGY

3.1 Modelling Theory of CGE

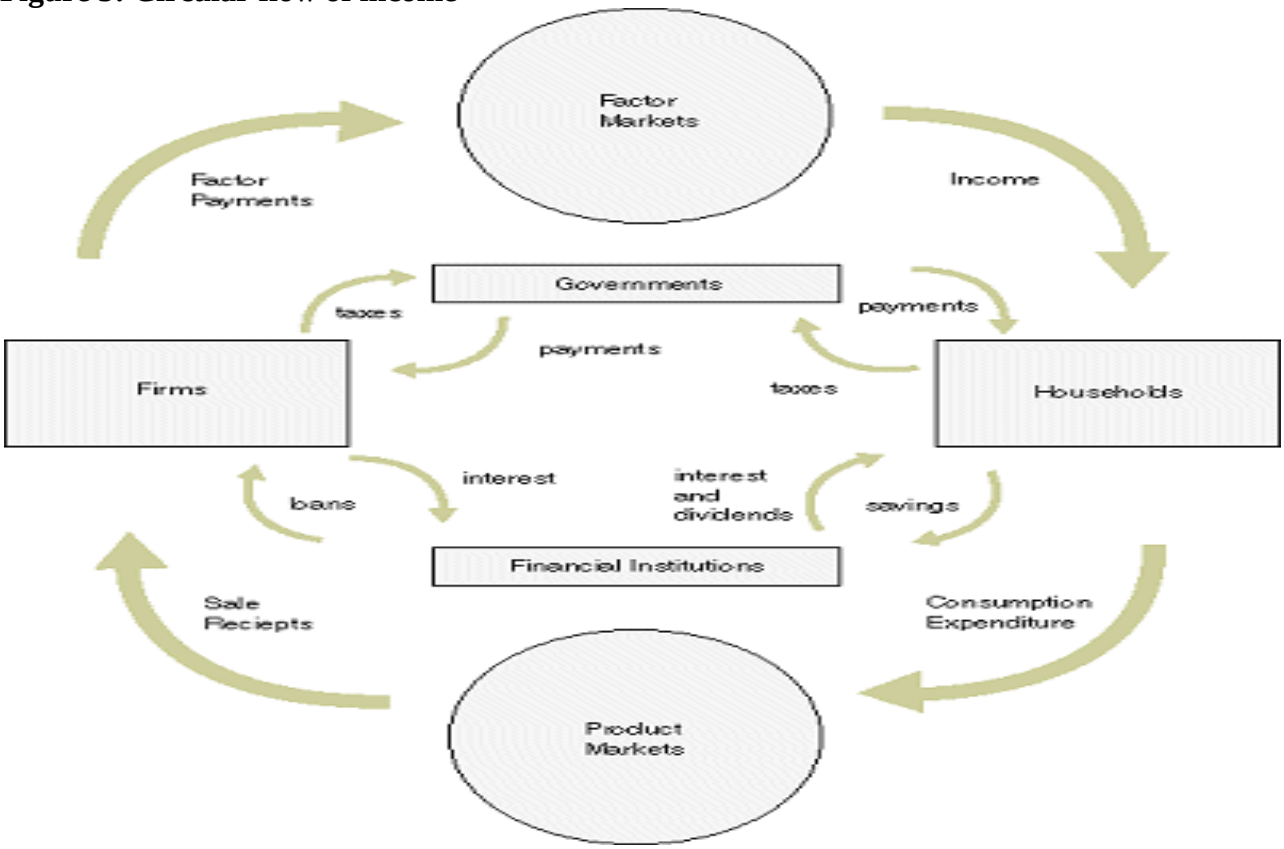
3.1.1 Introduction

In Chapter 2 of this thesis, we summarized the major lines of thought that have characterized previous research dealing with external shocks and their effects on economic growth, poverty and welfare. One of the lessons learnt in our review of the literature is that external shocks have both direct and indirect effects, which may not be easily captured by a partial equlibrium analytical framework. Rather, what is required to capture the effects of the shocks on economic growth, poverty and welfare is a detailed economy-wide framework that explicitly incorporates the sectors of the economy where these shocks originate and the intersectoral transmission channels through which the shocks spread and affect the economy. The next section discusses the conceptual underpinnings of the computable general equilibrium (CGE) model, which is the framework we use to analyse data in Chapters 4 and 5.

3.1.2 Theoretical Basis for Computable General Equilibrium Model

Paraphrasing Wing (2004), "CGE models are simulations that combine the abstract general equilibrium structure of an economy with realistic economic data to solve numerically for the levels of supply, demand and price that support equilibrium across a specified set of markets". Scarf (1967) was the first scholar to give an algorithm that was able to find a general equilibrium solution in a computational application. This made it possible to develop applied general equilibrium models, which determine the allocation of resources in the economy by the interaction of demand and supply, resulting in a vector of equilibrium prices. The CGE framework is strongly grounded in microeconomic theory, and is built around the circular flow of commodities (or income) in a closed economy as illustrated in figure 5.

Figure 5: Circular flow of income



Source: Adopted from www.bized.co.uk

As seen in figure 5, the main economic agents include households, who own the factors of production and are the final consumers of produced commodities, and firms, who rent the factors of production from the households to produce commodities that are then consumed by households. Usually, govenment is included in the circular flow of income as an agent that collects tax revenue, which is then given to the other economic agents (households and firms) as subsidy and lumpsum transfers. The circular flow of commodities depicted in figure 5 represents Walrasian general equilibrium in the economy. Three conditions must be met for Walrasian general equilibrium to hold, namely; market clearance, zero profit and income balance[31]. According to Wing (2004), the market clears when the flow of commodities from firms is absorbed by the activity of consumers, while the flow of factors from households is abosrbed by the activity of firms. This implys that firms' products are consumed by households in their entirity, and that primary factors that are owned by households are in turn fully utilized by firms. To paraphrase Wing (2004), the sum total of revenue from firms in essence accrue either to households as payment to primary factors, to other firms as payments for intermediate

[31] These three conditions are clearly shown as the solid line in figure 5

inputs, or to the government as taxes. According to Wing (2004), "the value of a unit of each commodity in the economy must then equal the sum of the values of all the inputs used to produce it, that is, the cost of the inputs of intermediate materials as well as the payments to the primary factors employed in its production". Thus, the principle of conservation of value ensures that constancy in returns to scale in production and perfectly competitive markets for produced commodities simultaneously hold[32], implying that firms make zero profit at equilibrium. Moreover, according to Wings (2004), "the returns to households' endowments of primary factors that are associated with the value of factor hiring to firms accrue to households as income that the households exhaust on commodity purchases". The income balance holds because all the factors are fully engaged (there is zero unemployment), and households exhaust all their income on commodity purchases and savings. The circular flow of income as depicted in Figure 5 represents "barter trade" in commodities and factors, since there is no flow of money as a commodity. Thus, as we shall see in the next section, the CGE model that is built around the circular flow of income assumes that the flows are expressed in terms of the value of one commodity whose price is assumed fixed (the numeraire) and therefore solves only for relative prices[33].

The Social Accounting Matrix

The circular flow is useful in constructing a social accounting matrix (SAM), which provides the statistical underpinnings for the CGE model. The SAM is defined as an economy-wide data framework that usually represents in real terms the economy of a single country at a particular moment in time. It is a square matrix whereby each account is represented by a row and a column and each cell in the matrix shows the payment from the account of its column to the account of its row – the incomes of an account appear along its row, its expenditures along its column. The underlying principle of double-entry accounting requires that, for each account in the SAM, total revenue (row total) equals total expenditure (column total). A SAM can then be seen as an extension of Leontief's input-output accounts, filling in the links shown in Figure 5; from the factor payments to household income and back to demand for products. According to Robinson (2003), CGE models that are based on a SAM framework are theoretically grounded in Walrasian general equilibrium theory, which as we have noted in the foregoing, assumes

[32]This is so defined to reflect the accounting principle of budgetary balance, which posits that for each activity in the economy the value of expenditures must be balanced by the value of incomes, and that each unit of expenditure has to purchase some amount of commodity.

[33] The underlying assumption here is that the CGE model is Walrasian in spirit. The Walrasian system is homogenous of degree zero in absolute prices, such that the absolute level of prices does not affect the equilibrium situation.

market-clearing price-adjustment mechanisms in product and factor markets. In a Walrasian equilibrium situation, demand equals supply of all commodities such that there results a vector of equilibrium prices and outputs. Further, Walrasian equilibrium presupposes competitive behaviour of all economic agents, whereby consumers maximise utility subject to a budget constraint, while producers maximise profits. According to Patron (1997), the first theorem of welfare economics states that in Walrasian equilibrium, "the resource allocation is Pareto efficient" while the second theorem states that "any Pareto efficient allocation can be supported as a competitive equilibrium with appropriate lump-sum transfers". Thus, starting from an initial equilibrium, any shock (or policy change) that distorts relative prices will move the economy out of the Pareto efficient allocation, implying a social cost in a general equilibrium model. Moreover, according to Patron (1997), "distributional aims may be attained by lump-sum transfers without affecting efficiency".

3.1.3 Functionality of CGE Models

The Walrasian competitive economy CGE models described in the foregoing are rarely used in developing countries, because of the structural rigidities and the nature of the public sector inherent in the countries (Kiringai, 2010). According to Taylor (1990), the appropriate functional form is determined by the conciseness of the model in capturing the stylized facts of the economy in question. Majority of the CGE models designed for developing countries follow the neoclassical-structuralist tradition pioneered by Dervis et al. (1982) and extended by Taylor (1990) and Lofgren et al. (2002). According to Taylor (1990), when one is modelling a developing country, there is need to depart from the theoretical optimizing agents and take into account inter-alia powerful agents, and different saving and consumption patterns. Also, according to the author, prices in most developing countries are not market determined; rather they are influenced by powerful agents through "mark-up pricing and thus the standard practice for modellers is to set up prices in real rather than relative terms". Another distinguishing feature of CGE models in a developing country setting is the choice of elasticities and closure rules, which are discussed below. In modelling CGE, the guiding principles are consistency with theory and ensuring analytical tractability to permit analysis of supply and demand responses to shocks. The desirable properties that inform the choice of functional forms is continuity and homogeneity of degree zero in prices and incomes, as well as data requirements. Thus while non-parametric specifications may be desirable, their intensive data requirements

render them inconvenient and difficult to use, and we follow the tradition of the numerous CGE based studies to chose parametric functional form specifications of Cobb Douglas, Constant Elasticity of Substitution (CES) and Linear Expenditure system (LES)[34]. What follows are the building blocks of a standard CGE model, adopted from Lofgren et al. (2002).

(a) Production system

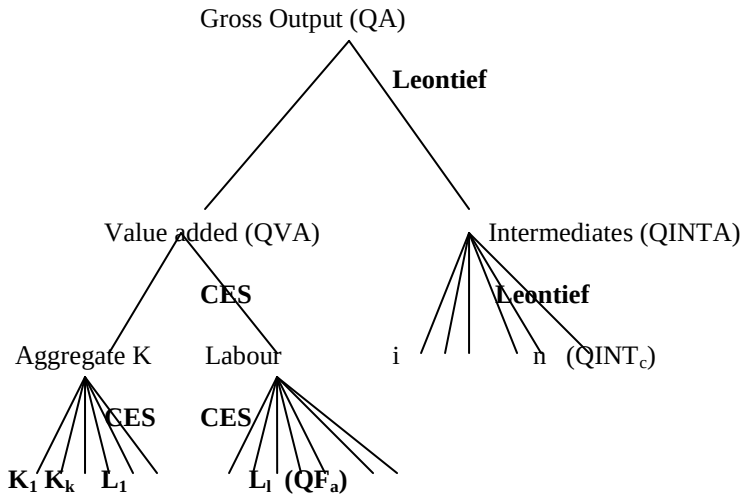
For a model with C sectors and F factors with respective commodity and factor prices, the supply side of the model is determined by C+CF+F independent equations. The equations determine factor input requirements where the factor price equals its marginal product. As observed above, Walrasian general equilibrium requires that demand must equal supply where prices adjust to clear the market (Wing, 2004). An archetype presentation of production in CGE models is a multi-level nested structure. The level of nesting is determined by the degree of the complexity of the model and the level of data disaggregation in the SAM. A standard nesting structure is illustrated in Figure 6. At the top level of the technology nest, aggregate intermediates and value added are combined to produce gross output. The choice of production function at this nest include: CD, CES or Leontief production functions. The distinguishing element in these functional forms is the elasticity of substitution, σ, between intermediates and value added where σ=0 in the Leontief formulation, σ=1 in CD alternative and in the CES functions:

$$\sigma = \frac{1}{1-\rho} \qquad -\infty < \rho < 1$$

Leontief functional form is used in production functions where the modeller assumes there is no substitutability between factors of production and intermediates, i.e. that technology is fixed.

[34] See Kiringai (2010) for a detailed discussion of these studies

Figure 6: Structure of the CGE model



Source: Adopted from Lofgren et al. (2002)

In Figure 6, the top nest is Leontief aggregation of value added and intermediates. The producer's objective function is expressed as a cost minimization problem expressed as:

$$QA_a = \min\left[\frac{QVA_a}{iva_a}, \frac{QINTA_a}{\text{int}\, a_a}\right] \quad \text{.....(3.1)}$$

Where QA_a is gross output, VA_a is value added, iva_a is value added coefficients $QINTA_a$ is composite intermediate inputs, $inta_a$ is input output coefficients.

Alternatively, the producers objective can be expressed as profit maximization subject to a nested technology where at the first (top) level of the nest, the activity output (*QA*) is a Leontief (fixed coefficient) function of aggregate value-added (*QVA*) and aggregate intermediate input (*QINTA*), expressed as:

$$\text{Maximize}\, PROFIT = PA \cdot QA - \sum_{f \in F} WF_f \cdot QF_f - \sum_{c \in C} P_c \cdot QINT_c \quad \text{..... (3.2)}$$

Subject to

$$QINT_c = ica_c \cdot QA \quad \text{..... (3.3)}$$

$$QA = ad \cdot \prod_{f \in F} QF_f^{\alpha_f} \quad \text{.....(3.4)}$$

Where PA is activity price, WF is average price of factor, QF_f is quantity demanded of factor f, Pc is price of domestic output of commodity, $QINT_c$ is quantity of commodity c as intermediate input, ad is an adjustment factor and ica_c is quantity of c per unit of aggregate intermediate input.[35] Substituting (3.3) into (3.2) gets:

$$PROFIT = PA \cdot QA - \sum_{f \in F} WF_f \cdot QF_f - \sum_{c \in C} P_c \cdot ica_c \cdot QA \quad \text{.....(3.5)}$$

and forming the Lagrangean yields:

$$L = PA \cdot QA - \sum_{f \in F} WF_f \cdot QF_f - \sum_{c \in C} P_c \cdot ica_c \cdot QA + \lambda \left(ad \cdot \prod_{f \in F} QF_f^{\alpha_f} - QA \right) \quad \text{.....(3.6)}$$

First-order conditions for maximization:

$$\frac{\partial L}{\partial QA} = PA - \sum_{c \in C} P_c \cdot ica_c - \lambda = 0 \quad \text{..... (3.7)}$$

$$\frac{\partial L}{\partial QF_f} = -WF + \lambda \cdot \alpha_f \cdot ad \cdot QF_f^{\alpha_f - 1} \prod_{\substack{f' \in F' \\ f' \neq f}} QF_{f'}^{\alpha_{f'}} = 0 \qquad f \in F \quad \text{..... (3.8)}$$

$$\frac{\partial L}{\partial \lambda} = -QA + ad \cdot \prod_{f \in F} QF_f^{\alpha_f} = 0 \quad \text{..... (3.9)}$$

Rearranging (3.7) and (3.8), and substituting into (3.5) we get:

$$WF = \frac{\alpha_f \cdot \left(PA - \sum_{c \in C} P_c \cdot ica_c \right) \cdot ad \cdot \prod_{f \in F} QF_f^{\alpha_f}}{QF_f} \quad \text{..... (3.10)}$$

Rearranging (3.9) yields:

$$QA = ad \cdot \prod_{f \in F} QF_f^{\alpha_f} \quad \text{..... (3.11)}$$

Using (3.11) to simplify (3.10) we get:

[35] See annex table 9 for detailed definitions of sets, parameters and variables

$$WF = \frac{\left(PA - \sum_{c \in C} P_c \cdot ica_c \right) \cdot \alpha_f \cdot QA}{QF_f} \quad \text{..... (3.12)}$$

Using the definition of value-added price and simplifying (3.12) yields:

$$PVA = PA - \sum_{c \in C} P_c \cdot ica_c \quad \text{..... (3.13)}$$

and

$$WF = \frac{PVA \cdot \alpha_f \cdot QA}{QF_f} \quad \text{..... (3.14)}$$

The value added coefficient and input output coefficients can be calibrated directly from the SAM as follows:

$ iva_a = \frac{QVA}{QA} $ and

$$\text{int}\, a_a = \frac{QINTA_a}{QA} \quad \text{..... (3.15)}$$

Next we look at the second level of production nest. According to Lofgren et al. (2002), the nest allows differentiation in the technology used in the aggregation of value added and intermediates. *QVA* is a CES function of the quantities employed of the primary factors of production (QF_f); and composite intermediate inputs (*QINTA)* is a Leontief function of disaggregated intermediate inputs ($QINT_c$).

Intermediates

Demand for intermediates is usually modelled as Leontief fixed technology (Lofgren et al., 2002). Armington (1969) assumption allows us to assume that domestically produced goods and imports from different regions are imperfect substitutes and therefore a CES function can be used to combine intermediate inputs from different regions into aggregate intermediate

input. The cost minimization problem is used to derive the demand for domestically produced goods and imports expressed as:

Minimize $PM_C.QM_C+PDD_C.QD_C$ ..... (3.16)

subject to $QINTA_a = \alpha_a^q \left[\delta_C^q QM_C + (1-\delta_C)QD_C\right]^{\frac{1}{\rho_c^q}}$ ..... (3.17)

Where PM_c and PDD_c represent the prices of imports and locally produced good respectively; α^q_a is the intermediate input efficiency parameter and δ^q_c is the Armington function share parameter, ρ_c^q is the Armington function exponent*;* and QM_c and QD_c are quantities of imported and locally produced intermediate inputs respectively. Forming the Lagrangean:

L= $PM_C.QM_C+PDD_C.QD_C+ \lambda\left[\alpha_a^q \left[\delta_C^q QM_C + (1-\delta_C)QD_C\right]^{\frac{1}{\rho_c^q}}\right]$ ..... (3.18)

The first order condition for cost minimization

$$\frac{dL}{dQM} = PM_c + \left[\frac{\lambda}{\rho_c^c}\left[\delta_c^q \alpha_a^q QM_c\right]^{\frac{1}{\rho}-1}\right] \quad \text{..... (3.19)}$$

$$\frac{dL}{dQD} = PDD_c + \frac{\lambda}{\rho_c^q}\left[\alpha_c^q(1-\delta)QD_c\right]^{\frac{1}{\rho}-1} \quad \text{..... (3.20)}$$

$$\frac{dL}{d\lambda} = \alpha_a^q \left[\delta_C^q QM_C + (1-\delta_C)QD_C\right]^{\frac{1}{\rho_c^q}} \quad \text{..... (3.21)}$$

Solving the cost minimization problem yields;

$$\frac{QD_C}{QM_C} = \left[\left(\frac{1-\delta_C^Q}{\delta_c^q}\right)\left(\frac{PM_c}{PDD_C}\right)\right]^{\rho_c^q} \quad \text{..... (3.22)}$$

Note that elasticities needed to calibrate equation (3.22) are obtained from the CGE modelling literature.

Value Added

Paraphrasing Lofgren et al. (2002), "the aggregation of primary factors into value added can be modelled either as CES or CD whereby the CES approach is more flexible and allows substitution possibilities between pairs of factor inputs, for instance between capital and labour or different types of labour". The degree of substitutability is determined by the elasticities. The CES value added function from which the demand for factors is derived can be expressed as:

$$QVA = \alpha\left[\sum \delta QF_f^{-\rho}\right]^{-1/\rho} \quad \text{..... (3.23)}$$

Where α is the efficiency parameter in CES value added and δ is the CES value added function share parameter for factor f, and $\sigma = 1$ is the elasticity of factor substitution. The efficiency and share parameters are estimated from the SAM dataset, while the elasticity is got from the CGE modelling literature.

Firms' demand for factors, which is driven by the cost-minimization motive, is based on the factors' relative prices, so as to equate marginal revenue product and marginal cost. To paraphrase Lofgren et al. (2002), "the marginal cost of the composite factor at the top of the factor demand nest for each sector is equal to its marginal revenue product, where marginal cost is the economy-wide average wage (W_f)".

The third level in the nested production function represents the substitution between different factors of production; different labour types, on one hand, and different types of capital or even different types of land. A CES form of production is adopted at this level of the nest, which permits the use of different elasticities of substitution between pairs of factors. The demand for individual factors f' and f'' is a cost minimization problem based on relative factor prices $w_{f'}$ and $w_{f''}$. The demand for an individual factor can be expressed as

$$QF_{fa} = \alpha_{fa}\left[\sum_{f'} \delta_{ff'a} QF_{f'a}^{-\rho_{f'a}}\right]^{\frac{1}{\rho_{f'a}}} \quad \text{..... (3.24)}$$

Where α_{fa} is the CES factor efficiency parameter, δ_{fa} is the factor share parameter and P_f is the transformation of the elasticity of factor substitution. The producers choose the quantity of each factor to minimize the cost:

$$\sum_{f'} w_{f'} QF_f \quad \text{..... (4.25)}$$

subject to (3.24). Solving the first order conditions for the cost minimization problem gives the demand for individual factor f' and reduces to:

$$w_{f'} = w_f QF_a \left[\frac{\delta_{ff'} QF_{f'a}^{\frac{-1}{\rho_f}}}{\delta_{ff''} QF_{f''}^{\frac{-1}{\rho_f}}} \right] \text{.....(3.26)}$$

which equates the marginal cost of nested factor to the marginal revenue product of the factor. Equilibrium in the factor markets is achieved on the assumption that labour supply is given at certain employment levels while wage rates are flexible to clear the market (Lofgren et al., 2002).

(b) Commodity markets

The demand side of the model captures the behaviour of the three agents denoted in figure 6, namely; households, firms and government. On the one hand, households and government first determine the level of saving and then allocate the remaining disposable income between different commodities while on the other hand firms demand investment and intermediate goods. Households receive income from factors while government gets its income from taxes. In the Lofgren et al. (2001) model, household income is expressed as follows:

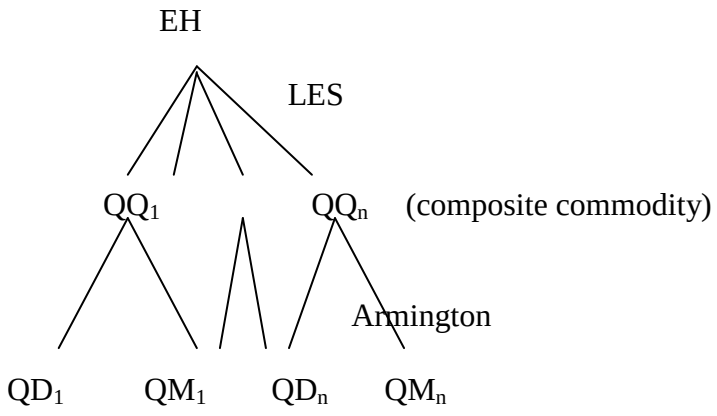
$$YH_h = \sum_f W_f QF_f (1-t) \text{..... (3.27)}$$

Where YH_h is income for household h, W_f is the return to factor f, and QF_f is the factor endowment for household *h*.

Household demand

Microeconomic theory assumes that households maximize utility subject to a given budget constraint. There are several alternative methods to formulate household demand in the literature[36]. These include; CD utility function, the Linear Expenditure System (LES), and almost ideal demand system (AIDS). According to Kiringai (2010), the CD demand function is convenient to use since its elasticities are easy to estimate from the data in the SAM, with a restriction that all the elasticities must sum to unity. However this renders the functional form more unrealistic. The CES form is an improvement on the Cobb-Douglas form since it relaxes some of the restrictions with constant price and substitution elasticities. The LES formulation however overcomes the restrictions in Cobb Douglas and CES functions, by permitting the use of different income elasticities for consumer goods to satisfy Engels Law. Thus the LES formulation is the most commonly used model of household demand system (Kiringai, 2010). Determination of household consumption is a multi-stage budgeting process. At the top nest, expenditure is allocated among goods either using any of the functional forms described above. At the second nest, expenditure is allocated between domestic and imported goods following Armington (1969) assumption[37]. At the top nest, consumers split the budget between imports and domestic goods, and at the second stage allocate the import budget to different countries (Lofgren et al., 2002). The nesting structure is presented in figure 7.

Figure 7: Structure of household demand



Source: Adopted from Lofgren et al. (2002)

[36]See for example Dervis et al. (1982) for a survey of literature

[37]An alternative approach is to assume imports and domestic goods are perfect substitutes. The Armington assumption is the more plausible and more commonly used approach.

where EH is household consumption expenditure, QQ is composite commodity, QD is quantity of output sold domestically and QM is quantity of commodity imports. As pointed out already, households maximize utility subject to a budget constraint. The LES function is derived from this optimization problem. The general form of the LES household demand can be expressed as follows:

$$\text{Max} \cup = \sum \beta_{ch} \ln\left(QH_c - \gamma_{ch}\right) \quad \text{..... (3.28)}$$

and $\sum \beta_{ch} = 1$

where QH_c is the quantity of commodity c demanded by household H; β_{ch} is the marginal budget share of the commodity, γ_{ch} is the income independent subsistence consumption and $\bigcup$ is the level of utility. The household income that can be allocated for consumption is derived net of savings and government taxes. The constrained optimization problem can, therefore, be expressed as follows:

$$\text{Maximize: } \bigcup (QH_c) = \sum \beta_{ch} \ln(QH_{ch} - \gamma_{ch}) \quad \text{..... (3.29)}$$

subject to:

$$EH_h - \sum PQ_c.QH_c = 0 \quad \text{..... (3.30)}$$

Solving the first order conditions of the maximization problem gives the following results:

$$\frac{\beta_{ch}}{QH_{ch} - \gamma_{ch}} = \lambda PQ_c \quad \text{..... (3.31)}$$

$$\text{and } EH_h - \sum PQ_c.QH_c = 0 \quad \text{.....(3.32)}$$

$$\text{therefore } \lambda = \frac{1}{EH_c - \sum PQ.QH_c} \quad \text{.....(3.33)}$$

The demand for commodity c by household h can be expressed conveniently as follows:

$$PQ_c QH_{ch} = PQ_c.\gamma_{ch} + \beta_{ch}.\left(EH_h - \sum PQ_c.\gamma_{ch}\right) \quad \text{..... (3.34)}$$

To calibrate the model requires the values of the marginal budget share (β_{ch}) and the subsistence consumption parameter (γ_{ch}). The marginal budget share is the first derivative of equation (3.30) with respect to expenditure and

$$\gamma_{ch} = \left[\frac{EH_h}{PQ_C}\right]\left[\alpha_{ch} + \frac{\beta_{ch}}{\varsigma_h}\right] \quad \text{..... (3.35)}$$

Where EH_h is the consumption expenditure by household h while ς_h is the elasticity of marginal utility with respect to income parameter. The other parameters; α_{ch}, EH_h and PQ_c are derived from the SAM and the elasticity of marginal utility is as is the practice gotten from the literature.

(c) Government

In CGE modelling Government is not treated as an optimizing agent but uses policy instruments to create incentives in the economy. These instruments, which are used to simulate policy outcomes in CGE models, include import tariffs, quotas, subsidies, and the exchange rate.

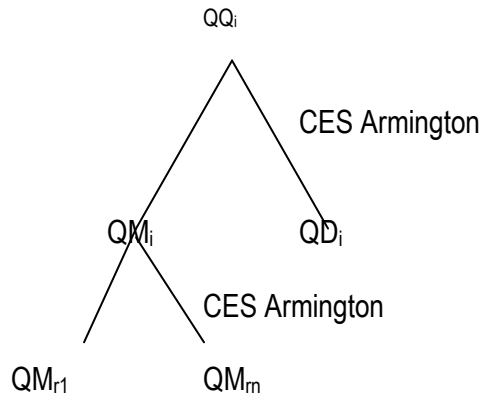
(d) International trade

Imports can be assumed to be perfect substitutes of domestic output and will always adjust to meet domestic supply, but more plausible is the Armington (1969) assumption of imperfect substitutability, which permits intra industry trading (Decaluwe and Martens, 1988). Imperfect substitution is captured through the CES Armington function between imports and domestic goods, and the CET between domestic sales and exports[38]. International trade models often differentiate goods by country of origin as imperfect substitutes. Thus, import demand

[38]According to Bowen et al. (2008), the Armington assumption has three limitations: first, the assumption that all domestic varieties are perfect substitutes, second, same are imperfect substitutes for imports and third that every country has market power with respect to its export goods.

becomes a two- stage decision process where in the first stage, according to Decaluwe and Martens (1988), "consumers determine the total quantity of imports, which are combined with domestic output through a CES Armington function into a composite commodity (QQ_i) equivalent to total domestic supply". At the second level, total imports are allocated to different source markets through a CES function. Figure 8 denotes the international trade nest.

Figure 8: Modelling international trade



Source: adopted from Lofgren et al. (2002)

Export supply is a two-stage decision process; in the first stage, domestic output (QX_c) is allocated between home consumption (QD_c) and exports (QE_c) to maximise revenue through a CET function (equation 3.38). In the second stage, total exports (QE_c) are allocated to different destination markets (QE_{cr}) to maximise revenue again through a CET. The profit maximization problem can be expressed as shown in equations 3.36 and 3.37:

Maximise $PE_c.QE_c + PDS_c.QD_c$ ..... (3.36)

subject to $QX_c = \alpha_c \left[\delta_c.QE_c^{\rho_c} + (1-\delta_C)QD_c^{\rho_c}\right]^{\frac{1}{\rho_C}}$ ..... (3.37)

where QX_c is total domestic output, PDS_c and PE_c are export and domestic supply prices respectively; and QE_c and QD_c are the quantities of exports and domestic demand, respectively. Solving the first order condition for profit maximization yields:

$$\frac{QE_c}{QD_c} = \left[\frac{PE_c}{PDS_c}.\frac{1-\delta_c}{\delta_c}\right]^{\frac{1}{\rho_c - 1}} \quad \text{..... (3.38)}$$

The elasticity of transformation ρ_c required to calibrate the equation 3.38 is also obtained from the CGE modelling literature.

Import demand is also a two stage decision process and is nested at two levels. In the first nest, consumers determine the total quantity of imports (QM_i), which are combined with domestic output (QD_i) through a CES Armington function into a composite commodity (QQ_i) equivalent to total domestic supply. At the second nest total imports are allocated to different source markets through a CES function (QM_{ir}). The two stage decision approach permits the differentiation of trade by source and destination market, with the elasticities of substitution, $\rho_c^{\,q}$ and transformation, $\rho_c^{\,t}$ differentiated by source and destination markets respectively.

(e) Macro Balances

External account

The external account includes trade (imports and exports) and current account (factor payments, institutional transfers and interest payments). To achieve equilibrium in this account, one approach is to endogenize imports and exports and assume all the others are exogenously determined (Kiringai, 2010). The real exchange rate provides the equilibrating mechanism through an implicit link to foreign savings. In the endogenous exchange rate in the foreign closure, the exchange rate adjusts to maintain the base level of the current account balance. The alternative is to fix the exchange rate and endogenous foreign savings to maintain equilibrium in the balance of payments but Francois and Reinsert (1997) argue that in this case, the welfare changes from the model are difficult to interpret.

Savings and investment balance

The choices for this account depend on the modeller. According to Lofgren et al. (2002), The usual practice is to have a savings-driven closure where investment adjusts to the level of savings, which is the neoclassical spirit. Alternative closure rules that are also used include structuralist, neoclassical, Keynesian, Johansen, Kaldorian and Orani (see Decaluwe and Martens, 1988; Taylor, 1990; and Ezaki, 2006).

Government balance

Since the government is not an optimizing agent, the government account is modelled to match specific behavioural assumptions. One approach is to fix real government expenditure, fix tax rates and the deficit (surplus) becomes a residual. An alternative approach is to fix the deficit (surplus) and the tax rates adjust endogenously (Lofgren et al., 2002).

(f) Numeraire

CGE models are homogenous of degree zero in prices. The doubling of all prices, for instance, would double the values but leave quantity unchanged. The model determines relative rather than absolute prices. The common practice is to select one price as the anchor for all other prices, the numeraire. The most commonly used is the exchange rate (Lofgren et al., 2002)

(g) Model Calibration

Paraphrasing Wing (2004), "calibration is a procedure by which a CGE model is 'fit' to the benchmark equilibrium recorded in a SAM. In other words it is the process of computing parameter values and determining appropriate elasticities so that the model solution replicates the base year[39]. Lack of reliable and adequate data in developing countries renders econometric estimation of elasticity and parameter estimates difficult. Thus according to Kiringai (2010), the practice is to get and use elasticities from existing literature: for instance, parameter estimates, expenditure shares and factor shares are computed from observed data, mainly from the SAM while the elasticity estimates are borrowed from published data, benchmarking with countries at a similar level of development or with similar structural features. The elasticity estimates include: Armington elasticities for domestic/ import substitution, transformation elasticities for domestic/export supply, foreign demand elasticities and household expenditure elasticities. The SAM data are assumed to fit the benchmark equilibrium of the economy and prices are equated to unity, so the benchmark SAM values become benchmark quantities and are used to compute technical coefficients and parameter estimates. In summary, the theoretical framework analysed in this section underpins the empirical formulations of the two models (IFPRI Standard Model and the Adam and Bevan, 2006) that we implement respectively in Chapters 4 and 5 of this thesis.

[39]A detailed description of calibration procedures can be seen in Mansur and Whalley (1984).

3.1.4 The Macro-Micro Model for Measuring Poverty and Welfare

An important objective of this study is to determine the possible effects of external shocks on welfare in Kenya. The CGE approach discussed in the foregoing, although sufficient to determine the impacts of external shocks on macro variables and the factor market, is inadequate to account for impacts on poverty and income distribution among households. In this section, we discuss a good method of determining welfare; the macro-micro approach. The macro-micro synthesis, according to Estrades (2013) involves "a process that captures most of the channels through which trade policies and external shocks affect the economy at the macro level (change in relative prices of goods, impact on labour market, change in relative factor remuneration, change in government revenue, change in consumption pattern by households and at the same time incorporates micro data that accounts for distributional impacts at the micro (household) level". Macro-micro models can be grouped into two; the representative household (RH) model and the micro-simulation model. In what follows we briefly discuss each of the models.

(i) Representative household method

The representative household method classifies households in the SAM into various 'representative' groups that are assumed homogenous. In order to apply this method in CGE models, more information than is available in the SAM is required to capture intra-group characteristics. The three additional parameters required to undertake poverty analysis are maximum and minimum incomes within each group, skewness of the income distribution, and the mean income for each group. These parameters can be computed from a household income and expenditure survey. As is evident in the literature, the choice of functional form of intra-group household income distribution is controversial, revolving around log normal and Beta distributions. Authors who have used the log-normal distribution include inter-alia Adelman and Robinson (1979) and Dervis et al. (1982). Demery and Demery (1991) while extending the work of Adelman and Robinson (1979), made an assumption of that variances of logarithms remained constant during the CGE simulation. The authors averred that between groups redistribution can then change poverty even if inequality remains unchanged. According to Chitiga Mabugu (2004), the assumption of the lognormal distribution can generally be accepted in cases where an income group receives all or most of their income from once source. Dissatisfied with the use of lognormal distribution, some authors, such as Decaluwe et

al. (1999) and Stifel and Thorbecke (2002) came up with alternative methods to model poverty. Decaluwe et al. (1999) used a beta income distribution function, which is a more flexible function than the log normal. The authors used an archetype African economy, specifying intra-group (Beta) distributions in conformity with the different socio-economic characteristics of the groups to show that the shape of the distribution may vary across households. In addition, the authors specified a poverty line by endogenizing the price of goods and argued that the fixed and unique bundle of basic needs commodities has an endogenous price; hence the poverty line changes after an experiment (Chitiga Mabugu, 2004). On their part, Stifel and Thorbecke (2002) used data of an archetype African economy with dualism. They used a Beta distribution for the income distribution of households and calculated poverty measures after economic shocks.

Another alternative in the RH approach is what is known as the "micro-accounting" approach, which, as discussed in Estrades (2013) assumes that each RH is representative of all households in its group, where the survey can be fed with data both on income by RH and on commodity prices in order to compute the changes in real income for all households of the survey, as well as to also adjust the value of the poverty line (In this case, the observed income distribution for the sample of actual households is taken into account. In this way, according to Estrades (2013) the approach has an advantage compared to the distribution function approach. The main drawback of this method however according to Estrades (2013), is that it assumes that "within-group distributions are unaffected by the shocks under consideration and disregards changes in employment at a macro level, as individuals are assumed to stay in their initial activity". Further according to Estrades (2013), if the model is dynamic, this approach does not take into account other changes such as the change in population structure by age and rural/urban structure. Agenor et al. (2004) suggested a variant of the micro-accounting approach, which they called the 'reweighting method'. In this approach, the authors suggested three dimensions: rural/urban, agriculture/formal/informal, skilled/unskilled. They also reweighted the household survey sample, holding the underlying characteristics constant. Additionally, income distribution within groups changes to the extent that population and income shares of each group change over time. Paraphrasing the authors, "when the simulated shock has an impact on employment, applying re-weighting techniques significantly modifies the poverty results as compared to the simple micro-accounting approach and the distribution function approach". The drawback in this approach is that, paraphrasing Estrades (2013); "changes in employment are incorporated by changing the weights of individuals without

taking into account behaviour". As can be deduced from our discussion, the RH approach is based on very strong theoretical assumptions such that the choices of households belonging to a given category are represented by the choices of a unique household maximizing its utility so that these choices coincide with the aggregated choices of a large number of heterogeneous individuals. Some authors such as Piggot and Whalley (1985) have attempted to incorporate as much as possible the income distribution and poverty data by greatly disaggregating household types. When dealing with households with very different characteristics (e.g. sources of income), such as the ones to be found in many LDCs, these types of models are ill-equipped to perform a comprehensive poverty analysis (Chitiga Mabugu, 2004). These drawbacks notwithstanding, the RH approach is still attractive "because of its simplicity and because it captures the largest impact of reforms", to paraphrase Bourguignon et al. (2008). Examples of studies that used the representative household approach in an African setting are cited in Chitiga Mabugu (2004)[40]. Next we analyse the alternative micro-simulation approach.

(ii) CGE Micro-simulation model

The micro-simulation approach in CGE modelling was introduced into the economic literature by Occult (1957). Carri (2008) defines CGE Micro-simulation as "modelling of income distribution and consumption of households, taking into consideration taxes and transfers while leaving household behaviour exogenous". There are two strands of literature on microsimulation modelling; fully integrated models and sequential (also known as top-down) models[41]. As discussed in Ahmed and O'Donoghue (2007), the fully integrated microsimulation approach has been used by several researchers, including Tongeren (1994), Cogneau (1999), Cockburn (2001), Cororaton and Cockburn (2005), Rutherford et al. (2005), Anabi et al. (2005), Cogneau and Robilliard (2000), and Cogneau et al. (2000) among others. Integrated CGE microsimulation according to Cockburn et al. (2010) "is straightforward to implement and requires only a standard CGE model and a nationally representative household survey with information on household income and consumption. Implementing the method involves shifting from a model with 'representative' households to 'real' households and ensuring that every household has an income and expenditure vector such that, unlike the RH approach, these are all actual households". The assumptions of the basic CGE model are

[40] These include Davies et al. (1994), Rattso and Torvic (1998), Mabugu (2001) and Chitiga-Mabugu (2001), all on Zimbabwe.
[41] See Ahmed and O'Donoghue (2007) for an elaborate survey of literature on these models

retained but the model code is changed to increase the number of households in the set defining household elements. Poverty is then analysed using an appropriate technique such as FGT indices. The model by Cogneau and Robilliard (2000) is one example of a fully integrated microsimulation model. This model, whose basic structure is borrowed from Cogneau (1999), attempts to examine the impact of several shocks on income distribution and the poverty situation in Madagascar. The model treats the determination of inter-sectoral relative prices as endogenous and disregards the usual assumption of representative agent, since, to paraphrase Ahmed and O'Donoghue (2007), "it is not able to capture the effects of growth strategies on multidimensional positions taken by households". According to Ahmed and O'Donoghue (2007), the representative agent assumption is relaxed in this model in a manner where first, "the information on micro variables is used from the household level, and secondly the household behavioural equations are estimated econometrically. These econometric estimations when imputed into the overall model allow for the behaviour to be endogenised". Thirdly according to the authors, the model underscores the importance of the error term for "assessing the unexplained heterogeneity". The model's treatment of the heterogeneity, which is quite explicit in terms of consumption preferences of individuals, set of opportunities available, skills and labour preferences is among its major strengths.

Cockburn (2001) suggests an approach that fully integrates the CGE model with the microsimulation process, which he applies using Nepalese data. In this model, the first step is to "create a link between the income and expenditure accounts in the SAM with the income and expenditure data provided in a household survey", according to Ahmed and O'Donoghue, (2007). The second step is to "introduce the entire set of weighted households directly into the CGE model and balancing the SAM data to establish equilibrium, using appropriate software such as GAMs. The balanced SAM is then stored in a spreadsheet from where the data can then be imported by GAMS. Once the new data has been imported and tested by running an aggregate form, the household data (aggregate form) can be replaced into weighted data (individual form) taken from the household survey". Although integrated CGE microsimulation seems to be the ideal approach, the data requirements can prove to be large and full reconciliation between micro and macro data is essential. Moreover, the size of the model can quickly become problematic and force the modeller to impose some simplifications either on the complexity of microeconomic household behaviours or on the size of the CGE model in terms of the number of sectors and factors of production. The 'top-down' or sequential approach is an alternative to integrated models, and according to Chitiga Mabugu

(2004) it has been more popular among researchers than the integrated approach. It uses a CGE and a microsimulation module in a sequential way: first the CGE model is run followed by a second step in which the changes in some selected variables (e.g. consumer prices, wages and employment) are passed on to the microsimulation module. As Robilliard et al. (2003) explain, "top-down models have the advantage of avoiding the use of representative agent assumptions, while accounting for general equilibrium effects, and also have the advantage of not formally requiring full reconciliation of micro and macro data". However, one disadvantage of this approach is a lack of theoretical consistency and coherence between the CGE and the microsimulation models, a problem that Savard (2003) attempted to address when he developed a top-down bottom-up (CGE-TDBU) model. Savard (2003) explains his approach as follows: "at first, aggregate results from the microsimulation module are incorporated in the CGE model, and then a loop is used to run both models iteratively until convergence is obtained. However, the existence of a converging solution is not guaranteed". Explicitly modelling each household in the CGE model addresses the shortcomings of the RH model and as recommended by Bourguignon et al. (2003) it integrates 'real' households within a CGE framework rather than using representative households.

Robilliard et al. (2002) conducted a study in which they simulated various shocks on the economy of Indonesia, using a micro model (incorporating all survey households and not representative households) that was fed with results from a CGE model. The authors showed that "representative household assumptions biased the results and led to wrong results in some of cases". Although this model was heavily criticized by Davies (2003) on account of inter-alia its degree of aggregation, it showed the importance of using microsimulation as opposed to aggregated models (Chitiga Mabugu, 2004). Busolo and Lay (2003) on Colombia model the household income generation process by taking individual and household heterogeneity into account. Household income is modelled such that it accounts for decisions on employment and other non-employment. Implementing this approach, which is what we adopt in this study requires that we integrate the three household categories of rural, urban skilled and urban unskilled in the aggregated SAM (2003) with the over 10,000 households in the Kenya Integrated Household Budget Survey (KIHBS, 2006), which is a nationally representative household survey with information on income and expenditure. Given that the SAM and KIHBS data are of different sources and year, data reconciliation is inevitable to create a coherent dataset. There are various steps one can follow in order to harmonise the data, as Hérault (2005) does in his study on South Africa. Paraphrasing Hérault (2005), the first thing

one would need to do is to " multiply the household income and expenditure vectors by their respective vectors of sample weights, so as to be able to extrapolate to national values as they appear in the SAM while taking care to account for inflation in the intervening years for the survey data. Also, as the aggregate survey income and expenditure data is subsequently fed into the SAM, it renders it unbalanced and therefore the second step is to employ an appropriate balancing procedure for the SAM". Balancing the SAM can be for instance through the 'least-squares SAM balancing procedure' that was used by Cockburn, et al. (2010) or the minimum entropy difference approaches popularised by Golan, Judge and Miller (1996) and Robinson, Cattaneo and El-Said (2001). The top-down microsimulation method is thus quite time and skill intensive. It requires a thorough understanding of the datasets with plausible assumptions made when reconciling the data. In constructing the SAM (2003), data on households was obtained from national accounts with 2003 being the base year; while KIHBS data was collected a few years later. These divergences in data render this method even more challenging to implement. Furthermore, in implementing the top-down approach, a behavioural microsimulation model that captures individual behaviour after an economic shock is needed to link it with the CGE model. A good example of such a model is the one Hérault (2005), which we have already alluded to. This model specifies three regression modules as follows; first is a "selection model for labour market choices comprising of a utility function with the underlying assumption that each individual chooses the sector with the highest associated utility". The second is a regression module for earnings which, according to Hérault (2005) is used to "predict individual gross earnings in each of the labour market categories chosen in the selection module". Finally, is a computation of household income that is realised after conducting regressions of the other two modules. Here, to quote Hérault, "individual earnings are added to other (observed) income to generate the updated household incomes".

The first step in linking the microsimulation model with the CGE model consists of carrying out simulations in the CGE model. Paraphrasing Hérault (2005), "the model returns the new macro-structure of the economy after the simulation shock, while taking into account the interactions between the various sectors of the economy". Some particular sets of variables derived from the simulation are of interest. These include inter alia prices, returns from capital and labour, and employment levels. In a second step, quoting Hérault; "the changes in the variables are passed on to the microsimulation model. With regard to prices, this procedure is relatively straightforward, because prices are exogenous to the microsimulation model". It would be necessary in our case however to aggregate the commodity groups in the KIHBS to

be congruent to the 50 sectors of the CGE model so that the price vector generated by the CGE model is passed on to the microsimulation model. However it is harder to pass on the other variables into the microsimulation model. The changes arising from the CGE model cannot be directly transmitted to the microsimulation model since it is based on microeconomic data, whereas the CGE model simulation yields macroeconomic figures. Thus there is lack of consistency between the results of the two models. It is common practice in the top-down method to impose macroeconomic results on the microsimulation model. This according to Hérault "involves coefficients of the microsimulation model being modified in such a way that it reproduces the macro numbers obtained from the CGE model, while allowing for the price and factor return changes which may affect individuals' behaviours". This is achieved by applying micro-macro consistency equations[42].

In a nutshell, the discussion in the foregoing delineates the strengths of the micro-simulation approach whose key advantage is the fact that it makes it possible to evaluate the micro effects of changes in macro variables, brought about by exogenous shocks and/or policy changes. Micro-modelling is thus useful in order to evaluate more precisely the macro impacts on poverty, income distribution and welfare. However, one major shortcoming of the micro simulation approach is its inability to directly measure welfare. Next we describe equivalent and compensating variations that are useful direct measures of welfare, which in this case refers to individual's well being measured in terms of utility.

3.1.5 Strengths and Weaknesses of CGE Modelling

CGE models are preferred over other frameworks because of their relative strengths. Probably the most important feature of the CGE framework is the fact that it is strongly grounded in microeconomic theory, thus it makes it easier for the modeller to quantify the impacts with real data. The model is not only able to explicitly incorporate price effects; it can also isolate the effects of individual policies while explicitly specifying the causal mechanisms through which shocks influence the economy. Further, the sectoral and institutional detail of the CGE model allows for a more detailed analysis of changes in the economy (after a policy or external shock) than is typically possible with macro-econometric models, which are usually more data-driven

[42]See Hérault (2005) for an elaboration of this technique.

(Thurlow, 2004). Another strong point for the CGE model is that it takes into account the inter-dependencies between different sectors, economic agents and markets in the economy and thus can reveal indirect or unintended effects, allowing for investigation the backward/forward impacts on different sectors of the economy from shocks. Moreover, the CGE model enables the modeller to trace the distributional impacts of consumer income changes, which is necessary to determine the effects of external shocks on welfare and poverty.

Despite their strong points, CGE models have come under criticisms by a number of scholars. Questions have been raised about the robustness of the CGE model when it comes to finding a real-world equilibrium solution. An answer to these questions according to Wing (2004) is complex, as it hinges on three important issues; existence, uniqueness and stability of the equilibrium. These attributes are necessary and sufficient conditions for a good CGE model, implying that "its solution is predictable, replicable and robust to perturbations along the path to convergence". General equilibrium theory revolves around two rather very strong assumptions[43]. First, according to Wing (2004), "it is assumed there is a weak axiom of revealed preference whereby an economy with multiple households exhibits a stable preference ordering over consumption bundles in the space of all possible prices, income levels ruling out the potential for non-homothetic shifts in households' consumption vectors if incomes change but prices remain the same". The second assumption is "gross substitutability, where the "aggregate demand for any commodity or factor is non-decreasing in the prices of all other goods and factors such that if this holds a vector of equilibrium prices exists and is unique". Moreover, according to Ahmed and O' Donoghue (2007), general equilibrium theory itself has been under scrutiny for a long time by scholars who have been sceptical about the uniqueness and stability of the Arrow-Debreu equilibrium. Other criticisms levelled against CGE models as pointed out in Kiringai (2010) are their static nature (based on a fixed one-year dataset) hence are not useful for forecasting; their functional forms based on several assumptions; their results being very sensitive to the specification form, closure rules and the choice of base-year; use of point estimate parameters derived through calibration that are not subjected to econometric tests; and their use of borrowed or guesstimated elasticities

[43] See Wing (2004) for an exploration of literature that shows how difficult it is to satisfy the two conditions in the presence of real-life economic distortions like taxes.

3.2 Equivalent and Compensating Variation

Compensating variation (CV) and equivalent variation (EV) are two methods that are usually used to directly measure welfare. The two concepts were introduced into the literature by Hicks (1956) as alternatives to the consumer's surplus. It is important to point out that it is not possible to measure the incidence of poverty or inequality using EV or CV. Moreover, while consumer's surplus can only measure utility in ordinal terms, EV and CV are exact measures of utility, that is, they are 'money-metric'. According to Nick Sanders of the University of California, Davis, "it is possible to cardinally determine the amount of utility (welfare) lost or gained after a price change". The two concepts are similar but not exactly the same thing. Both deal with changes in price and how this affects utility-a measure of welfare. Paraphrasing Nick Sanders, "EV is how much money the consumer would be willing to give up (or be paid) to prevent prices from changing. It is the change in income that would get the consumer to the same new level of utility as the change in price would if it happened". Thus, to get the EV according to Nick Sanders, "the consumer is put in a different utility level under old prices by changing income". On the other hand, "CV is how much money a consumer would need to be given (or taken from him) to get him back to the same level of utility that he had before the price change". Therefore, to get CV according to Nick Sanders, "the consumer is taken to the initial level of utility at the new prices by changing income". Although EV and CV are exact and unambiguous measures of welfare change, most empirical work has used approximations (Bacon, 1995). This is largely motivated by their information requirements especially the fact that the utility function need to be known in order to compute utility. Hence, a series of approximations have been suggested whose information requirements are much less. One approach usually used treats these as Taylor series approximations of increasingly higher−order polynomials, but according to Bacon (1995) the approach has two problems. In general, the higher−order polynomial is expected to be a more accurate approximation, but the higher−order functions have greater information requirements and indeed may need knowledge of the demand function itself. The second problem is that higher−order polynomials are not always closer approximations, particularly when large price changes are involved. The view that one has to have a knowledge of the utility function to be able to calculate EV or CV has led to further research in this area. As discussed in Bacon (1995), Vartia (1983) provides a method of calculating EV and CV for any demand function that is derived from a well behaved but unknown utility function. Vartia argues that knowledge of the demand function is sufficient

to determine the true EV and CV; whereas the demand curve referred to is one where quantity is a known function of price and income. This approach starts with a differential equation based on Roy's identity[44]:

$dC(P)/dP = Q(C(P), P)$……..equation 3.39

where *C* is the compensating level of income at a given utility level for a given price, and *Q* is the demand as a function of that level of compensating income *C* and price *P*. The compensating level of income is the income, with price *P* that yields the same utility as the original income and base price. It is a calculation based on comparing different price/income combinations around a given utility curve without directly specifying the curve. For certain demand functions it is possible to obtain an explicit solution to the above equation by integration. Vartia's approach is based on obtaining a numerical approximation to the solution of the differential equation by representing it as a difference equation in which the size of steps can be made as small as needed to obtain convergence to any preset level of accuracy. The key result used by Vartia is that along a constant utility curve (with a single price change), the change in the compensating level of income (that holds utility constant) is given by a differential equation in the compensating level of income:

$(C): dC(t)/dt = Q\{P(t), C(t)\}\, dP(t)/dt$……..……equation 3.40

where prices follow a linear path (as a function of time *t*) from the initial price *P* (0) to the final price *P* (1). That is, along the price path, the compensating level of income follows a differential equation whose elements are built up out of the demand function and prices. It calculates the change in compensating income as the price change times the demand at that point, where demand is a function of the level of compensating income and the price. By changing the compensating income at each point, the change in compensating income varies along the price path.

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[44]This is named after the French economist Rene Roy who in 1947 came up with the lemma that relates the ordinary (Marshallian) demand function to the derivatives of the indirect utility function.Specifically, where V(P,Y) is the indirect utility function, then the Marshallian demand function for good i can be calculated as: $x_i^m = -\frac{\partial V}{\partial p_i} / \frac{\partial V}{\partial Y}$ where P is the price vector of goods and Y is income.

By summing all these increments, the total change, that is, the CV in income is obtained, and the fact that the level of compensating income and the associated level of demand are known at the starting point (being the actual levels of money income and demand) allows an iteration along the curve in a series of approximations to yield a final value for the level of compensating income. The EV can be calculated in exactly the same way, but the starting values must use the final price and demand, and the iteration moves along the price path to the base price. Thus according to Bacon (1995), the EV and CV are correct measures of the change in welfare brought about by a price change. However to paraphrase Varian (1992), "the decision to choose either EV or CV as the more appropriate measure of welfare depends on the circumstances involved and what question one is trying to answer. If one is trying to arrange for some compensation scheme at the new prices, then the CV seems reasonable, but if one is trying to get a reasonable measure of the "willingness to pay" then EV is the measure of choice". Our method of choice in this study is EV, because we are interested in measuring the 'consumer burden' as a proxy for welfare loss.

3.3 Data

The 2003 social accounting matrix (SAM) for Kenya, constructed in 2006 is the benchmark data that we use to calibrate to the base the analytical models that we use in the analytical chapters of this thesis[45]. The structure of the SAM is as shown in table 11. It is likely that the structure of the Kenyan economy has changed since 2003, and thus it would be ideal to update the database if we are to capture the changes that have occurred on production technology and structure of demand in the country. However it is beyond the scope of this study to construct a new SAM for Kenya due to the enormity of the exercise in terms of time and requisite resources[46].

[45] See Kiringai, et al. (2006) for a detailed explanation of how the 2003 SAM for Kenya was constructed.
[46] It is important to note that a new SAM (2009) for Kenya was recently officially released by KNBS through the *Economic Survey, 2015*.

Table 11: Basic Structure of the 2003 SAM for Kenya

	Activities	Commodities	Factors	Enterprises	House-holds	Government	Investment	Rest of the World (ROW)	Total
Activities		marketed outputs			home-consumed outputs				activity income
Commodities	intermediate inputs	transactions costs			private consumption	government consumption	investment, change in stocks	exports	total demand
Factors	value-added								
Enterprises			factor income to enterprises			transfers to enterprises		transfers to enterprises from ROW	enterprise income
House-holds			factor income to households	surplus to households		transfers to households		transfers to households from ROW	
Government		sales taxes, import tariffs	factor income to government	surplus to government, enterprise taxes	direct household taxes			transfers to government from ROW	government income
Savings				enterprise savings	household savings	government savings		foreign savings	
Rest of the World (ROW)		imports		surplus to ROW		government transfers to ROW			Foreign exchange outflow
Total	activity expenditures	total supply	factor expenditures	household expenditures	enterprise expenditures	government expenditures	investment	foreign exchange inflow	

Source: Adopted from Kiringai et al. (2006)

The SAM presented in table 11 is extensively explained in Kiringai et al. (2006). Here we elucidate on its key feautres. As we noted earlier, the SAM is a square matrix, whereby in its cells are the entities that carry out production- the 'activities' and those representing markets for goods and non-factor services-the 'commodities'. SAM flows are valued at producers' prices in the activity accounts and at market prices (including indirect commodity taxes and transactions costs) in the commodity accounts. The commodities include activity outputs, which are either exported or sold in the local market, and imports. In the activity columns, payments are made to commodities (intermediate demand), and factors of production (value-added comprising of operating surplus and compensation of employees). In the commodity columns, payments are made to domestic activities, the rest of the world, and various tax accounts (for domestic and import taxes). This treatment provides the data needed to model imports as perfect or imperfect substitutes vis-à-vis domestic production. Secondly, Domestic and international trade flows in the SAM are explicitly associated with transactions (trade and transportation) costs, also referred to as marketing margins. For each commodity, the SAM accounts for the costs associated with domestic, import, and export marketing (i.e., each commodity purchases other trade and transport commodities). For domestic marketing of domestic output, the marketing margin represents the cost of moving the commodity from the producer to the domestic consumer. For imports, it represents the cost of moving the commodity from the border to the domestic market, while for exports it shows the cost of moving the commodity from the producer to the border. Third and finally the government is disaggregated into a core government account and different tax collection accounts, one for each tax type.

In the SAM, direct payments between the government and other domestic institutions are reserved for transfers. Payments from the government to factors (for the labour services provided by public sector employees) are captured in the government services activity. Government consumption demand is a purchase of the output from the government services activity, which in turn, pays labour.The numerical SAM (2003) for Kenya is presented in Annex Table A1. As observed, the SAM has 50 commodity and 50 activity accounts. The activity account is valued at producers' prices, in this case Kshs. 1,886,249 million. The commodity account is valued at purchase prices i.e., Kshs. 2,440,000 million, which includes indirect commodity taxes and transaction costs. There are two factors of production in this matrix: labour (Kshs. 430,332 million) and capital (Kshs. 499,236 million). Labour has been further subdivided into skilled, semi-skilled and unskilled, while capital includes land. Trade and transportation costs are the costs associated with domestic, import, and export marketing and are valued at Kshs. 97,623 million. Government income and payments are disaggregated into a core government account and different tax collection accounts

are valued at Kshs. 218,359 million. The SAM has ten urban and ten rural households so that there are twenty households in total. The capital account has the saving-investment account valued at Kshs. 196,554 million and the change in stock account values at Kshs. 17,444 million. The rest of the world account which deals with imports and exports are valued at Kshs. 424,120 million. Data on production and trade elasticities is not available in the SAM and is obtained from the CGE literature.

CHAPTER FOUR: IMPACT OF TERMS OF TRADE ON ECONOMIC GROWTH, INCOME DISTRIBUTION AND POVERTY IN KENYA

4.1 Introduction

In Chapter 2, we reviewed the theoretical and empirical literature that examines the effects of TOT on the economies of developing countries. Our goal in the present chapter is to analyse the effects of TOT on Kenya's economic performance. Specifically we are interested in determining the impact of TOT on (i) macroeconomic variables, including real GDP, investment, private consumption and savings; (ii) sectoral output; (iii) poverty and last but not least (iv) income distribution and welfare. Next before embarking on the simulations, we present an overview of Kenya's external trade experience, focusing on food (maize, rice and wheat) and petroleum oil sectors. These two sectors are chosen because they play a critical role in transmitting external shocks into the economy[47].

4.2 Kenya's External Trade Experience

According to Kiringai (2010), the performance of Kenya's external sector has not been satisfactory, and this has been the motivation behind several liberalization episodes that the government has undertaken since independence (see the review of literature in chapter 1 of this thesis). Kenya mainly exports primary products, which face elastic demand in the global market. These exports include horticulture, tea, coffee, textile apparels and soda ash while major imports include petroleum, food and capital goods. Table 12 shows a continuously unfavourable trend in the balance of trade for Kenya.

[47]We chose the food subsector because of two reasons; first, it is of crucial importance as a source of income to Kenyan households. Secondly, these foods particularly maize and wheat are the main staple foods in Kenya and therefore any price changes occurring have a direct bearing on welfare in the country.

Table 12: Kenya's Balance of Trade as a Share of GDP, 2003-2014

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Exports	16.1	16.7	22.2	20.1	20.5	25.4	24.8	32.8	16.8	15.2	13.2	10.0
Imports	22.6	21.9	37.71	41.7	45.3	56.8	56.6	75.8	42.7	40.4	37.2	30.2
Trade balance	-6.5	-5.2	-15.5	-21.7	-24.7	-31.4	-31.8	-43.0	-25.9	-25.2	-24.0	-20.2

Source: Author's Computation from Statistical Abstract and Economic Survey, Various Years

It is discernible from Table 12 that the value of imports to Kenya has been growing faster than the value of exports during the period under review, hence the deterioration in the trade balance observed in the table. Clearly, the trade balance worsened beginning 2005, with its GDP share increasing to -15.5 from -5.2 in 2004. The trade imbalance continued to rise thereafter, reaching its peak in 2010, when it hit -43.0 percent of GDP. Subsequently, it steadily recovered, so that by 2014 it fell to -20.2. Exchange rate policy is a major factor influencing a country's global competitiveness, as the RER (inflation adjusted) measures the relative price of tradables to non-tradables. If the RER depreciates, a country's exports become cheaper and hence more attractive to the rest of the world, while imports become relatively more expensive, thus discouraging consumption of imported products and thereby favouring domestic production. The reverse occurs when the RER appreciates. Kenya has since the mid-1990s pursued a free float RER policy that has seen a relatively stable exchange rate. The country's wide trade imbalance could be explained by the fact that while demand for exports declined owing to reduced demand in the trading partner countries (as a result of the recent global economic crisis), the value and volume of imports have increased tremendously due to on the one part the need to facilitate a growing economy in terms of capital goods and on the other part the high petroleum prices occasioned by the political upheavals of the last few years in the oil-exporting countries of Middle East and North Africa[48]. Kenya's terms of trade particularly that of all items has over the years maintained a declining trend, although it marginally recovered in 2009 and 2010[49]. This decline, which is in tandem with the widening trade deficit observable in Table 12, is largely due to the oil price shocks and the importation of high priced food to bridge the gap created by shortages in the domestic market. How

[48] The international price of petroleum has however substantially fallen in the last two years.

[49] In this study our focus is on commodity (or net barter) terms of trade, defined as the ratio of relative export and import prices when volume is fixed. Although it has its weaknesses, this approach is chosen purely on account of ease of data availability. Using income terms of trade (ratio of value of exports to price of imports) is a better approach as it takes into account volume of imports such that even when the price of exports decline relative to imports, it may be more than compensated by an increase in the volume of imports. In other words, since income TOT is actually a measure of an economy's ability to import and in particular its ability to import crucial imports, it is a better variable to use in measuring the impact on economic development.

then is deterioration in TOT harmful to the economy such as Kenya's? As we saw in Chapter 2 of this thesis, opinion is divided among the numerous authors who have written on the subject. It is our endeavour to shed more light on this important issue in this chapter.

Trade in Food Products

Agriculture remains the largest sector in the Kenyan economy. It directly contributes 25 percent to GDP and 60 percent of export earnings (Republic of Kenya, 2007). The major agricultural commodities produced in Kenya are classified into food crops, industrial and export crops, horticulture and livestock and livestock products. The major tradable food crops are maize, wheat and rice, while export crops include tea, coffee and horticultural crops. Key livestock products include beef and milk. Our scope in this study is limited to analyzing how changes in international food prices shock the economy, this being done by carrying out CGE-based simulations on food. Table 13 shows the trend in the export and import of the major food crops for some selected years.

Table 13: Trade in Major Food Crops, 2003-2014 (Value in Kshs millions)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Exports												
Maize (raw)	125	246	289	360	563	473	283	284	169	57	192	324
Meals and flours of Wheat	6	1	3	17	19	95	109	78	159	290	145	87
Imports												
Maize (raw)	1,417	4,647	924	1,550	4,716	6,665	33,945	5,471	11,479	6,451	2,291	9,308
wheat flour	6,267	6,755	7,957	8,019	9,706	13,937	13,841	17,451	31,371	29,743	1,964	1,712
Rice	2,981	3,659	3,962	4,540	1,095	5,985	7,430	7,958	12,548	14,520	14,111	15,305

Source: Economic Survey, Various Years

As seen in Table 13, food exports during the selected period are almost negligible; apart from maize exports whose annual average value between 2003 and 2014 was about Kshs 280 million. On the other hand, over the same period the country recorded increasing levels of imports of wheat and rice while that of maize was erratic. The annual average for the value of maize imports was about Kshs 7.4 billion between 2003 and 2014 compared with Kshs 12.4 billion and Kshs 7.2 billion of wheat and rice respectively. The main reason for increased food imports is market liberalization reforms the government has been implementing since 1993 together with the decline in domestic production (Waiyaki et al, 2007). Paraphrasing Levin (2010), "escalating food prices has been a major concern of policy makers in recent years, especially in developing countries". As

a result, a plethora of studies have been done to assess the effects of the price rise on welfare. Some of these studies are cited in Levin (2010) and include Zezza et al. (2008), Dessus et al. (2008), Ivan and Martin (2008), Wodon and Zaman (2008), Arndt et al. (2008) and Reys et al. (2009]. A common finding of these studies is that poverty will generally increase in the short-term following increased food prices. As we noted in Chapter 2, Levin (2010) examined the effects of an increase in the world price of maize on poverty and income distribution in Kenya and found that a favourable TOT shock would have positive welfare effects.

Trade in oil products

Kenya is a net importer of petroleum oil as Table 14 shows. Petroleum is second to wood fuel as the most important source of energy in Kenya. According to Ngui et al. (2011), petroleum subsector contributes 8.4 percent to total GDP and represents 20 percent of the total primary energy consumption in the country. The transport sector is the largest consumer of petroleum products followed by the manufacturing sector and others (agriculture, tourism, power generation and government). That the oil subsector has a prominent role in Kenya's industrial and commercial structure cannot therefore be gainsaid. Recent research by the African Development Bank reveal that in most African countries including Kenya, petroleum prices remain the major drivers of inflation with implications for economic growth and welfare (see www.afdb.org)[50]. Table 14 shows Kenya's exports and imports of petroleum products for some selected years.

[50] Kenya decontrolled prices of petroleum products in 1994, thus leaving the oil market to its devices. However in December 2010 the government reversed this policy and reverted back to price controls on petroleum products ostensibly to protect consumers. According to a study by Orondoh (2014) the policy of oil price controls has had little significance if any in reducing the level of inflation in Kenya. It has only managed to reduce inflation volatility.

Table 14: Trade in Petroleum Products, 2003-2014 (Value in Kshs millions)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Imports												
Crude petroleum	25,415	45,954	51,529	55,016	49,241	81,453	54,495	72,598	124,042	68,086	41,037	-
Petroleum fuels	39,493	41,522	42,494	55,807	70,205	110,664	52,304	61,171	102,100	116,736	252,673	292,673
Lubricating oils and greases	1,878	1,310	1,647	2,897	2,331	5,560	13,497	5,671	24,059	28,608	-	-
Total	66,785	88,785	95,669	113,720	121,776	197,676	120,296	139,440	250,201	213,430	293,710	292,673
Domestic Exports												
Petroleum products	71	832	6,828	6,759	10,347	7,486	6,696	7,158	9,591	5,977	2,652	3,694
Petroleum by-products	221	195	758	658	381	342	436	488	515	606	-	-
Total	292	1,027	7,586	7,417	10,728	7,828	7,132	7,646	10,106	6,583	2,652	3,694

Source: Economy Survey, Various Years

As seen in Table 14, the value of imports rose steadily during the period covered, save for 2008 and 2011 when it rose by unprecedented margins. The tremendous rise in the import bill was occasioned by the escalating prices of petroleum products at the international market, which prevailed for most of those years. The sharp rise in petroleum prices exacerbated an already bad situation, happening at a time when demand for Kenyan exports was on the decline because of the global economic meltdown. The negative oil shock thus contributed to the worsening of the current account deficit, which increased from 5.5 percent of GDP in 2009 to 7.9 percent of GDP in 2010[51]. An increase in the current account deficit usually causes macro-economic instability and dampens economic growth and hence welfare prospects. According to World Bank (2011), petroleum imports accounted for 25 percent of the total import bill in Kenya and as we have seen in the foregoing, the oil subsector has a major role in the economy especially in the transport and manufacturing sectors. Thus, a major price increase in the international market is likely to have deleterious effects on domestic production, trade and consumption.

4.3 Analytical Framework for Analysing Terms of Trade Shocks in Kenya

The conceptual underpinnings of CGE modeling are discussed in Chapter 3 of this thesis. Here we specify an apropriate model to use in analysing the impact of TOT on the Kenyan economy, an analytical framework that is capable of capturing the mechanisms by which external shocks ripple through the economy. Various studies have modelled the Kenyan economy using the CGE approach. More recent of these include; Kiringai (2010), Levin (1998, 2010), Thurlow et al. (2008), Kiringai and Thurlow (2006), Wobst (2005), and Karingi and Siriwardana (2001; 2003). Other older studies included; Damus (1992), Damus et al. (1990), and Mwega (1986). As we noted earlier, Walrasian general equilibrium models that presume a competitive economic environment are not applicable in LDCs including Kenya, because of the inherent structural rigidities characterising their economies. Based on this fact, Lofgren et al. (2002) have, under the auspices of IFPRI specified a neoclassical-structuralist model[52], referred to as "IFPRI Standard Model". This model has features that make it a useful tool to model an economy such as Kenya's. These features include, paraphrasing Lofgren et al.

[51] The current account deficit in Kenya is mainly financed by the financial account and its main source of funds is official flows. In addition to assessing the impact TOT has on welfare in Kenya this study is interested in examining the effects of external shocks transmitted into the economy via official financial inflows

[52] See Dervis et al. (1982) for an exposition of the neoclassical-structuralist model.

(2002), "household consumption of non-marketed commodities, explicit treatment of transaction costs for marketable commodities and a separation between production activities and commodities that allows any activity to produce multiple commodities and any commodity to be produced by multiple activities". The model has been particularly useful in modelling African economies as is evident in Levin (2010), Thurlow et al. (2008), Kiringai and Thurlow (2006) as well as Wobst (2005). We thus follow this tradition to apply the model in our analysis in this chapter[53]. Table A9 in the annex presents the functional (empirical) form of the model[54], while Table A10, also in the annex defines the sets, parameters and variables. The IFPRI model has five parts, including the production structure, trade structure, institutions, home consumption and marketing margins. The model takes the functional form shown in figure 6 and follows what we earlier observed about the SAM disaggregation of factors, activities, commodities and institutions. It is expressed as a set of (mostly non-linear) simultaneous equations, which define the behaviour of economic agents. Producers are driven by the desire to maximize profits, while consumers' aim is to maximise utility. Additionally, the model has a set of constraints that must be satisfied, covering all markets and macroeconomic variables, such as the investment-savings balance, government balance and the ROW current account balance. Next is a more detailed discussion of the building blocks of the model.

Activities, Production and Factor Markets

As already mentioned, the structure of the IFPRI model takes the form as shown in figure 6. The underlying assumptions in this framework is that producers maximise profits subject to a production technology specified by a CES function at the top level, while the value added is a CES function of primary factors. The aggregate intermediate input is a Leontief function of disaggregated intermediate inputs. In the words of Lofgren et al. (2002), "each activity in the model produces one or more commodities according to fixed yield coefficients. Each activity uses a set of factors up to a point where the marginal product of the factor is equal to its wage, which may differ across activities". The choice of functional form (in the first level of the nest in figure 6) is informed by the structure of the input-output model. According to Kiringai (2010), the Leontief functional form is used in production functions where the modeller assumes there is no substitutability between factors of production and intermediates, i.e. that

[53]The Kenyan version of the IFPRI Standard Model is domiciled at the Kenya Institute For Public Policy Research and Analysis (KIPPRA)

[54] See manual by Lofgren et al. (2002) which has detailed explanatory notes for each and every equation in the model.

technology is fixed. Thus in the Kenyan model valued added (QVA_a) and aggregate intermediate quantities ($QINTA_a$) are combined under a Leontief specification to get total output. The second level nest is a CES aggregation of value added, which combines the factor demands of an activity into an aggregate quantity of value-added for that activity. Factor aggregation as already mentioned can be expressed in terms of a CES or CD function. As in Kiringai (2010), we adopt the CES approach to allow for substitution between labour and capital. The degree of substitution between the two composite factors depends on the elasticity of substitution. The intermediate inputs are a composite commodity, which is an Armington aggregation of domestically produced goods and imports from different external markets. Moreover, the model assumes that firms can substitute between domestic and foreign intermediate inputs through a CES function. At the third nest is a CES aggregation of pairs of factors, with substitution between different types of factors. The CES functional form permits the use of different elasticities of substitution between pairs of factors. Activities can produce more than one commodity, for instance agriculture can produce market and non-market commodities. Activity output QA_a is converted to commodity outputs ($QXAC_{ca}$) in fixed proportions (θ_{ac}). Commodities produced by different activities are aggregated to a composite commodity output (QX_c) through a CES function.

Institutions

Paraphrasing Lofgren et al. (2002), "institutions are represented by households, enterprises, the government and the rest of the world. The households receive income from the factors of production and transfers from other institutions. Transfers from the rest of the world to households are fixed in foreign currency. Households use their income to pay direct taxes, save, consume and make transfers to other institutions. Consumption by households is modelled as LES demand functions derived from maximization of Stone-Geary utility function"[55]. Furthermore, the model assumes that factor incomes accrue only to enterprises and not households, whereby enterprises also receive transfers from other institutions. Incomes are allocated to direct taxes, savings and transfers to other institutions (no consumption). According to Lofgren et al. (2002), "government collects taxes and receives transfers from other institutions and uses this income to purchase commodities for its consumption and for transfers to other institutions. Government consumption is fixed in real terms whereas

[55] The LES approach allows modelling of income independent of subsistence consumption and the use of different income elasticities for consumer goods to satisfy Engels Law.

government transfers to domestic institutions are CPI-indexed, while government savings are regarded as residue". The ROW is the final institution. As noted above transfer payments between the ROW and domestic institutions and factors are fixed in foreign currency. Foreign savings (current account deficit) is the difference between foreign currency spending and receipts.

Commodity Markets and Prices

All commodities (domestically produced and imports) are assumed to enter the market, save for home-consumed output. Domestic output may be sold in the market or consumed at home. A CES function is used as the aggregation function at the first stage of commodity flow while a CET function is used at the second stage. Demand for exports is assumed to be infinitely elastic at given world prices while domestic demand is the aggregate of the demands for private consumption, government consumption, investment, intermediate inputs and transactions inputs. If a commodity is imported, all domestic market demands are for a composite commodity made up of imports and domestic output, the demands for which are modelled as CES aggregation function following Armington (1969). To paraphrase Lofgren et al. (2002), "total market demand goes to imports for commodities that are not produced domestically, and to domestic output for non-imported commodities. The derived demands for imported commodities are met by international supplies that are infinitely elastic at given world prices. The import prices paid by domestic consumers also include import tariffs and the cost of a fixed quantity of transaction services per import unit. Similarly the derived demand for domestic output is met by domestic suppliers and the prices paid by the consumers include the cost of transactions". Finally, flexible prices ensure that there is market equilibrium whereby demands and supplies of domestically marketed domestic output intersect. There are two important things we need to note in the functional form of the model; first, the world import price is fixed, arising from the 'small-country' assumption, i.e. for all imports, the assumed share of world trade for the modelled country is so small that it faces an infinitely elastic supply curve in the world market. Secondly, the model does not include any commodities that are imported for immediate re-export. Since this is a significant feature of Kenya's trade, the 2003 SAM for Kenya is crafted in such a way that it includes an activity that imports a non-produced commodity and exports all of its output.

Macroeconomic balances

The model has three macro balances: government balance, the current account balance and the savings-investment balance[56]. In the words of Lofgren et al. (2002), "the appropriate choice between the different macro-closures depends on the context of analysis". Numerous empirical studies that have investigated the effects on welfare of various policy alternatives and shocks, have adopted the 'Johansen closure'[57] rule in their analysis. This method assumes fixed foreign savings, fixed real investment and fixed real government consumption in the economy. The Johansen procedure avoids the misleading welfare effects that appear when foreign savings and real investment raise household welfare. However in paraphrasing Lofgren et al. (2002), "it is often informative to explore the impact of experiments under a set of alternative macro-closures since the results provide important insights into real world trade-offs that are associated with alternative macroeconomic adjustment patterns". Our model assumes that government savings are fixed and adjust direct taxes to maintain government consumption growth at the exogenously determined level (2% annually).

To paraphrase Kiringai (2010), this assumption "mimics the Kenyan economy since the budget deficit has been used as the fiscal anchor to maintain macroeconomic stability and guard against government debt crowding out lending to the private sector". The external balance is maintained by assuming that the exchange rate is flexible and adjusts to maintain the exogenously determined current account balance. This assumption is quite plausible because the exchange rate in Kenya is market determined. Additionally, we assume that investments are savings driven and take the CPI as the numeraire in the model. Additionally, the model we implement is sequential (recursive)-dynamic. Paraphrasing Annabi et al. (2004), "a sequential-dynamic model is basically a series of static CGE models that are linked between periods by an exogenous and endogenous variable updating procedure". Here, capital stock is updated endogenously with a capital accumulation equation, while population (total labour supply) is updated exogenously between periods. Further, our model assumes that economic agents have myopic behaviour, implying that the agents have less than perfect foresight; i.e. they are not sufficiently informed to adequately react to future changes in prices. TOT has inter-temporal effects on investment, economic growth and welfare, which may not be captured by the static version of the model; we therefore use the dynamic version, which we run 5 years, i.e. between

[56]The general algebraic modeling system (GAMs) code enables the modeler to choose among a relatively large number of pre-programmed alternative closure rules for the balances.
[57]Named after Leif Johansen (1960) the originator of CGE models

2003 and 2008[58]. The 2003 SAM for Kenya is formatted (in the GAMs file) to ensure that data on all variables of our interest are incorporated to suit the model[59]. After calibrating the model to the base dataset, we conduct simulations whose results we use in a linked micro simulation module to investigate the impact of TOT shocks on income distribution, poverty and welfare in Kenya.

4.4 Simulations and Discussion of Results

In what follows, two different scenarios, which we refer to as WPFOOD and WPOIL (acronyms for world price of food and oil respectively) are analysed and compared with the baseline scenario. The first scenario, WPFOOD entails increasing and decreasing the initial (2003) world price of foodstuffs by 100 percent and 50 percent respectively[60]. According to the Food and Agriculture Organization (FAO), the world price index for food was 213.8 in March 2015 compared to 173.8 recorded in March 2014, implying a 25 percent increase in the world price of food over a period of one year. Thus our simulation, which entails the huge changes in the world price of food as explained above, is but a deliberate exaggeration that abstracts from reality, which is important for us to be able to accentuate the economic effects of external shocks[61]. The second scenario, WPOIL entails changing the world price of oil for Kenya (a net importer of oil), whereby a hike in the price constitutes an adverse shock whilst a slump represents a positive shock. As we saw in table 1, petroleum prices in Kenya have been on an upward trend for decades, with an average growth of 15.3 percent during the last decade. However, recently global oil price has plummeted, as data from www.macrotrends.net indicate. Between May 2014 and May 2015, the price of crude oil has plummeted by almost 43 percent while it has grown by -2.1 percent on average since 2010. Thus, under WPOIL we conduct two simulations; the first entails increasing the world price of oil by 20 percent while the second involves decreasing the price by 10 percent. These changes, which are relatively huge shocks to the Kenyan economy; mimic recent world market developments in the oil sector.

[58]In this study we assume terms of trade for Kenya are temporary and unanticipated, unless otherwise stated.
[59]According to Lofgren et al. (2002), the model can accommodate any degree of disaggregation in the dataset therefore it is flexible enough to enable the researcher capture country-specific aspects of economic structure and functionality.
[60] Due to the nature of its underlying assumptions, our model cannot run when the world price of food is reduced by more than 50 percent.
[61] Additionally, we simulate a 100 percent increase in the world price of food for purposes of replicating Levin (2010) who, as already stated simulated a 100 percent increase in the world price of maize.

4.4.1 Baseline Scenario

The baseline scenario assumes that the economy follows a growth path without external shocks based on growth assumptions presented in Table 15 and in the annex tables A4, A5 and A6. As observed, the economy grew at an average of 4.6 percent during the period 2003 to 2005, with agriculture, manufacturing and services being the major contributors to GDP during the period. Over the period, hotels and restaurants had the fastest growth rate at 10.6 percent followed by transport and communications at 6.2 percent. The lowest growth rate was recorded for ownership of dwellings at 1.9 percent[62].

Table 15: Baseline Growth Rates

Sector	Contribution to GDP (%)	Average Growth rate (%)
	2003	2003-2005
Agriculture and forestry	0.28	3.6
Fishing	0.01	2.4
Mining and quarrying	0.01	2.8
Manufacturing	0.11	5.2
Building and construction	0.03	4.1
Electricity and water	0.03	5.7
Trade	0.11	5.6
Restaurants and hotels	0.11	10.6
Transport, storage and communications	0.04	6.2
Finance	0.07	3.7
Real Estate and business	0.15	2.9
Ownership of dwellings	0.07	1.9
Other services	0.15	2.1
Total GDP	1.00	4.6

Source: Economic Survey, 2006

In estimating the baseline growth rates of labour force and land, we follow Kiringai (2010) who came up with 1.5 percent for rural labour, 2.1percent for urban labour and 0.5percent for land[63]. The results of the simulations that we conduct below are compared to a counterfactual (baseline) scenario, which replicates the growth path of the Kenyan economy to 2005 in the absence of external shocks commencing with the 2003 benchmark that replicates the SAM.

[62] It is important to note that since sector growth rates are exogenously determined in the model, there is no need to provide the TFP numbers for the baseline and the simulations.
[63]See annex tables A4 and A5

4.4.2 WPFOOD Scenario

As already stated, this scenario involves two simulations; the first is a favourable TOT shock that entails increasing the world export price of food by 100 percent while the second is an adverse TOT shock which involves reducing the prices by 50 percent.

(i) 100 Percent Increase in World Food Prices

Macroeconomic effects

The macroeconomic effects of a 100 percent increase in the world price of food are as shown in Table 16.

Table 16: Macroeconomic Effects of a 100% Increase in the World Price of Food (Real Values, % Change from the Initial Value)

Variable	Initial Value (Kshs billions)	Baseline*	100% hike in global food price
Absorption	1267.7	2.7	3.3
Private consumption	868.0	2.7	3.5
Investment	179.2	4.2	4.5
Government	202.9	1.5	1.5
Exports	281.4	4.0	3.5
Imports	-406.9	2.8	4.8
GDP at market prices	1142.2	3.0	2.8
Indirect Taxes	131.8	3.1	1.6
GDP at factor cost	1010.4	3.0	3.0

Source: Author's Analysis Based on CGE Model

Note* Baseline growth results are realised after the model is calibrated at initial equilibrium, assuming no shocks.

As observed in Table 16, increasing the world price of food by 100 percent yields mixed results for the Kenyan economy, at least at the macro level. While majority of the variables experience increased growth compared to the baseline growth, others like real GDP and indirect taxes regress. As is to be expected, the favourable TOT causes a boom in the food sector, which leads to an increase in revenues. Investment growth increases to 4.5 percent compared to 4.2 percent base growth, as investors increase capital stocks to take advantage of increased profitability of the economy. The favourable TOT leads to the appreciation of the

real exchange rate, which coupled with rising domestic inflation (due to the spending effect of the shock), makes Kenyan exports other than food more expensive in the global market, hence reducing their worldwide demand, which leads to a reduction in the growth of exports (now 3.5 percent compared to 4.0 percent base growth). Furthermore, as domestic prices rise, domestic goods become less attractive to Kenyan consumers, and this results in a "substitution effect"[64] which increases the growth of imports to 4.8 percent compared to 2.8 percent base growth. This leads to a worsening of the trade balance (and possibly current account assuming capital inflows are fixed), as imports are now much higher than exports, with deleterious effects on economic growth[65]. The dampening of economic growth is manifested by the change in the growth of real GDP, which falls to 2.8 percent compared to 3.0 percent base growth. Concomitant with this slump in economic growth is the reduction in the growth of indirect taxes to 1.5 percent compared to the pre-shock level of 3.0 percent[66]. Apart from import tariffs, a big chunk of indirect taxes in Kenya is sales tax comprising of excise duties on petroleum products, excise duties on beverage and tobacco, insurance premium tax, value-added taxes, and other taxes on products. Thus, the fall in indirect taxes in the backdrop of rising private consumption and imports is not surprising but should be viewed in the context of the sectoral effect of the TOT shock, whereby, as we shall see later, there is a shrinking of production in such sectors as manufacturing and services, which reduces the incidence of tax on products.

Moreover, the export boom causes an increase in real household incomes, resulting in an "income effect", which leads to a surge in domestic demand whose growth increases to 3.3 percent compared to 2.7 percent growth in the base case. These results replicate in general terms findings of a few other CGE studies that have, while modeling the Kenyan economy observed a beneficial effect of a positive TOT shock. As we saw earlier, these studies include Levin (2010) who found that a favourable TOT shock leads to GDP growing at a higher rate during the shock compared to the baseline growth. Another study whose results our findings replicate is Karingi and Siriwardana (2003). Although using a slightly different approach in

[64] We owe the use of the terms substitution effect and income effect to Devarajan et al (1997) who used them to explain the terms of trade effect on an economy.
[65] It is clear that the Marshall Lerner Condition is satisfied for Kenya. This Condition states that if demand of exports and imports is elastic, i.e. greater than unity, then an increase in the terms of trade will worsen the trade balance.
[66] In our model government consumption is treated as fixed in real terms, thus remains unchanged even if there is a change in tax revenue.

their model[67] the authors found real GDP increasing in tandem with investment, as was the case with manufactured, agricultural and services imports. In what follows, we examine the sectoral effects of an increase in world food prices.

Sectoral Effects

Before we examine the sectoral effects of doubling the world price of food, it is necessary that we analyse Kenya's production structure, presented in Table 17. As observed, the service sectors have the highest share of gross output of close to 40 percent of the economy. This outcome is a significant shift in the structure of the economy whereby agriculture had the largest share of production in the first two decades after independence. The outcome is also surprising since the development strategy in the early eighties was to transform Kenya into an industrial nation by the year 2020. The development strategy identified industry as the driver for growth and poverty reduction through strong backward linkages between industry and the rural sector and it envisaged emergence of a strong agro-industrial base (Kiringai, 2010). The analysis in Table 17 shows that by the end of 2003 (the reference year in our model), agriculture contributed about 15 percent of gross output and all primary sectors (agriculture, forestry and fishing) jointly account for only 16 percent of total output, with the highest contribution coming from cash crops. Within industry, food processing accounted for 10 percent of gross output and heavy industry about 27 percent. While Kenya's comparative advantage is in primary sectors, her ability to export manufactures would be driven by competitive advantage, acquired through human capital development and adoption of new technology to increase total factor productivity. According to Kiringai (2010), various studies undertaken at firm level in Kenya conclude that the country has no comparative advantage or competitive advantage in manufacturing. While citing Kimuyu (1999), Kiringai asserts that in recent years, the country's competitiveness has been challenged by price distortions and exchange rate misalignment and high transportation and other transaction costs, which implicitly tax business. The analysis also shows that the export supply ratio for the total economy is quite low at 11.5 percent. Sectors with the highest export supply share of gross output include cash crops (57 percent), heavy industry (13 percent) and food processing (12 percent). As is typical of a low-income country, the services export share for Kenya is quite low at 4 percent. Investment demand in Kenya is concentrated in the construction sector (78

[67] As stated elsewhere in this thesis, the authors conducted simulations on the Kenyan economy where negative and positive TOT shocks were jointly applied in such a way that the positive shock was larger than the negative shock.

percent), which is the largest non-tradable sector of the economy. It is followed by heavy industry with a 20 percent share. Some 70 percent of Kenya imports are heavy manufactures, followed by transport services; imports of food are minimal at about 3 percent of total imports. When it comes to consumption, the highest demand is for manufactured food (17 percent) followed by private services (11 percent) and for public services (10.5 percent). The demand for staples is low at 4 percent and comprises mainly of maize. In the simulations that follow, we examine how TOT shocks affect the productivity of the various sectors in Kenya.

Table 17: Kenya's Structure of Production

	Gross output	S_d	Exports	E/X_d	E/S_d	Consumption	D_d	Investment	imports	M/D_d
Staples	2.9	3.2	0.2	0.8	0.8	3.9	4.5	0.9	3.8	0.3
Cash crops	7.9	3.8	39.2	57.2	133.6	4.8	15.6	0.9	1.0	0.0
Other primary	1.0	0.8	2.4	28.6	40.1	1.5	1.9	0.3	0.1	0.0
Man food	11.0	10.8	12.2	12.8	14.7	17.6	19.4	-0.1	8.0	0.1
Textiles	1.3	1.2	1.7	15.0	17.7	2.1	1.8	-	2.2	0.4
Footwear	1.0	1.0	1.4	15.7	18.7	1.1	1.9	-	0.4	0.1
Wood	0.7	0.4	3.3	54.4	119.1	0.4	1.2	-	0.7	0.2
Printing	1.5	1.7	-	-	-	1.1	2.1	-	2.6	0.4
Petroleum	7.0	7.0	6.4	10.6	11.9	1.8	7.2	7.8	19.7	0.9
Chemicals	4.3	4.1	5.6	15.1	17.8	2.8	2.7	-	17.3	2.2
Machinery	4.7	4.6	5.7	13.9	16.2	0.2	3.3	11.6	17.8	1.8
Non Metallic	1.8	1.8	1.5	9.9	11.0	-	3.3	-	1.0	0.1
Other Manufactures	4.6	4.5	5.3	13.3	15.4	1.9	6.0	0.7	9.1	0.5
Other industry	26.8	26.2	30.8	13.3	15.3	11.2	29.6	20.1	70.7	0.8
Construction	6.7	7.6	-	-	-	0.4	13.6	77.8	-	-
Trade	5.7	6.4	-	-	-	0.8	11.5	-	-	-
Hotels	1.5	1.7	-	-	-	2.5	3.0	-	-	-
Transport	9.0	8.4	13.5	17.4	21.0	11.2	13.6	-	12.8	0.3
Communication	2.0	2.2	0.7	3.9	4.1	2.8	4.1	-	-	-
Private Services	39.3	42.4	15.2	4.5	4.7	34.4	72.4	77.8	16.4	0.1
Public Services	9.2	10.4	-	-	-	22.8	18.6	-	-	-
Total	100.0	100.0	100.0	11.5	13.0	100.0	100.0	100.0	100.0	0.3

Source: Adopted from Kiringai (2010)

Notes: (1) S_d domestic supply, (2) E/X_d export share in gross output, (3) S/S_d export share in domestic supply, (4) D_d domestic demand, (5) M/D_d import share in total demand.

Table 18 shows the sectoral effects of doubling world food prices for selected sectors and presents data on the growth of output measured in terms of real GDP at factor cost.

Table 18: Real GDP for Selected Sectors (% Change from Initial Value)

Sector	INITIAL (Kshs Billions)	Baseline	100% increase in world food price
Expanding sectors			
Maize	35.7	4.0	4.8
Wheat	0.4	4.0	7.6
Dairy	18.7	0.7	0.8
Roots	14.1	0.9	1.0
Fish	3.8	1.2	1.3
Forestry	7.0	1.3	1.4
Construction	53.1	4.0	4.3
Contracting sectors			
Cut-flowers	18.6	6.0	5.9
Sugar	2.0	5.0	4.9
Coffee	6.9	0.6	0.5
Oils	23.5	0.7	0.6
Other crops	10.4	0.8	0.7
Textiles	5.6	5.0	4.9
Footwear	4.8	1.2	1.1
Petroleum	3.4	5.0	4.4
Beverages	12.9	5.0	4.9
Tea	39.5	4.0	3.9
Machinery	8.4	4.0	3.9
Chemical	7.3	3.0	2.9
Milling	8.9	2.7	2.0
Bakeries	4.8	1.3	1.3
Other manufactures	30.9	4.0	3.9
Other food manufactures	0.9	1.9	1.6
Transport	73.4	5.0	4.9

Source: Author's Analysis Based on CGE Model.

A closer look at Table 18 reveals that although a doubling of the world price of food is beneficial on the aggregate to Kenya as we saw earlier, it has both positive and negative effects on the various sectors of the economy. Among the sectors that benefit is wheat with its output expanding by 3.6 percentage points relative to the base growth, followed by maize with an increase in output by 0.8 percentage points. Other sectors which show some improvement relative to the base growth include construction (0.3 percentage points) and dairy, roots, fish and forestry whose output increase by 0.1 percentage points respectively. The expansion in

output of these sectors explains in large part the source of economic growth we analysed in table 15. Table 18 also shows several sectors that contract following a favourable TOT. Among the contracting sectors is the milling sector, whose GDP decreases by -0.7 percentage points relative to base growth. Others are petroleum (-0.6), other food manufactures (-0.3) as well as cut-flowers, sugar, coffee, tea, oils etc, which respectively shrink by -0.1 percentage points. This negative outcome is to be viewed in the context of what we discussed in Chapter 2 as the causes and effects of the Dutch disease. Analogous to the scheme by Neary and Van Wijnbergen (1986) we have in our case a booming food sector that benefits from a doubling of the export price, a tradable sector comprising of cash crops, manufacturing and services and finally a non-tradable sector comprising of among others fishing, forestry and construction. The TOT shock leads to a currency appreciation and rise in domestic prices, which reduces the competitiveness of Kenya's tradable sector. In addition, the rise in domestic inflation causes an increase in the cost of inputs, which together with the decline in trade competitiveness reduces output in the cash crop and manufacturing sectors. Moreover, the higher domestic income arising from increased revenues in the booming food sector brings about a spending effect, which leads to an increase in expenditures on both traded and non-traded goods and a rise in the price of non-tradable goods. Consequently, this raises the relative profitability of the non-traded sector, which expands at the expense of traded goods sector (excluding the food sector). The food sector in Kenya shares domestic factors of production with the other sectors, particularly cash crops. Therefore the food export boom bids up the price of factors in the sector, resulting in a resource movement effect which further squeezes the traded sector. It so happens that there is an increase in the marginal product of factors in the food sector, which attracts the factors from other sectors. This leads to a decline in production of traded goods as a result of higher costs of production which ultimately contracts the traded sector. According to Corden and Neary (1982), the spending effect tends to increase the output of non-tradables while the resource movement decreases it. In our case as already observed, the output of non-tradable sectors increases, implying that the spending effect is stronger than the resource movement effect for Kenya in the aftermath of a favorable TOT shock.

To our knowledge only two studies, namely; Levin (2010) and Karingi and Siriwardana (2003) have comprehensively examined the effects of TOT shocks on sector productivity in Kenya. In a simulation which we have already described, Levin (2010) found agriculture increasing to 7.5 percent compared to 3.9 percent base growth, while manufacturing contracted to 2.9 percent compared to 4.3 percent base growth. Karingi and Siriwardana (2003) on their part found, in

the absence of any policy intervention[68], agriculture expanding by more than twice the manufacturing sector (5 percent compared to 2.3 percent) as a result of a joint TOT shock.

(ii) 50 Percent Reduction in World Food Prices

Macroeconomic effects

The macroeconomic effects of a 50 percent reduction in the world price of food are as shown in table 19.

Table 19: Macroeconomic Effects of a 50 % Reduction in the World Price of Food (Real Values, % Change from the Initial Value)

Variable	Initial Value (Kshs billions)	Baseline	50% dip in global food price
Absorption	1267.7	2.7	2.7
Private consumption	868.0	2.7	2.7
Investment	179.2	4.2	4.2
Government	202.9	1.5	1.5
Exports	281.4	4.0	3.9
Imports	-406.9	2.8	2.8
GDP at market prices	1142.2	3.0	3.0
Indirect Taxes	131.8	3.1	3.0
GDP at factor cost	1010.4	3.0	3.0

Source: Author's Analysis Based on CGE Model.

How a negative TOT impacts the economy is well documented in the literature that we surveyed in earlier sections of this thesis. For a small economy like Kenya whose exports supply is inelastic and faces elastic demand in the world market, we would expect that a dip in the world price of food leads to a decline in real income and hence a reduction in demand for both tradables and nontradables. Furthermore the price of tradables relative to nontradables would decline, depreciating the real exchange rate. Funke et al. (2008) argue that it is the consumption and investment decisions of economic agents, domestically and abroad that determine the impact of TOT. As already stated elsewhere in this study, authors (see e.g. Broda

[68] In their study the authors examine the impact of policies such as import tariffs and indirect taxes in the advent of TOT shocks

and Tille, 2003 and Corden, 1984) hypothesise that a country with a fixed exchange rate regime will adjust to a TOT shock through a change in its output while in a country with a flexible exchange rate the economy adjusts to the shock through a change in its nominal exchange rate. As our findings indicate (Table19), the latter case seems to apply for Kenya, which maintains a flexible exchange rate regime. The results are consistent with the received wisdom on the effect of a negative TOT shock (e.g. the real exchange rate depreciates by 0.3 percent), the impact on the aggregate economy is trivial. Granted, most of the macroeconomic variables experience some growth; however this growth approximates the base case growth, with the exception of exports and indirect taxes whose growth decrease by 0.1 percentage points relative to the base growth[69]. Thus, due to the flexibility of the exchange rate, the Kenyan economy is able to adjust fairly quickly to absorb the adverse effects of the negative TOT shock and return the economy back to the pre-shock equilibrium.

Sectoral Effects

Table 20 shows the sectoral effects of halving the world price of food and contains data on output growth measured in terms of real GDP at factor cost.

[69] Rounding off the figures to one decimal place assumes away the marginal growth.

Table 20: Real GDP for Selected Sectors (% Change from Initial Value)

Sector	INITIAL (Kshs Billions)	Base	50% reduction in world food price
Contracting sectors			
Maize	35.7	4.0	3.9
Wheat	0.4	4.0	3.3
Expanding sectors			
Other food manufactures	0.9	1.9	2.0
Printing	5.4	1.5	1.6
Petroleum	3.4	5.0	5.1
Unaffected sectors			
Rice	1.8	5.0	5.0
Barley	0.6	1.3	1.3
Tea	39.5	4.0	4.0
Coffee	6.9	0.6	0.6
Sugar	2.0	5.0	5.0
Roots	14.1	0.9	0.9
Oils	23.5	0.7	0.7
Other crops	10.4	0.8	0.8
Cut-flowers	18.6	6.0	6.0
Forestry	7.0	1.3	1.3
Fishing	3.8	1.2	1.2
Mining	4.3	5.0	5.0
Construction	53.1	4.0	4.0
Beverages	12.9	5.0	5.0
Machinery	8.3	4.0	4.0
Chemical	7.3	3.0	3.0
Milling	8.9	2.7	2.7
Bakeries	4.8	1.3	1.3
Other manufactures	30.9	4.0	4.0
Communications	29.3	1.3	1.3

Source: Author's Analysis Based on CGE Model

In the foregoing we have pointed out that the macroeconomic effect of reducing world food prices by 50 percent is negligible since relative prices adjust fairly quickly to absorb the adverse effects of the shock, returning the economy back to the pre-shock equilibrium. Clearly, save for a few which register some impact, most sectors remain unaffected by the negative

TOT shock[70]. Those that experience a decline in output are obviously wheat and maize with a percentage point difference (relative to the base growth) of 0.7 and 0.1 respectively. Rice as we found earlier remains unaffected, although by design its world price is reduced together with that of maize and wheat. Sectors whose output performance improves albeit marginally include other food manufactures and printing, each of which has a 0.1 percentage points difference relative to the base growth. Thus, judging from sector performance it is apparent why the impact of the TOT shock on economic growth is negligible. As is to be expected, halving the world price of food leads to a depreciation of the exchange rate by 0.3 percent, a reduction in real factor incomes in the food sector and a decline in demand for non-tradables (assuming as before that these goods face positive income elasticity and a less than perfectly elastic supply). The price of non-tradables relative to tradables must fall; resulting into a decline in spending, which draws resources away from non-tradables to tradables. Additionally, halving the price reduces the marginal value product of factors in the food sector and hence labour demand, inducing a movement of labour out of the sector to other sectors. This resource movement negatively affects output in the food sector to the benefit of manufacturing which experiences some improvement. At the same time, the output of non-tradables is unchanged implying that in the event of an unfavorable TOT shock, the spending effect counteracts with the resource movement effect.

4.4.3 WPOIL Scenario

As stated earlier, this scenario involves two simulations; an increase in the world market price of oil by 20 percent per annum (unfavourable TOT) and a decrease of the price by 10 percent (favourable TOT).

20 Percent Increase in the World Price of Oil

Macroeconomic effects

Table 21 shows the macroeconomic effects of a 20 percent increase in the world price of oil.

[70] Some minor change is observed for most sectors, however, this is assumed away when we round off the numbers to one decimal place.

Table 21: Macroeconomic Effects of a 20 % Increase in the World Price of Oil (Real Values, % Change from the Initial Value)

Variable	Initial Value (Kshs billions)	Baseline	20% hike in global oil price
Absorption	1267.7	2.7	1.9
Private consumption	868.0	2.8	2.2
Investment	179.2	4.2	1.5
Government	202.9	1.5	1.5
Exports	281.4	4.0	7.0
Imports	-406.9	2.8	2.9
GDP at market prices	1142.2	3.0	2.9
Indirect Taxes	131.8	3.1	2.4
GDP at factor cost	1010.4	3.0	2.9

Source: Author's Computation Based on the CGE Model

In an earlier section of this study we discussed the dynamics of adverse TOT in an economy, highlighting the effects of a 50 percent increase in the world price of food on the Kenyan economy. As is clearly seen in table 16, the macroeconomic effect of a 20 percent increase in the import price of oil, although adapting the usual pattern envisaged by literature, is diametrically different from that of a 50 percent decrease in the world price of food (see Table 19). An increase in the import price of oil leads to a change in the balance of trade for Kenya, so that for the same amount of exports, the country now buys fewer imports. Moreover, since imported goods are unavailable domestically and are required as inputs in production, a rise in the import price results in an increase in import expenditure. Exports increase by 7.0 percent of initial value, to generate foreign exchange that is needed to pay for more expensive imports. The real exchange rate depreciates as the economy adjusts to the shock[71], encouraging more exports and making imported goods relatively more expensive. However, due to the substitution effect, import volumes slightly increase to 2.9 percent compared to the base run growth of 2.8 percent. The real purchasing power of domestic production decreases owing to the oil price shock, and since this is tantamount to a transfer of income from Kenya to the rest of the world; real incomes fall. Ultimately, savings decrease (due to the consumption smoothing behaviour of economic agents, also known as the Harberger-Laursen-Metzler

[71]Devarajan, et al. (1997) argue that whether the real exchange rate will depreciate in the aftermath of a negative TOT shock depends on the value of the elasticity of substitution between imports and domestic goods.

effect), which leads to a reduction in investment and hence GDP growth. Thus, as observed in table 16, investment growth drops to 1.5 percent compared to 4.2 percent base growth, which leads to a fall in real GDP growth by 0.1 percentage points relative to the baseline growth. Our results are generally consistent with the findings of other CGE studies on Kenya. For instance, Karingi and Siriwardana (2003) found Kenya to be very vulnerable to negative TOT shocks (although in their joint simulation model the negative TOT effect was less than the positive effect, as earlier noted). Sanchez' (2011) examined the effects of rising oil prices on oil-importing countries and found evidence of negative effects of a worsening TOT shock on Kenya, which was among the countries included in the sample. In addition, Levin (1998) found overall income declining in Kenya as a result of an adverse TOT shock**.**

Sectoral effects

The sectoral effects of a 20 % increase in the world price of oil are as shown in table 22, and as we did in a previous section, real GDP growth is used as a measure of sector performance.

Table 22: Sectoral Effects of a 20 % Increase in the World Price Of Oil: Real GDP for Selected Sectors (% Change from Initial Value)

Sector	Initial(Kshs billions)	Baseline	20% increase in oil price
Contracting sectors			
Maize	35.7	4.0	3.9
Rice	2.7	5.0	4.9
Roots	14.1	0.9	0.8
Beef	14.8	0.7	0.6
Dairy	18.7	0.7	0.6
Meat	11.9	1.2	0.9
Fish	3.8	1.2	0.6
Forestry	7.0	1.3	1.0
Milling	8.9	2.7	1.6
Baking	4.8	1.3	1.2
Beverages	12.9	5.0	4.7
Textiles	5.6	5.0	4.5
Footwear	4.8	1.2	0.3
Construction	53.0	4.0	1.5
Expanding sectors			
Sugar	2.0	5.0	5.2
Cut-flowers	18.6	6.0	6.2
Wood	2.9	3.0	3.4
Machinery	8.3	4.0	4.2
Coffee	6.9	0.6	0.7
Tea	39.5	4.0	4.1
Petroleum	3.4	5.0	31.6
Printing	5.4	1.5	1.7

Source: Author's Analysis Based on CGE Model

As we saw earlier, a 20 percent increase in the import price of oil is generally harmful to Kenya since it dampens the macroeconomic situation, including reducing economic growth. As seen in Table 22, the shock has a varied impact on the sectors; while a reasonable number contract and hence explain the slump in economic growth, a few others expand. On the one hand, the sectors most negatively affected by the shock are those that produce for the domestic market, including construction, whose real GDP growth deviates from the base growth by -2.5 percentage

points[72]. Others are milling (-1.1), footwear (-0.9), beverages (-0.3), fish (-0.6) and textiles (-0.5). On the other hand, the sectors most positively affected by the shock are mainly those producing exportable goods and include petroleum, with a deviation from the baseline of +26.6 percentage points. It is followed by wood (+0.4), cut-flowers (+0.2), sugar (+0.2), printing (+0.2), coffee (+0.1) and tea (+0.1) among others. As already observed, a 20 percent increase in the import price of oil yields a 1.2 percent depreciation of the exchange rate, which leads to an increase in the price of imports and a rise in input costs, which results in a marginally lower value added for productive sectors. On the flipside, export growth increases, as world demand for Kenyan exports surges, explaining the expansion of tradable sectors that we observe in table 20. In addition, the income effect apparently dominates the substitution effect, leading to a contraction in the output of domestic goods and expansion of exportables.

(i) 10 Percent Reduction in the World price of Oil

Macroeconomic effects

Table 23 shows the macroeconomic effects of a 10 percent decrease in the world price of oil.

Table 23: Macroeconomic Effects of a 10 % Decrease in the World Price of Oil (Real Values, % Change from the Initial Value)

Variable	Initial Value (Kshs billions)	Baseline	10% dip in global oil price
Absorption	1267.7	2.7	3.4
Private consumption	868.0	2.8	3.4
Investment	179.2	4.2	5.5
Government	202.9	1.5	1.5
Exports	281.4	4.0	2.4
Imports	-406.9	2.8	3.6
GDP at market prices	1142.2	3.0	3.1
Indirect Taxes	131.8	3.1	3.5
GDP at factor cost	1010.4	3.0	3.0

Source: Author's Analysis Based on CGE Model

As is to be expected, the response of the Kenyan economy to a reduction in the world price of oil is typical. The favourable TOT shock leads to an appreciation of the real exchange rate by 0.8 percent, making exports more expensive and consequently shrinking world demand.

[72] As the construction sector has the largest share of investment demand in Kenya (78 percent), it is not surprising that overall investment declines when this sector shrinks after a worsening of TOT.

Growth in export volumes thus falls to 2.4 percent compared to 4.0 percent base growth. Moreover, real incomes increase, causing an income effect, which leads to a surge in the growth of private consumption to 3.6 percent compared to 2.8 percent base growth. In addition, the favourable TOT shock bids up the price of domestic goods making imports more competitive and hence raises the growth of imports to 3.6 percent compared to 2.8 percent base growth. Unlike in static models, the usual response to a TOT shock in a dynamic framework such as the one in this study is for consumption and investment to move in different directions (see Devarajan and Go, 1998). We find on the contrary investment increasing by 1.3 percentage points higher than the baseline level even as consumption rises. There are two reasons why investment improves; first, as the economy expands (GDP at market prices is 0.1 percentage points over and above the baseline level), the rate of return to capital increases, and investors have a higher propensity to increase capital stocks. Secondly, there is the plausible assumption that capital goods have a strong content in Kenyan imports; hence investment increases in tandem with the rise in imports.

Sectoral Effects

The sectoral effects of a 10 percent decrease in the world price of oil are as shown in Table 24.

Table 24: Sectoral Effects of a 10 % Decrease in the World Price of Oil: Real GDP for Selected Sectors (% Change from Initial Value)

Sector	Initial (Kshs billions)	Baseline	10% decrease in the world price of oil
Contracting sectors			
Sugar	2.0	5.0	4.9
Tea	39.5	4.0	3.9
Cut-flowers	18.6	6.0	5.9
Other food manufactures	0.9	1.9	1.7
Wood	2.9	3.0	2.8
Petroleum	3.4	5.0	-9.6
Expanding sectors			
Dairy	18.7	0.7	0.8
Meat	11.9	1.2	1.4
Fish	3.8	1.2	1.5
Forestry	7.0	1.3	1.5
Milling	8.9	2.7	3.2
Baking	4.8	1.3	1.4
Beverages	12.9	5.0	5.2
Textiles	5.6	5.0	5.3
Footwear	4.8	1.2	1.7
Construction	53.0	4.0	5.2

Source: Author's Analysis Based on CGE Model

A closer look at table 24 reveals what we would expect to happen; a reduction in the import price of oil has a beneficial effect on sector performance compared to the deleterious case of the negative oil shock. Generally, the sectors producing for export are negatively affected while those that produce for the domestic market benefit. Contracting sectors include petroleum with a real GDP growth deviation from the baseline of -14.6 percentage points. It is followed by other food manufactures (-0.2), wood (-0.2), sugar (-0.1), tea (-0.1) and cut-flowers (-0.1). Sectors that improve as a result of the positive TOT shock include construction (+1.2), footwear (+0.5), milling (+0.5) and fishing (+0.3) to mention but a few. A 10 percent decrease in the import price of oil leads to an appreciation of the Shilling's exchange rate, which results in the dipping of the price of imports and a decline in production costs, which in turn results in increased value added

for the productive sectors. The Shilling appreciation by contrast leads to a lowering of export demand and hence reduced export volumes. Eventually the substitution effect dominates the income effect, leading to a contraction of exportables and an expansion of non-exportables.

4.4.4 Impact of Terms of Trade Shocks on Income Distribution and Poverty in Kenya

(i) Impact of Terms of Trade Shocks on Income Distribution in Kenya

In this section we examine the impact of TOT shocks on income distribution among the various factors of production in Kenya and so essentially we need to explain what happens to wages and capital rents when world prices change. The Stopler-Samuelson theorem states that in a two-goods economy a change in the relative prices of goods will lead to a change in relative factor prices and a change in the distribution of national income[73]. The price of the factor used intensively in the production of the good whose relative price has risen will increase. The price of the factor used intensively in the production of the good whose relative price has decreased will fall. The reasoning behind this theorem is that an increase in the world price of one good will cause an economy's production to shift toward increased production of the good and away from production of the other good. If each industry employs a different mix of factors, then the composition of aggregate demand for factors will shift, leading to a change in relative factor prices. To our knowledge, only two studies, Levin (1998) and Levin (2010) have empirically examined the impact of TOT on welfare in Kenya using a CGE micro-simulation approach. In what follows, we implement the micro simulation module that we discussed in Chapter 3 and which is linked to our CGE model to examine the impact on welfare of WPFOOD and WPOIL.

I. WPFOOD Micro-Simulation

Results of this module are as shown in Table 25, which analyses the distributional impact of TOT shocks on factors of production.

[73]However, this theorem does not apply for economies that specialize in the production of primary goods that are intensive in the use of natural resources and that do not have a significant import competing sector.

Table 25: Nominal Factor Incomes (% Change between First and Final Years)

Factor	Initial Value	Base	100% increase in world food price	50% decrease in world food price
Rural labour				
Rural informal High Skill	42.73	1.5	4.4	1.5
Rural informal Semi Skilled	62.0	3.3	7.8	3.2
Rural informal low skilled	2.0	0.8	2.4	0.8
Rural formal High Skill	10.8	3.6	5.4	3.6
Rural formal Semi Skilled	40.1	4.1	6.4	4.1
Rural formal Unskilled	31.1	3.9	5.0	3.9
Urban labour				
Urban informal High Skill	29.3	0.6	2.7	0.6
Urban informal Semi Skilled	13.5	2.5	3.5	2.5
Urban informal low skilled	8.6	-1.1	0	-1.0
Urban formal low skilled	19.6	2.3	2.7	2.3
Urban formal Semi Skilled	67.3	4.1	3.5	4.1
Urban formal High Skill	105.7	3.8	4.7	3.8
Capital				
Capital Urban informal	149.5	3.1	6.8	3.1
Capital Urban formal	75.7	2.7	4.3	2.7
Rural Capital	323.9	4.1	4.2	4.1
Land				
Land	28.4	3.2	10.2	3.1

Source: Author's Analysis Based on CGE Model

(a) <u>100% Increase in the World Price of Food</u>

The analysis in Table 25 shows that national income is distributed among three factors of production, namely; labour, capital and land. Labour is categorized into rural and urban and is divided into six types, namely; informal high skill, informal semi skilled, informal low skilled, formal high skill, formal semi skilled and formal unskilled. Capital has three categories including urban informal capital, urban formal capital and rural capital. As our results indicate (see Table 25), a 100 percent increase in the world price of food leads to an increase in real income of factors (apart from that of urban formal semi skilled labour, which is an outlier). This surge in income which is most felt by land lords is, as we saw earlier the result of a rise in revenues that accrue to farmers following an export boom in the food sector. A closer look at the results brings into focus two key observations. First, as is to be expected, rural labour generally gains more from the favourable TOT shock than its urban counterpart. While the

income of rural labour increases by an average 2.4 percentage points relative to the base growth, that of urban labour increases by an average 0.8 percentage points. Secondly, skill endowments seem not to matter much in both rural and urban areas; what makes the difference in earning is what type of sector labour is employed, whether formal or informal. In both rural and urban areas, labour in the informal sector gains more than its counterpart in the formal sector. The reason for this spatial and occupational differences in earning is quite obvious; food-growing farmers gain from increased revenues arising from the food export boom, while urban labour loses because of the contraction of the tradables sector (plausibly, the bulk of this labour is employed in the formal sector industries such as food manufacturing industries and services that are negatively affected by the TOT shock)[74]. Besides, as shown in Levin (2010) maize alone contributes to over 20 percent of farm income in Kenya and thus when the sector expands as a result of the food export boom, there is a positive effect on rural labour income.

The effect of the TOT shock on capital is different compared with that on labour, at least as far as the spatial distribution of income is concerned. As observed in Table 25, the two categories of urban capital (informal and formal) gain more than rural capital. Informal and formal capital for urban areas respectively deviate from the base growth by +3.7 and +1.6 percentage points while rural capital deviates by +0.1 percentage points. This outcome buttresses our findings in an earlier section of this study where we concluded that a doubling of the world price of food would boost the profitability of economic agents who respond by increasing their capital stocks, hence increasing total investment. But why does urban capital earn more income than its rural counterpart in the aftermath of a positive TOT shock? The answer is the resource movement effect. When the tradables sector (where the bulk of urban capital is employed) contracts due to the effects of Dutch disease, factors (including capital) are drawn away from the sector to the booming food sector and other non-tradable sectors. When this happens, the supply of factors in the tradable sector decreases and assuming a fixed demand for factors, factor prices are bid up, hence the rise in factor income[75].

(b) 50% Decrease in the World Price of Food

Results of this simulation are given in Table 25, which indicates an insignificant change in incomes for most factors. Nonetheless, rural informal semi skilled labour and land lose out, albeit marginally with each having their real income decline by 0.1 percentage points, relative

[74]This is consistent with the Stopler-Samuelson theorem we have already alluded to.
[75]The converse is true for the food sector, hence the insignificantcapital gains experienced in the sector.

to base growth. Urban informal low skilled labour has its income rise slightly by 0.1 percentage points. This is consistent with our earlier results that showed that decreasing the world price of food by 50 percent has an insignificant impact (both at macro and sectoral levels) since the flexible exchange rate allows the economy to adjust quickly and absorb the negative effects of the shock.

II. WPOIL Micro-simulation

Results of this module are as shown in Table 26, which analyses the effect that changes in the international price of oil has on income distribution in Kenya.

Table 26: Nominal Factor Incomes (% Change between First and Final Years)

Factor	Initial Value	Base	20% increase in world oil price	10% decrease in world oil price
Rural labour				
Rural informal High Skill	42.73	1.5	6.7	-0.3
Rural informal Semi Skilled	62.0	3.3	-0.1	4.8
Rural informal low skilled	2.0	0.8	8.5	-1.4
Rural formal High Skill	10.8	3.6	-0.9	5.7
Rural formal Semi Skilled	40.1	4.1	0.1	5.9
Rural formal Unskilled	31.1	3.9	0.4	5.7
Urban labour				
Urban informal High Skill	29.3	0.6	8.4	-2.2
Urban informal Semi Skilled	13.5	2.5	0.8	4.2
Urban informal low skilled	8.6	-1.1	15.1	-7.3
Urban formal low skilled	19.6	2.3	0.0	3.7
Urban formal Semi Skilled	67.3	4.1	0.3	5.9
Urban formal High Skill	105.7	3.8	0.4	5.7
Capital				
Capital Urban informal	149.5	3.1	1.7	4.0
Capital Urban formal	75.7	2.7	2.4	3.7
Rural Capital	323.9	4.1	2.4	5.7
Land				
Land	28.4	3.2	0.5	4.2

Source: Author's Analysis Based on CGE Model

(a) 20% Increase in the World Price of Oil

As seen in Table 26, the effect of the negative TOT shock is diverse across factors; while the impact on labour income is mixed depending on skill endowments, it is clearly negative for land and capital. The analysis also reveals a spatial dimension in income distribution when rural and urban labour is compared. Rural labour is more negatively affected than its urban counterpart, with the former having an average income growth deviation from the baseline growth of -0.4 percentage points compared to +2.5 for the latter. Nonetheless, analysing the results at a more disaggregated level reveals that urban informal low skilled labour gains most from the shock, with its income growth deviating from the baseline growth by +16.2 percentage points. It is followed by urban informal high skilled (+7.8), rural informal low skilled (+7.7) and rural informal high skilled (+5.2). The labour category that loses most includes among others rural formal high skilled (-4.5) followed by urban formal semi skilled (-3.8) and rural formal unskilled (-3.5).

The analysis also indicates that rural capital loses out more than its urban counterpart with an income growth deviation from the base growth of -1.7 percentage points compared to -1.4 and -0.7 for the informal and formal capital respectively. This outcome on factor income should be viewed in the backdrop of our earlier analysis regarding the macro and sectoral effects of a rise in the world price of petroleum oil. As we saw, the negative TOT shock leads to a contraction of several sectors, which contributes to a dampening of economic growth. As the sectors most negatively affected by the shock are those that produce for the domestic market, including construction, agriculture (excluding cash crops) and food manufactures (e.g. milling) it is clear then why there is a general decline in factor incomes particularly for land, rural capital, rural labour and urban formal skilled labour. As the output of contracting sectors decreases, factor rewards must decline if producers have to maintain their profitability levels. This reduces the demand for factors in the sectors and given the supply, factor prices are bid down, hence the fall in factor income. The converse is true for labour categories that gain following a negative shock; exportable sectors such as petroleum, horticulture and cash crops essentially increase rewards for factors following an expansion in output (hence profitability), which leads to an increase in demand for factors in the sector that bids factor prices up, hence the rise in factor incomes.

(b) 10% Decrease in the World Price of Oil

Results of this simulation are as shown in table 26. For this case of a favourable TOT, the outcome on factor incomes differs across various factors. The analysis shows labour income growth varying depending on skill endowments. However for land and capital the effect is positive; whereas the income growth for land deviates from the base growth by +1.0 percentage point, the growth of informal and formal capital deviates by +1 and +1.6 respectively. Income growth for rural and urban labour on average deviates from the base growth by 0.5 and -0.4 percentage points respectively, indicating that in general terms, rural labour benefits from the TOT shock as urban labour loses out. At a more disaggregated level however, we observe urban formal high skilled labour gaining most from the shock, with its income growth increasing by 1.9 percentage points relative to the base growth. In addition, rural and urban formal semi skilled labour benefit equally after an oil price shock with their income growth increasing by 1.8 percentage points relative to the base case. Plausibly, these are the labour categories employed in the expanding non-tradable sectors for instance construction and fishing, which, because of their enhanced profitability pay relatively higher incomes. On the other hand, urban informal low skilled labour loses out most with its income growth falling by to -6.2 percentage points relative to the base case. Other categories of labour that are negatively affected by the shock include urban informal high skilled (with a deviation of -2.8percentage points), rural informal low skilled (-2.2) and rural informal high skilled (-1.8). The income of these categories of labour decline as the exportable sector (the employing sector) contracts thereby lowering factor rewards in line with the reduced profitability.

(ii) Impact of Terms of Trade Shocks on Poverty in Kenya

To measure the impact of TOT on poverty in Kenya, we employ the micro-simulation module that we discussed in Chapter 3. Table 27 gives the outcome of four experiments we conducted earlier in the main CGE model and as earlier stated here the poverty measure is based on the FGT index. In this poverty module, we use data derived from the welfare monitoring survey that was undertaken by the Kenyan government in 1997 and includes a rural and urban poverty line of Kshs 1239 and Kshs 2648 per adult equivalent per month respectively. In all the four experiments, the simulation covers a short period, starting from 2003 and ending in 2005, the year for which we report the FGT indexes. As we saw earlier in chapter 1, the number of Kenyans below the poverty line in 1997 was 52.9 percent for rural areas and 49.2 percent for

urban areas. By contrast, in 2003 (the base year of our model) the poverty incidence for rural and urban areas was 48.9 percent and 43.9 percent respectively, indicating a slight improvement in welfare for Kenya. In what follows we analyse the effects of various changes in TOT on poverty.

Table 27: Changes in Poverty: Final Year Values

	Incidence $\alpha = 0$	Gap $\alpha = 1$	Severity $\alpha = 2$
National			
(i) Baseline	48.1	16.1	7.2
(ii) WPFOOD			
100% rise in world food price	47.1	15.8	7.1
50% fall in world price of food	48.1	16.1	7.2
(iii) WPOIL			
20% rise in world price of oil	48.6	16.5	7.5
10% fall in world price of oil	47.4	15.8	7.1
Rural			
(i) Baseline	48.9	16.7	7.6
(ii) WPFOOD			
100% rise in world price of food	47.8	16.3	7.4
50% fall in world price of food	48.9	16.7	7.6
(iii) WPOIL			
20% rise in world price of oil	49.3	17.1	7.8
10% fall in world price of oil	48.4	16.4	7.4
Urban			
(i) Baseline	43.9	13.1	5.5
(ii) WPFOOD			
100% rise in world price of food	43.3	13.0	5.4
50% fall in world price of food	43.9	13.1	5.5
(iii) WPOIL			
20% rise in world price of oil	44.4	13.4	5.7
10% fall in world price of oil	42.4	12.6	5.3

Source: Author's Computations Based on CGE Microsimulation Model

(a) <u>100% Increase in the World Price of Food</u>

Table 27 shows the spatial dimensions of poverty after a TOT shock. As observed, a doubling of the world price of food leads to a reduction of poverty in Kenya, which is manifested by the decrease in the FGT indices for both rural and urban areas. However, although poverty is still

higher in rural than urban areas after a TOT shock, a critical analysis of the results reveals that the decrease in the FGT indices is bigger in rural than in urban areas, indicating a relatively more beneficial effect on poverty reduction in rural areas following a favourable TOT shock. The reason for this spatial difference in the TOT impact is because the boom in the food export sector boosts real incomes of rural producers, which makes them relatively better off than their urban counterparts. At the same time, the export boom leads to an appreciation of the real exchange rate, which as we saw earlier results in a Dutch disease which leads to the contraction of tradable sectors (largely employing urban labour) which in turn leads to loss of employment and hence welfare of the urban population. Moreover, the food export boom leads to an appreciation of the real exchange rate and an increase in domestic prices, which erodes the purchasing power of the population, more so for those living in urban areas that are relatively less able to mitigate against the negative effects of inflation[76].

(b) 50% Decrease in the World Price of Food

As the results in Table 27 indicate, the FGT indices arising from this experiment are approximately equal[77] to those of the base case scenario, suggesting that a reduction in the world price of food by 50 percent would have little or no effect on poverty in Kenya. This outcome is a reflection of our earlier results where we found that halving the world price of food has little effect on the economy.

(c) 20% Increase in the World Price of Oil

Results of this experiment are as shown in table 27, which portray a pattern that is diametrically opposite to the effect on poverty after a 100 percent increase in the world price of food. Notably, all the FGT indices increase relative to the base case scenario, implying that an adverse TOT shock leads to a rise in poverty, both in rural and urban areas. However, it is to be noted that while the magnitude of the increase in the severity of poverty is the same for both rural and urban areas, that of the incidence and depth is lower in the former than in the latter, suggesting a more detrimental impact on poverty in urban areas. Earlier in this study, we found an oil price shock having a deleterious effect on the growth of the Kenyan economy. We also noted that the real purchasing power of domestic production would decrease after an oil price shock, a situation that is tantamount to a transfer of income from Kenya to the rest of the

[76] Here we use the cost of basic needs poverty line, which takes into account the effect of inflation. The rural population has a big chunk of their basic needs met by consumption of own-produced and un-marketed food products, unlike its urban counterpart.
[77] This is when the figures are rounded-off to one decimal place.

world. Effectively, this leads to a reduction in real incomes and hence increased poverty. On the other hand, poverty increases faster in urban than rural areas because as already noted the oil price shock leads to a contraction of mostly the urban sectors (e.g. manufacturing and construction) which leads to labour lay-offs and hence reduction in incomes.

(d) 10% Decrease in the World Price of Oil

Results of this experiment are as shown in table 27. As observed, a positive oil price shock reduces poverty both in rural and urban areas. A closer examination of the results however reveals that the impact of this shock is almost similar to that of a positive food price shock discussed in the foregoing, although in this case the impact is relatively more intense in urban than rural areas. As noted elsewhere in this study, decreasing the international price of oil boosts total investment in the country and hence raises economic growth, which leads to an increase in household incomes, which in turn leads to a reduction in poverty. As already mentioned, the positive impact arising from the oil shock is felt more in urban than rural areas. The reason for this is not difficult to fathom; it is a fact that urban households consume relatively more petroleum products such as kerosene for cooking and lighting, as well as gasoline for transport, thus a fall in the international price of oil is undoubtedly more advantageous to them than rural households.

(iii) Impact of Terms of Trade on Welfare

To measure welfare, we apply the EV method that we discussed in Chapter 3. As we saw in that chapter, EV by definition is the amount of income that would have to be given to (or taken away from) the consumer before the TOT shock to leave him or her as well off as he or she would be after the shock. As we observe in Table 28, which shows the impact on welfare of the TOT shocks, there are different outcomes for different simulations; however there is a zero effect when the world price of food is reduced by 50 percent. What follows is an analysis of the rest of the simulations

Table 28: Effect of Terms of Trade on Welfare: Equivalent Variation

Household	(i) Base	(ii) WPFOOD		(iii) WPOIL	
		100% rise in world food price	50% fall in world food price	20% rise in world oil price	10% fall in world oil price
rural 1st per capita expenditure quintile	2.0	0.9	2.0	1.7	2.1
rural 2nd per capita expenditure quintile	2.3	2.9	2.4	1.8	2.7
rural 3rd per capita expenditure quintile	2.3	2.6	2.3	2.0	2.5
rural 4th per capita expenditure quintile	2.5	3.0	2.5	2.2	2.7
rural 5th per capita expenditure quintile	2.3	2.7	2.3	2.3	2.4
rural 6th per capita expenditure quintile	2.5	3.1	2.5	2.1	2.9
rural 7th per capita expenditure quintile	2.6	2.9	2.6	2.1	2.9
rural 8th per capita expenditure quintile	2.5	3.2	2.5	1.9	2.9
rural 9th per capita expenditure quintile	2.6	3.7	2.5	1.9	3.0
rural 10th per capita expenditure quintile	2.5	4.2	2.5	1.7	3.1
urban 1st per capita expenditure quintile	1.9	2.2	1.9	2.2	2.4
urban 2nd per capita expenditure quintile	1.6	2.6	1.6	2.8	1.8
urban 3rd per capita expenditure quintile	2.5	3.6	2.5	2.1	3.3
urban 4th per capita expenditure quintile	3.0	3.7	3.0	3.3	3.7
urban 5th per capita expenditure quintile	3.0	3.6	3.0	2.6	3.8
urban 6th per capita expenditure quintile	2.5	3.5	2.5	2.1	3.2
urban 7th per capita expenditure quintile	2.2	2.7	2.2	1.8	2.7
urban 8th per capita expenditure quintile	2.8	3.5	2.8	2.8	3.5
urban 9th per capita expenditure quintile	2.9	3.8	2.9	2.1	3.9
urban 10th per capita expenditure quintile	3.1	3.8	3.1	2.2	4.1

Source: Author's Analysis Based on CGE Model

Note**: (**1) EV is given as % of base consumption value (2) there are 20 households (divided equally between rural and urban areas) that are categorized according to their expenditure quintiles

.

(a) 100% Increase in the World Price of Food

The results portray a rosy picture when we simulate a 100 percent increase in the world price of food. It is clear that for this case; virtually all households gain in welfare, although urban households on average benefit more than rural households (mean of the deviation from the base EV value is 0.72 for urban areas compared to 0.51 for rural areas). We have already observed in an earlier section that a positive food price shock increases economic growth, largely driven by increased output in some sectors. This has a positive impact on welfare as enhanced productivity creates more employment opportunities for job seekers and hence more incomes to households.

(b) 20% Increase in the World Price of Oil

As observed in Table 28, the adverse TOT shock has a negative impact on all households, which experience reduced welfare relative to the base case scenario. However, rural households in this case are more negatively affected, with a deviation from the base value of -0.4 compared to -0.2 for urban areas. The deleterious effect of the negative oil shock on economic growth and the reduction in real purchasing power of domestic production leads to a reduction in household real incomes and hence reduced welfare.

(c) 10% Decrease in the World Price of Oil

As seen in Table 28, the impact of a positive oil price shock is to increase welfare, in a pattern similar to that of the food price shock, although now the impact is comparatively less strong. As already mentioned, a reduction in the international price of oil boosts total investment in the country and hence raises economic growth, which leads to an increase in household incomes ceteris paribus, which in turn leads to an increase in welfare.

4.5 Summary and Conclusion

In this chapter we have applied a SAM-based CGE model that is a variant of the IFPRI Standard CGE Model. We have used the model to conduct simulations that entail changing the world price of food and oil and determining the macro and sectoral effects of the TOT shocks. In order to evaluate the welfare and distributional impacts of these shocks, some variables of interest (including vector of prices, income and outputs) that are generated by the CGE model

are passed onto a linked top-down micro-simulation module, which then determines the FGT measures of poverty, factor income distribution and welfare as measured in terms of equivalent variation. The model is calibrated on the basis of SAM (2003), a database developed for Kenya in 2006. This SAM is highly disaggregated; comprising of 50 sectors, 20 household types, and 6 labour categories. Following is a summary and conclusion of our key findings. First, a favourable TOT in the food sector has mixed outcomes for the Kenyan economy at the macro level. While there is a slight decline in the growth of GDP (at market prices) and exports, growth in investment and private consumption improves, pushing up the absorption. The positive food price shock produces winners and losers in terms of sectoral productivity. In this case, the spending effect of the price shock leads to an expansion of the non-tradable sectors, to the detriment of the tradable sectors. In addition, a favourable food price shock has a positive effect on household incomes, which influences an improvement in welfare (as measured in terms of EV) and a reduction in poverty.

Second, a positive oil price shock generally has the same effects as the positive food price shock, but the effect is more pronounced on the macroeconomic variables than on welfare. Additionally, like in the positive food price shock, the positive oil price shock yields winners and losers when it comes to sector productivity; the non-tradable sectors expand while the tradable sectors contract. This happens when the real exchange rate appreciates, leading to a lower export demand and the substitution effect of the TOT shock dominating the income effect. The distributive impact of the positive oil price shock is generally positive, with only a few types of labour losing out. This positive effect on income distribution is reflected on the effect on poverty reduction and welfare, which improve in tandem. Third and finally, an adverse food price shock has little or no effect on the economy. However, an adverse oil price shock is quite deleterious to the economy as it leads to a deterioration of all macro variables, apart from exports, which improves as a result of the depreciation of the real exchange rate. As far as sectoral productivity is concerned, the negative oil price shock results in an expansion of mostly the tradable sectors while nontradables sectors contract. Expansion of the tradable sectors can be explained by the depreciation of the real exchange rate, which makes exports cheaper in the international market. On the flipside, non-tradables contract as a result of the increase in the cost of imported inputs. The distributive impact of the negative oil price shock is mixed across labour categories but definitely negative on capital and land. Rural labour is more negatively affected compared to urban labour, an outcome that should be understood in the context of how the negative oil price shock affects sector productivity. The welfare effects

of the adverse TOT are substantially negative, as all FGT indices increase, implying a rise in poverty in all its dimensions. Welfare as measured in terms of EV also declines for all households, and it is more pronounced on rural households. The deleterious effect of the adverse TOT on economic growth, coupled with the reduction in the purchasing power of domestic production leads to a reduction in household real incomes and hence welfare.

CHAPTER FIVE: IMPACT OF CAPITAL INFLOWS ON ECONOMIC GROWTH AND WELFARE IN KENYA

5.1 Introduction

The theoretical and empirical literature examining the effects of capital inflows on the economies of developing countries is reviewed in Chapter 2. Our general objective in the present chapter is to analyse the effects of capital inflows on Kenya's economic performance. Specifically we are interested in determining the impact of capital inflows on (i) macroeconomic variables; including real GDP, investment, private consumption and savings; (ii) sectoral output; (iii) poverty and last but not least (iv) welfare. Before analysing the data, it is necessary that we briefly discuss the pattern and evolution of capital inflows to Kenya.

Official Development Assistance

As observed in Table 9, Kenya has since the 1970s experienced relatively unpredictable flows of foreign aid. Kenya experienced a slackening in ODA inflows in most of the 1980s and 1990s. The reason for this is twofold; to paraphrase Mwega (2009), the decline "reflected Kenya's own falling out with donors over the implementation of structural adjustment programmes (SAPs)[78]. Secondly, it also reflected the general decline in ODA to SSA following the end of the cold war". It is to be noted however that despite its volatility, the level of ODA inflows to Kenya since the 1970s has been higher compared to the other inflows, with the exception of the period between 1999 and 2003 when it had been overtaken by remittances from Kenyans abroad. The recovery in the aid inflows from 2003 onwards was, according to Mwega (2009) "a response to increased government borrowing to finance development projects", particularly on infrastructure that were initiated by the Mwai Kibaki regime.

Remittances

We have already noted elsewhere in this thesis that Kenya is a major source of migrants to the rest of the world. Close to about 200,000 Kenyan migrants are in the OECD countries (Lucas, 2005). A major benefit of migration is remittances. As is shown in Table 9, Diaspora

[78]These are a set of economic policies that are often introduced to a country as a condition to get loans from the International Monetary Fund. These policies usually consist of a combination of free market policies, including privatization, fiscal austerity, free trade and deregulation.

remittances inflows to Kenya have increased systematically over time perhaps in tandem with the increase in Kenyan migrants. The share of remittances to GDP however remained low in the 1970s, increasing marginally in the 1980s and 1990s. The remittances surged in the 2000s, even overtaking ODA flows at some point. The average GDP share of remittances was 2.4 percent for the period between 2003 and 2013 indicating reasonable growth despite the financial and economic crisis that hit the world towards the end of that decade. Studies have shown how important remittances have become as a source of domestic household incomes for Kenya. For instance, World Bank (2006) estimates that remittances "reduced the number of people living in absolute poverty in Kenya by almost 9 percent even though the poorest do not often have relatives abroad, so they do not benefit from remittances directly". Other studies as we saw in Chapter 2 that have found remittances to be crucial for development in Kenya include Kiiru (2010) and Simiyu (2013).

Foreign Direct Investment

FDI in Kenya dates back to the 1940s, when then colonial master Britain's firms begun to invest directly in the country. After independence in 1963 Kenya received reasonably high FDI inflows compared to other countries in the region, owing largely to the favourable investment climate the government had maintained at the time. However, as seen in table 9, beginning early 1970s FDI inflows to the country begun to dwindle, reason being the restrictive investment policies the government had adopted to stem profit repatriation by MNCs and also the collapse of the EAC (Kinyanjui, 2010). The poor economic performance experienced in Kenya in the mid 1980s and 1990s coupled with poor physical infrastructure affected the industrialization process which in turn discouraged both domestic and foreign investment despite government's commitment to promote FDI[79]. By the year 2006, the Kenyan economy had made remarkable recovery thanks to reform measures put in place in the economic recovery strategy paper[80] that was launched in 2003 by President Kibaki's administration. Attendant to this phenomenal economic growth therefore, was a remarkable growth in FDI inflows during the intervening period. The average share of FDI to GDP stood at 0.55 percent in the 2000s decade and about 0.7 percent in the period between 2011 and 2013. MNCs in Kenya have invested in a variety of

[79] Incentives that have been put in place over time in Kenya include abolishment of export and import licensing; rationalizing and reducing import tariffs; revoking all export duties and current account restrictions; freeing Kenya shillings exchange with local banks and removing restrictions on borrowing by foreign as well as domestic companies.

[80] The paper attempted to address factors inhibiting investment, including negative perception by investors about political instability, poor governance and corruption, inadequate infrastructure, insecurity, crime and policy instability.

sectors, including floriculture, horticulture, manufacturing, services telecommunication among others. The main form of FDI in the country is green field establishments with more than 200 MNCs while the main sources of FDI are Britain, US, Germany, South Africa, Netherlands, Switzerland and lately China and India (Kinyanjui, 2010). As we saw in Chapter 2, some researchers find evidence of FDI spillovers being transmitted to the Kenyan economy while others find none.

In a nutshell, the impact of external shocks on economic growth, poverty, income distribution and welfare depends on how the Kenyan economy is configured, and the level and scope of its integration into the world economy. Thus the extent to which macro prices, including stock prices, interest rates and exchange rates are affected by the shocks is dependent upon the country's economic international interconnectedness. In Kenya some effects of the shocks are discernible; there are imbalances that have caused a depreciation of the Kenya shilling and a running down of foreign exchange reserves. For instance according to http://www.exclusive-analysis.com, the Kenya shilling depreciated by 33 percent against the US dollar by November 2011, while the reserves were 3.4 months of import cover, below the threshold allowed by law of 4 months and 6 months required by the EAC convergence criteria. All these effects have adversely affected the economy. Whereas in 2007 the Kenyan economy grew by 7 percent (the highest growth in over two decades), it performed poorly in 2008, growing at a rate of 1.6 percent. Although the post-election violence was largely to blame for this poor economic performance, the negative effects of the global financial crisis that was at its pick during this time could not be ruled out. That economic growth has been affected by shocks is thus clearly evident, but how the same might have affected welfare in Kenya is not discernible at a glance. Our hypothesis, which we subsequently test, is that the shocks have had far reaching consequences for welfare in the country.

5.2 Analytical Framework for Analyzing Capital Inflows Shocks

It is important at the outset to point out that aid flows enter the government budget and are used in various sectors such as infrastructure, education, health etc. Modelling aid flows is thus not a straight forward affair and the IFPRI model we used in Chapter 4 is ill-suited to achieve the desirable results. This is because it captures only the demand effects of capital inflows whereas

we are also interested in determining the supply-side effects. CGE models have a long tradition in development economics; however, there are only a few studies that have used these models to determine the impact of ODA. Some of these studies are cited in Clausen et al. (u.d) and include Bandara (1995), Vos (1998), Adam and Bevan (2002, 2006) and Agenor et al. (2008). For our case, a suitable model to use is one that has a recursive dynamic framework with updating equations for all the stock variables including capital stock, working capital and labour force as well as various policy variables. Several studies have used the recursive modelling approach to measure the impact of external shocks on the economy. For instance a study by Morley, et al. (2011) builds on previous real CGE models constructed at the IFPRI and use data from Honduras to analyse the impact of a reduction in remittances, a change in foreign saving and changes in minimum wage. Thurlow (2004) also extends the IFPRI standard model to construct a recursive CGE model for South Africa. In both studies the authors assume that agents have 'adaptive expectations' behaviour, rather than 'forward-looking expectations' that underlie alternative inter-temporal CGE models. On their part, Adam and Bevan (2006) build a recursive dynamic model that is able to capture the supply response of the economy to foreign inflows as well as measure the distributional effects of the inflows and public expenditure dealings. This model is fashioned, in the words of Adam and Bevan (2006), "on a small open economy and calibrated to reflect the principal features of an archetypical low-income, aid-dependent and cash crop agriculture- based economy", where data from Uganda was applied. The Kenyan economy exhibits most of these features and since it shares close similarities to Uganda in terms of economic structure and level of development, this model by Adam and Bevan (2006) is appropriate for our analysis. The full model is presented in Table A11in the annex; however, what follows are highlights of its key features.

(i) Private Production and Consumption

Paraphrasing Adam and Bevan (2006), "producers and consumers are assumed to enjoy no market power in world markets, so the TOT are independent of domestic policy choices and are therefore held constant. Firms are assumed to be perfectly competitive, producing a single good that can be sold to either the domestic or the export market". Each sector *i* has a CD production function of the form:

$$X_i = A_i S_i^{\alpha s} L_i^{\alpha l} KP\alpha_i^{\alpha k} KG_i^{\alpha g} \quad \text{.....equation 5.1.}$$

Where X stands for output, S for land, KP for sector-specific private capital, KG for infrastructure, and lastly L for a composite labor input. Additionally, αs, αl, αk and αg are elasticities. Adam and Bevan assume that "only production in the rural sectors requires land, which is fixed in perpetuity while private-sector-specific capital stocks are fixed in each period but evolve over time through depreciation and gross investment". The labour composite, represented by L, is designed according to Adam and Bevan as a "CES aggregation of skilled and unskilled labor, with fixed supplies that are inter-sectorally mobile. Labour markets are competitive so that composite labor is employed in each sector up to the point that it is paid the value of its marginal product". Further, according to Adam and Bevan (2006), "private-sector output is determined by the level of infrastructure, KG, which is provided by the government, and constant returns to scale prevail in the private factors of production, but increasing returns are possible in the presence of public infrastructure". Moreover, according the authors the model has three household types that are differentiated by factor endowments and how they consume and save. The first, paraphrasing Adam and Bevan, "is a rural household, which produces food and cash crops and owns the land and capital in these two sectors". This household is not obligated to pay direct taxes and doesn't save. The second household is "an urban unskilled household, whose only factor of production is unskilled labor", which it sells to manufacturing, services, government and other sectors, including construction, forestry and mining. The household doesn't own capital or land, and doesn't save, however, unlike the rural household, it pays direct taxes. The third and final type of household is the urban skilled household, which sells skilled labour to manufacturing, services, public and other sectors and has the remainder of the capital in the economy. This household is presumed to pay direct taxes at a higher rate than the urban unskilled household, and according to Adam and Bevan it "earns interest on its net holdings of government domestic debt, and has positive net savings in the initial equilibrium". Each household type has a consumption function defined by a LES, which allows for the income elasticity of demand for different goods to deviate from unity.

(ii) Macroeconomic Closure and Dynamics

The Adam and Bevan (2006) model is savings-driven, with a closure rule that is neoclassical in nature in which aggregate private investment is constrained by total savings net of exogenous government investment, where households' propensity to save is exogenous. As already stated, the model is recursive dynamic whereby "each solution run tracks the economy over several years". Within-year public and private capital stocks are fixed, and the model is solved given

the parameters of the experiment. The solution defines a new vector of prices[81] and quantities for the economy, including the level of government and private investment, "which feed into the equations of motion for sectoral capital stocks", as shown in equation 5.2.

$$K_{i,t} = K_{i,t-1}(1-\mu_i) + \Delta K_{i,t-j} \quad \text{.....equation 5.2}$$

Where μ_i denotes the sector-specific rate of depreciation, and *j* measures the gestation lag on investment. In the simulations that follow, the default setting is j = 1, although scenarios where government investment augments the stock of infrastructure capital only with a longer lag are considered. For purposes of analyzing capital inflows effects, the model is calibrated to initial static steady-state equilibrium in which net government and private investment is presumed to be zero, i.e. gross investment exactly matches depreciation, and there is no growth in the labour supply.

(iii) Aid and Government Expenditure

Most macroeconomic studies do not distinguish between different forms of aid as the underlying data on its specific uses are typically unavailable (Clausen, et al., u.d). However, consistent with Adam and Bevan (2006) we assume that for the Kenyan case ODA solely accrues to government and is used exclusively to finance increased government investment. In the model, Adam and Bevan (2006) assume that "increased public capital stock entails a higher level of operations and maintenance (O&M) expenditure, which is calibrated on the basis of evidence in the literature"[82]. Further the authors assume that in the baseline, the additional O&M costs are "financed out of the additional aid flow so that the domestic budget deficit is (ex ante) unchanged". Another key assumption of the model is that aid-financed increases in public investment expenditure are more intensive in non-tradable inputs on the margin than for both private investments and infra-marginal government expenditure. Scaling-up is thus according to Adam and Bevan assumed to "skew aggregate demand toward non-tradables in the short run". Finally, the model assumes that government investment in areas such as health and education has no effect on human capital. The model holds that "although adjustment to the physical capital stock takes place, changes to the human capital stock do not materialize since this feedback is slow in the time horizon of the model".

[81] The model sets domestic commodity prices as numeraire.
[82] Adam and Bevan (2006) set recurrent O&M expenditure at 3.5 percent of the additional capital stock in line with what has been observed in World Bank–financed capital projects.

Data and Parameterization

To calibrate the model we use the Kenya SAM (2003) discussed earlier in this thesis. The SAM is aggregated into six sectors, namely; food crop agriculture, cash crop agriculture, manufacturing, services, other industries and public sector. The SAM is made up of three institutions including government, enterprises as well as households which are divided into rural and urban. The SAM also has three factors of production, land, capital and labour which comprises of skilled and unskilled. Macroeconomic and other supplementary data are got from Government of Kenya publications including the Economic Survey and Statistical Abstract of various years. Like in many other developing countries, data on estimated elasticities is unavailable for Kenya. Thus to calibrate the model, Armington elasticities are guestimated, based on Gibson (2003) while production elasticities are borrowed from Adam and Bevan (2006) as shown in Table 29. It is assumed that for exports, the shift from domestic supply to export supply is easier in the agricultural sectors than in the other sectors, more so in manufacturing. Moreover, elasticity of public infrastructure in private production is assumed to be equal to 0.5, consistent with Adam and Bevan (2006). This value is relatively higher than what is in the literature according to Adam and Bevan (2006) who cite Hulten (1996) and so is chosen to "reflect the expectation of a higher marginal product of capital for countries with a severely depleted capital stock and the likelihood that the contemporary marginal productivity of public infrastructure expenditure may be higher than the historically suggested".

Table 29: Trade and Production Elasticities

	Food	Cash crops	Manufacturing	Services	Others	Public sector
Armington elasticity of substitution	1.273	1.1	0.417	1.067	1.28	1.065
CET elasticity of transformation	2.0	2.0	2.0	2.0	2.0	2.0

Source: Most elasticities are adopted from Gibson (2003) and Adam And Bevan (2006) while others are estimated.

5.2.1 Modeling Foreign Aid Shocks in Kenya

Here, the objective is to measure the impact of foreign aid flows to Kenya. As is observed in table 8, ODA flows to Kenya have had a non-even trend. In absolute terms, ODA grew by 20 percent between 2003 and 2004, decreased to 15 percent in 2004-2005, rose slightly to 19 percent in 2005-2006 but finally fell sharply to 13 percent in 2006-2007. Thus, the annual average increase in net ODA inflows in the period between 2003 and 2007 was about 15 percent. In the shock experiment that we conduct we assume that ODA inflows permanently increase by 20 percent for a period of 10 years. This increase, which is about 1.0 percent the share of baseline ODA to GNI, is half the figure used in Adam and Bevan (2006). We conduct, on the same lines as Adam and Bevan (2006), a policy experiment consisting of an increase in public infrastructure investment that is exclusively financed by a permanent 20 percent increase in ODA, holding tax rates and all other components of public expenditure (except O&M expenditure) constant. The increased public capital stock is assumed to entail a higher level of O&M expenditure, equivalent to 3.5 percent of the increase in the public capital stock. This share of the O&M is the weighted average of R-coefficients[83] across all sectors, adjusted based on the evidence on "the recurrent expenditure requirements of the World Bank's financed capital projects" as compiled by Hood, Husband and Fu (2002). Underpinning implementation of the model are various key assumptions for each of the five experiments; that:

(i) productivity enhancement through public investment in infrastructure is unproductive-experiment 1,
(ii) productivity enhancement through public investment in infrastructure is neutral-experiment 2 ,
(iii) productivity enhancement is biased towards export production-experiment 3,
(iv) productivity enhancement is biased towards domestic production-experiment 4,
(v) productivity enhancement is biased towards domestic production, as in experiment 4; however there is a subsistence threshold for food-experiment 5.

(a) Macroeconomic effects of Foreign Aid Inflows Shock

[83]This is the annual incremental recurrent expenditures expressed as a proportion of total project investment costs.

Table 30 presents the results of the five experiments described above, showing the effects of ODA inflows shock on the macroeconomic variables for Kenya. We report, for purposes of brevity the impact for year 1, denoted by to t=1 and the cumulative evolution of the economy after 5 and 10 years, denoted by to t=5 and to t=10 respectively. What follows is an analysis of the results of each of the experiments.

Table 30: Macroeconomic Effects of a Rise in Aid (% Change from the Baseline)

	Period	Experiment					
Productivity bias[a]		1-benchmark	2-neutral	3-export	4-domestic	5-domestic with high subsistence food share	5-domestic with low subsistence food share
Alphag[b]		0	0.5	0.5	0.5	0.5	0.5
EPSL[c]		0.99	0.99	0.99	0.99	0.99	0.99
O&M[d]		3.5	3.5	3.5	3.5	3.5	3.5
Initial public capital as a % of ‘‘optimal’’ public capital[e]		50.0	50.0	50.0	50.0	50.0	50.0
Subsistence food share in consumption[f]		0.0	0.0	0.0	0.0	0.9	0.45
Prices and quantities							
Export-weighted real exchange rate[g]	to t=1	1.8	-7.9	-7.3	-8.6	15.5	1.1
	to t=5	-29.2	-9.3	-9.4	-9.2	25.6	1.5
	to t=10	-25.8	-14.1	-14.4	-13.9	27.4	2.2
Total exports	to t=1	-7.1	6.0	6.9	5.0	8.8	-2.6
	to t=5	-8.4	12.8	13.3	12.5	17.7	-3.7
	to t=10	-3.0	15.9	16.6	15.2	17.0	-3.9
Manufacturing exports	to t=1	-12.3	9.0	10.3	7.7	5.1	-0.4
	to t=5	-17.7	12.3	12.6	12.1	14.8	2.4
	to t=10	-15.5	10.5	10.8	10.2	19.7	3.8
Cash crop exports	to t=1	-6.9	7.5	8.5	6.5	4.0	-4.3
	to t=5	1.2	15.9	16.4	15.4	7.1	-6.1
	to t=10	9.9	21.0	21.9	20.2	4.0	-6.7
Real GDP	to t=1	-0.8	5.7	6.1	5.4	12.4	2.2
	to t=5	-1.6	11.0	11.3	10.8	21.6	1.6
	to =10	-4.0	11.6	12.1	11.2	21.3	1.4
Private investment	to t=1	3.8	43.8	44.1	43.4	51.7	37.0
	to t=5	-2.3	43.5	43.6	43.4	74.2	37.4
	to =10	-18.2	38.1	38.3	37.8	77.4	38.3

Period		Experiment					
Productivity bias[a]		1-benchmark	2-neutral	3-export	4-domestic	5-domestic with high subsistence food share	5-domestic with low subsistence food share
Alphag[b]		0	0.5	0.5	0.5	0.5	0.5
EPSL[c]		0.99	0.99	0.99	0.99	0.99	0.99
O&M[d]		3.5	3.5	3.5	3.5	3.5	3.5
Initial public capital as a % of ‘‘optimal’’ public capital[e]		50.0	50.0	50.0	50.0	50.0	50.0
Subsistence food share in consumption[f]		0.0	0.0	0.0	0.0	0.9	0.45
Domestic budget balance (percent of real GDP)	to t=1	-1.3	0.7	0.7	0.7	5.1	4.0
	to t=5	-2.0	1.2	1.2	1.2	5.4	4.0
	to =10	-1.9	-0.1	-0.1	-0.1	5.3	4.0

Source: Author’s Analysis Based on CGE Model

[a]Denotes whether the productivity enhancement is neutral (Neutral) or biased toward domestic production (Domestic) or export production (Export).
[b]Elasticity of public infrastructure in private production.
[c]Elasticity of substitution between skilled and unskilled labour.
[d]Operations and maintenance (O&M) costs (as percentage of additional capital stock).
[e]Size of initial infrastructure capital stock relative to optimal given initial private capital stocks and labour.
[f]indicates the presence of sector-specific subsistence level of consumption (as a percentage of baseline consumption)
[g]The real exchange rate is defined as (p^e/p^d) where p^e denotes the domestic price of exports and p^d denotes the price of domestic goods, so that negative values indicate an appreciation. To get the real exchange rate, we compute the ratio of the mean of the two sets of prices.

Note: (1) All simulations consider a permanent increase in aid flows of 20 percent and assume that a share of this additional aid goes to finance additional O&M expenditure (equivalent to 3.5 percent of the increase in the public capital stock).
(2) Values are reported as changes relative to baseline except for fiscal measures, which are reported as percentage of GDP.

Experiment 1: Unproductive Infrastructure (alphag=0)

This experiment represents unproductive infrastructure and is the benchmark. By setting the elasticity of public infrastructure in private production (alphag) equal to zero, the infrastructure investment is assumed to bestow no benefits on private sector productivity, even as additional aid increases the economy's total capital stock[84]. Thus, the model captures only the demand-side effects of increased ODA. A key assumption of the model for this experiment is that the subsistence component in consumption is zero so that the consumption is homothetic in income across all goods and households. As is discerned from Table 30, experiment 1 yields results that portray a pessimistic view on foreign aid with regard to macroeconomic performance[85]. The results indicate that foreign aid, if not productively used could be detrimental to private investment and hence economic growth. As we observe, real private investment initially increases to 3.8 percent compared to the base growth, however it declines in the long run to -18.2 percent. This decline may be due to three reasons: first, because of the rise in the cost of imported capital and intermediate goods resulting from the appreciation of the real exchange rate, which deters investment. Secondly, because of the decline in total savings arising from the deterioration of the fiscal gap and aid-induced increased consumption[86]. Third and finally, expansion of the public sector pulls resources away from the private sector. In Kenya skilled labour is presumably a scarce resource, implying that when the public sector employs an extra skilled person, one such person is less available for the private sector, hence reducing the production in this sector[87].

As is to be expected, growth in real GDP moves in tandem with the growth in real private investment. Initially, the impact on real GDP growth is minimal, it changes by -0.8 percent compared to the base growth, however as the simulated economy evolves, the negative effect becomes more pronounced so that by the tenth year, GDP growth shrinks to -4.0 percent of base growth. Apparently, government uses the aid mainly for the purchase of non-tradable goods, effectively increasing domestic demand for non-tradables and hence rise in domestic prices of non-tradables relative to tradables. This leads to an appreciation of the real exchange

[84]According to Perrault et al. (2008), unproductive investment could be interpreted as an investment in the construction of monuments, in the army (that is if the country is not in conflict), or other types of government investments.

[85]It is to be noted that our results compare favorably with findings by Adam and Bevan (2006) who conducted a similar experiment using Ugandan data although their choice of trade elasticities are different.

[86]As Adam and Bevan (2006) explain, the government is here assumed to be a net seller of foreign exchange and therefore the real exchange rate appreciation reduces the domestic value of the budget balance, thus increasing the domestic financing requirement.

[87]As noted earlier, our model allows for inter-sectoral mobility of labour.

rate, which increases to an all-time high of 29.2percent of base growth in the fifth year[88]. As is envisaged by the Dutch disease literature (see e.g. Devarajan et al., 1993 and Younger, 1992), the appreciation of the real exchange rate, through the spending effect, causes inflation and hence loss of competitiveness in the exportable sector, which in turn leads to a substantial reduction in exports, decreasing to -8.4 percent of base growth in the medium term and -3.0 percent in the long run. In addition, appreciation of the real exchange rate punishes producers of locally produced tradables, since these now have to compete with cheaper imports. The final effect is a reduction in domestic production.

Experiments 2, 3, 4 and 5: Productive Infrastructure (*alphag*=0.5)

Akin to Adam and Bevan (2006), these experiments are based on a set of underlying assumptions. Unlike experiment 1, alphag is now equal to 0.5, implying that public infrastructure is productive and raises private sector productivity. For simulation 2 however, the productivity effect is neutral or uniform across sectors and between production for domestic and export markets. For experiments 3, 4 and 5, productivity is still felt across all sectors; however the model considers the case where the productivity embodies bias towards firstly, production of tradables for the export market (simulation 3) and secondly production of non-tradables for the domestic market (simulation 4). Like in experiment 1, we assume in experiments 2, 3 and 4 that consumption is homothetic in income. However, we assume in experiment 5 existence of a subsistence component in food consumption, whereby we consider a high share of 90 percent. A subsequent sensitivity analysis however considers the case where the subsistence food share is varied to 45 percent. According to Adam and Bevan (2006), presence of a subsistence component implies that positive income gains will be allocated disproportionately away from food expenditure so that on the margin the income elasticity of demand for food will be less than unity. Moreover, the higher the subsistence share in food consumption, the lower the income elasticity of food[89]. What follows is an analysis of the results of each of the four experiments described above.

[88]The extent of the appreciation of the real exchange rate is determined by the income elasticity of demand and the elasticities of demand and supply in the non-tradable sector.

[89]The choice of a high share of subsistence food is not far-fetched for Kenya, since its economy, like those of many other Sub-Saharan African countries is characterized by a low standard of living This can be understood in the context of Engel's law which states that the income elasticity of demand for food is between 0 and 1, as food is a necessity good. A high value of this statistic, referred to as Engel coefficient reflects a low standard of living while a low value reflects a high standard of living for a country.

(i) Experiment 2

As seen in Table 30, results of this experiment show a marked improvement in the macroeconomic variables, in stark contrast with experiment 1. Since our model assumes that private sector output is determined by infrastructure provided by the government, increased investment in infrastructure (due to additional ODA) now bestows benefits on private sector productivity, which increases the economy's total capital stock and hence boosts private investment and concomitantly, economic growth. There is a sizeable cumulative growth in private investment and real GDP, which respectively reaches 38.1 and 11.6 percent of baseline growth by the tenth year. As literature on the determinants of private investment points out (see Oshikoya, 1994 for a survey), the budget balance is a key factor of private investment in developing countries. A closer look at our results reveals this assertion to be true for Kenya, given the assumptions underlying the present experiment. The fiscal balance improves slightly, reaching an all-time high 1.2 percent of GDP by the fifth year. This occurs because, by financing public investment, aid reduces the need to raise seignorage revenue to bridge the fiscal gap, thus crowding in the private sector and as a result there is increased growth of investment and real GDP[90].

Additionally, increased ODA boosts private investment via the wealth effect. According to Giavazzi and Pagano (1990), a lower deficit implies reduced future taxes to service government debt. Reduced future taxes increase the present value of perceived private permanent income or wealth, which increases private spending on investment. As observed in Table 30, a large increase in aid also leads to an appreciation of the real exchange rate, although it has a less appreciated path compared to experiment 1. Notwithstanding this appreciation, the fall in export volumes (observed in experiment 1) is reversed so that by the tenth year, total exports increase to 15.9 percent over and above the baseline growth. There are several channels that negate the impact of appreciation on exports. First, since the ODA is channelled to the supply-side of the economy, it eases supply bottlenecks in the economy and hence increases productivity, thereby reducing inflation and mitigating against the negative effects of the change in relative prices. Second, appreciation leads to increased imports, which comprise of capital goods and productive inputs that are used for domestic production of exportable goods. Third, as Adam et al. (1994) aver, it may be that a shift of resources out of

[90] Our model's closure rule is that investment tracks savings. Thus an improvement in the budget balance will have a positive effect on private investment as total savings increase.

tradable goods sector is beneficial to the economy, as long as the increase in ODA is permanent. Forth and finally, additional aid presumably helps reduce transaction costs especially in the tradable goods sector[91].

(ii) Experiment 3

As already mentioned this experiment entails a productivity bias in favour of exports. It is discernible from Table 30 that this experiment results in a stronger economic performance relative to experiment 2. Private investment growth increases to 38.3 percent of baseline growth by the end of the simulation period. This leads to an increase in the growth of real GDP, which moves to 12.1 percent of baseline growth during the same period. The growth path of the fiscal balance however remains the same as in the neutral case, which implies that bias in production, whether towards export or domestic market has little or no effect on public sector performance. Notably, the real exchange evolves along a slightly more appreciated path than when productivity is neutral (experiment 2). This notwithstanding, export performance improves, largely driven by the relative increase in the growth of manufacturing and cash crop exports (due to the productivity bias). Total export volumes therefore increase to 16.6 percent of baseline growth by the tenth year, which is 0.7 percentage points over and above the long-run export growth realized in the neutral case. This increase in total exports fuels economic growth, which reinforces the need for an export-oriented trade policy for Kenya.

(iii) Experiment 4

This experiment entails a productivity bias toward production of the domestic good. As seen in Table 30, this experiment yields outcomes that show a weaker performance of the macro variables compared to the other two scenarios already analysed[92]. While the long-run growth in the fiscal balance remains unchanged, that of private investment increases to 37.8 percent of baseline growth. This is 0.3 and 0.5 percentage points lower than the long-run growth realized in experiment 2 and 3 respectively. At the same time, the long-run growth of real GDP increases to 11.2 percent, a lower rate compared to 11.6 and 12.1 percent resulting from experiment 2 and 3 respectively. Arguably, the demand effects of additional aid in this case are stronger than the supply response, implying that Dutch disease effects witnessed in experiment

[91] Elbadawi (1998) estimated the relative role of endowment, transaction costs, and exchange rates for manufacturing exports in a sample of African countries. He found that high transaction costs and exchange rates misalignment explain the bulk of Africa's export underperformance.

[92] The results are also inconsistent with the findings by Adam and Bevan (2006) under a similar experiment using Ugandan data, although as already pointed out; we have used a different set of Armington elasticities.

1 are not fully neutralized despite the fact that aid is productively invested[93]. Ultimately, economic performance weakens in this scenario as compared to the other two scenarios; neutral and export-bias. Furthermore, the resource movement effects of the aid draws resources out of the tradable goods sector (manufacturing and agriculture) to the non-tradable goods sector (construction, services and public) and thus shrink the tradable sector. As the tradable sector is relatively more endowed with positive spillovers hence a key source of productivity expansion, its contraction leads to a reduction in overall economic performance[94]. The decline in the productivity of the tradable sector is clearly manifested by the relative under-performance of the manufacturing and cash crop exports, as seen in table 3.2. Manufacturing exports growth increases to 10.2 percent of baseline growth by year 10, while that of cash crops increases to 20.2 percent in the same period. Long-run growth in total exports therefore increases to 15.2 percent of baseline growth, a weaker performance compared to experiment 2 and 3, which yield a long-run growth of 15.9 and 16.6 percent respectively.

(iv) Experiment 5

As stated earlier, this experiment like experiment 4 entails a productivity bias towards production of domestic goods but this time there is a high subsistence share in food consumption for all households, which we assume to be equivalent to 90 percent of baseline consumption. Our results indicate a dramatic effect on the economy when consumers are assumed to adopt a linear expenditure system[95]. There is a sharp depreciation of the real exchange rate, which by the tenth year increases to 27.4 percent of base growth. A couple of factors explain this outcome. First, the increased aid inflow helps reduce supply-side rigidities in the economy and hence intensifies the supply response especially in the favoured non-tradable sector, which leads to a rise in domestic production[96]. Second, the change in consumer behaviour leads to a weakening of the demand for food since now a big chunk of food is own-produced. This contributes to the fall in domestic prices, which implies a weakening of demand effects that are offset by the strong supply response of the aid. Subsequently, all the macro variables register remarkable gains, which as observed in table 3.2 are greater than in any of the other experiments. The variable that gains most under this scenario is private investment, which has its growth increase to 77.2 percent of base growth by

[93] Bandara (1995) points out that this may be a consequence of the specific structure of exports and production in an economy.
[94] According to Alessandro et al. (2005), there is no evidence in the literature of positive spillovers in non-tradable goods sectors in aid-receiving countries.
[95] This is consistent with the findings by Adam and Bevan (2006).
[96] Given the supply of money, this leads to a reduction in inflation.

the end of the simulation. This is a consequence of the improvement in the fiscal balance, which moves from a deficit (realized in experiments 1, 2, 3 and 4), to a surplus of 5.3 percent of real GDP. The impact of the surplus is to increase total savings in the economy while it also leads to easing of the credit squeeze[97], which bestows a crowding-in effect on the private sector, thus leading to an improvement in private investment. As is well established in the literature, depreciation of the real exchange rate is an important deterrent for private investment since it causes a rise in the relative prices of imported capital and intermediate goods. However as Oshikoya (1994) found, depreciation may influence the growth of private investment when it stimulates investment in the tradable and import substitution sectors. This perhaps explains the remarkable growth of private investment in the present experiment, even as the real exchange rate depreciates. The massive increase in private investment has a large positive impact on economic growth. In contrast with all the other experiments, real GDP now has a higher growth path, moving to 12.4 percent relative to base growth in the first year, 21.6 percent in the medium term and 21.3 percent in the long run. As a consequence of the depreciation of the real exchange rate, total exports increase, contributing to the good performance of the economy. Exports therefore increase to 17.7 percent in the fifth year, riding on manufacturing exports, which unlike cash crop exports perform quite well, especially in the medium and long term[98].

Sensitivity Analysis

In order to test the sensitivity of the magnitude of the subsistence component in food consumption used in experiment 5, we conduct a simulation involving a share equivalent to 45 percent of the baseline food consumption. The results are as shown in the last column of Table 30. As observed, when the subsistence food share is adjusted downwards, the results are quite dramatic, indicating its strong sensitivity. The lower subsistence food share (hence higher income elasticity of demand) leads to a worsening of performance of most of the macro variables, in contrast with experiments 2, 3 and 4 as well as the case when the share is 0.9. The real exchange rate depreciates somewhat, negatively affecting total exports which in the tenth year decline to -3.9 percent of base growth. Private investment growth moves to 38.3 percent of base growth by the tenth year, while real GDP growth increases to 1.4 percent of base growth over the same period. The only variable marginally affected by the change in the

[97] This may be caused by high interest rates, credit rationing and higher current or future tax burden on households
[98] It is quite intriguing that the performance of the cash crop export sector relatively weakens when income demand for food drops. This is in contrast with experiment 4 where domestic bias is also assumed.

income elasticity of demand for food is the fiscal balance, which maintains a surplus of 4.0 percent of GDP over the simulation period.

(b) Effects of Foreign Aid Inflow Shock on Disposable Income and Wages

Table 31shows the effects of ODA inflow shock on disposable income and wages arising from the five experiments.

Table 31: Effects of Aid Inflows on income and Wages (figures in percentage)

		Period	Experiment				
Productivity bias[a]			1-benchmark	2-neutral	3-export	4-domestic	5-domestic
Alphag[b]			0	0.5	0.5	0.5	0.5
EPSL[c]			0.99	0.99	0.99	0.99	0.99
O&M[d]			3.5	3.5	3.5	3.5	3.5
Initial public capital as percent of ''optimal'' public capital[e]			50.0	50.0	50.0	50.0	50.0
Subsistence food share in consumption[f]			0.0	0.0	0.0	0.0	0.9
Real disposable income	Rural	to t=1	-1.7	5.9	6.2	5.4	0.8
		to t=5	-4.5	8.1	8.1	7.9	1.1
		to =10	-0.1	13.4	13.8	13.6	1.5
	Urban skilled	to t=1	5.6	9.3	9.2	10.7	17.8
		to t=5	-8.8	12.1	12.1	12.2	16.8
		to t =10	-4.2	19.7	19.5	19.8	14.6
	Urban unskilled	to t=1	5.0	8.7	10.1	10.6	18.0
		to t=5	-7.7	11.9	12.2	12.1	17.0
		to t=10	-3.1	19.3	19.9	19.5	14.7
	Total	to t=1	1.8	7.2	7.6	7.3	9.0
		to t=5	-6.3	9.6	9.6	9.5	8.7
		to t=10	-1.7	15.8	16.1	15.9	7.8
Factor markets (average real wage; wa/cpi)	Skilled	to t=1	0.1	-0.8	-0.8	-1.0	-8.3
		to t=5	3.7	-1.3	-1.3	-1.5	-5.7
		to t=10	3.5	-1.8	-1.8	-1.9	-8.3
	Unskilled	to t=1	-1.1	6.8	7.4	6.7	5.0
		to t=5	-4.6	9.1	9.3	9.2	4.0
		to t =10	-4.2	15.2	15.6	15.4	4.0

Source: Author's Analysis Based on CGE Model

Note: all simulations consider a permanent increase in aid flows of 20 percent. Values reported as changes relative to baseline except for fiscal measures, which are reported as percentage of GDP

(i) Experiment 1

As already noted, this experiment entails a scenario where the impact of ODA inflows falls solely on the demand side of the economy, whereby Dutch disease is a consequence. Table 31 analyses the impact effects of additional aid on income distribution. The results clearly indicate a deleterious effect on household real income, whereby although growth in total real income initially improves; it reaches its lowest point in the medium term, moving to -6.3 percent relative to the baseline growth. Disaggregating the effect on income distribution in terms of rural and urban households, it is discernible that although urban households initially benefit,

they lose out more than rural households as the simulated economy evolves. Moreover, the negative effect is more severe for skilled labour in urban areas than for their unskilled counterparts in the same locality. This particular outcome is somewhat of a paradox since, as shown below, skilled households have their real wages increase following the ODA inflows shock and we would therefore expect this category of labour to have enhanced real incomes. There are various reasons why our experiment yields a lopsided distribution of income. First, it is evident that the positive spending effect of the government (on health, education and public administration) impacts more on rural households than urban households. Secondly, as the real exchange rate appreciates, resources switch from the tradable sector (mostly manufacturing and services which employ urban labour) to the non-tradable sectors (where a large proportion of rural labour is engaged)[99]. This causes the real income of urban households to fall relatively faster. Third, poor urban households, who comprise a large proportion of the urban population, are less able to cushion themselves against inflation[100].

It is also discernible in Table 31 that the impact on real wages varies between the two categories of labour that are included in the analysis; skilled and unskilled labour. There is a marked increase in the growth of the average real wage for skilled labour, moving to a long run growth of 3.5 percent relative to the baseline growth. At the same time, unskilled labour fairs badly; its average real wage decreases to -4.2 percent relative to the base growth. The reason for this outcome is not difficult to decipher. Since the additional aid is presumably used for the purchase of non-tradable goods, it leads to an increase in domestic demand for non-tradables and concomitantly an increase in the domestic prices of these goods. This in turn causes a rise in profitability of the non-tradable sector. This profitability translates to higher returns for factors of production (we assume that factors are paid a wage equal to their marginal product) and this attracts the factors from the tradable sectors (which plausibly is relatively intensive in skilled labour)[101] to the non-tradable sector (which is intensive in unskilled labour), eventually leading to an increase of real wages in terms of the prices of the prices of tradables. It is also likely that real wages for unskilled labour are more negatively affected by the resulting rise in

[99]In the model we categorize "others" as a rural sector. This comprises of all other subsectors other than agriculture, manufacturing and services such as building and construction which is a major non-tradable industry

[100]Some analysts such as Morley (1991) and Albanesi (2007) have shown that inflation hits the poor more than the rich as the latter can invest in capital or real estate when inflation occurs.

[101]The notion by Chao et al. (2010) that for developing countries the exportable (tradable) sector tends to be relatively intensive in unskilled labour is contestable, in our view.

inflation than that of skilled labour since nominal wages for the former are sticky[102]. Generally speaking our findings stand in contrast to Adam and Bevan (2006) results, where additional aid not only leads to a rise in total real income, but also leaves rural households relatively worse off. The reason for these divergent results may be due to the difference in the underlying databases that both our studies use; our model is more disaggregated since it includes an extra sector, "others" that is not in the Adam and Bevan (2006) model. Thus, as this sector is categorized as a rural sector, it is possible that we should get contrary results.

(ii) Experiments 2, 3 and 4

Results of these experiments are as shown in Table 31. Here the effects of ODA inflow shock are in stark contrast with what is observed in experiment 1. A closer look at the results reveals the long run outcomes for experiment 3 being generally slightly better than in experiment 2 and 4. The long run total income in experiment 3 rises 16.1 percent over its baseline compared with 15.8 and 15.9 percent for experiment 2 and 4 respectively. This implies that the productivity bias towards export production is relatively more beneficial to Kenya than the domestic production bias. Analysing the results at a more disaggregated level however shows that the income gain differs across households for different experiments. While urban households fair better than rural households in all the experiments, the gains are disproportionate in terms of size. In experiment 3, which as we have seen benefits most from the aid supply response, the long run real income for rural households rises to 13.8 percent over its baseline compared with 13.4 and 13.6 percent for the same households in experiment 2 and 4 respectively. Urban skilled households gain almost equally in experiments 2 and 4, with the long run growth in real income moving to 19.7 and 19.8 percent respectively. In experiment 3 however, the same households have their real income increasing to 19.5 percent in the long run. Urban unskilled households on the other hand fair better in experiment 3 than in the other experiments; its long run real income growth reaches 19.9 percent over the baseline compared with 19.3 and 19.5 percent registered in experiments 2 and 4 respectively. The gains on real incomes can be attributed to the improved performance of the economy, whereby growth of real GDP increases markedly as the ODA inflows offset supply-side bottlenecks. The effect on real income is higher for urban than rural households as the former benefit more from the demand effects arising from increased government expenditure on intermediate goods from urban sectors.

[102] The bargaining power of unskilled labour for higher wages is likely to be weaker since it is not well organized in trade unions as skilled labour.

According to Adam and Bevan (2006), backward linkages from the urban formal sectors to the rural sectors are extremely weak. The effect on real wages differs between the two categories of labour, skilled and unskilled. The effect on skilled labour is almost uniform across the three experiments where its real wage dramatically falls to an average of about -1.8 percent in the long run. Unskilled labour however gains considerably; its real wages move to a long run growth of 15.2 percent over its baseline value in experiment 2, 15.6 percent in experiment 3 and 15.4 percent in experiment 4. As explained in the foregoing, the effect of Dutch disease is to cause a contraction of the tradable sector and expansion of the non-tradable sector due to the resource movement, which has implications on wages in the sectors. In the present experiments, Dutch disease effects are not present and therefore the negative effects on real wages for skilled labour are due to other factors like the rise in domestic prices of tradable goods[103].

(iii) Experiment 5

Results of this experiment are given in Table 31. As seen, the distributive pattern is similar to that of experiments 2, 3 and 4; however the magnitudes of the changes are significantly different. Skilled labour is the hardest hit, with its real wage dropping to -8.3 percent relative the baseline growth by the tenth year. Growth of the wage rate of unskilled labour, although positive, declines from 5.0 percent relative to base growth to 4.0 percent. Focusing on real incomes, we notice rather an intriguing outcome; for rural households growth in real income is quite low, starting off at 0.8 percent of base growth in the short run, through 1.1 percent in the medium term to 1.5 percent in the long run. On the other hand, the real incomes of urban households grow remarkably in the short run (slightly above 17.5 percent relative to base growth); only to subsequently deteriorate as the simulated economy evolves. Thus, in the long run real income growth is 14.6 and 14.7 percent for skilled labour and unskilled labour respectively. As is explained by Adam and Bevan (2006) who obtained comparable results in a similar experiment, the reason why urban households enjoy substantial gains in real income is because of the decline in food prices. Rural households on the other hand fair poorly because of the adverse shift in the internal terms of trade, which is magnified by the low-income demand in food consumption from all households. Moreover, according to Adam and Bevan (2006) rural households as net producers, suffer twice over: the fall in food prices caused by

[103]For some reason, there is little or no effect on nominal wages for skilled labour in all the three experiments.

the increase in supply is exacerbated by the weakness in the demand for food because of the low-income elasticity.

5.2.2 Modeling Remittances Shocks in Kenya

Unlike ODA inflows, remittances do not enter the national budget. They are transmitted directly to households and have an impact on household consumption and investment. To the best of our knowledge, none of the studies focusing on the effect of remittances inflows to Kenya have used an economy-wide approach. For instance as we saw earlier, Kiiru (2010) and Simiyu (2013) used a micro econometric approach, basing their analysis on the premise that remittances are basically used by households for consumption and have an insignificant effect if any on the economy as a whole. However as elsewhere noted, this notion could be erroneous. Diaspora remittances to Kenya are also channelled to investment in real estate and purchase of government securities such as infrastructure bonds and savings development bonds (https://www.centralbank.go.ke). Since remittances are likely to have multiplier effects that reverberate across the entire economy, an economy-wide study is an imperative. It is in this light that this study should be viewed, which as a first of its kind in Kenya attempts to model remittances using a CGE approach. We use the same model that was used in the previous section, albeit with some modifications, which are necessary given that the transmission mechanism through which remittances enter the economy is different from that of ODA inflows. Thus, the following are the key assumptions underlying the present model. First, foreign aid is assumed fixed and just like in the previous section; both the public and private capital stock adjusts over time through depreciation and gross investment. This together with the updating of the labour supply[104] and autonomous TFP ensures that the model is recursive dynamic. Second, because remittances do not enter into the government budget, issues such as the elasticity of public infrastructure in private production (alpha g) and O&M costs that are central in the aid model do not matter in this simulation. Third, in order to conform to Engel's law, we take food to be a necessity good in the backdrop of a rise in household incomes resulting from the surge in Diaspora remittances. Thus we assume presence of a subsistent component in food consumption so that the income elasticity of demand for food is less than unity[105]. Forth, rural and urban households are assumed to benefit equally from remittance

[104] We assume like in the aid model that labour supply is fixed but inter-sectorally mobile. Additionally, elasticity of substitution between skilled and unskilled labour is 0.99.

[105] We use a subsistence share equivalent to 10 percent so that the income elasticity of demand remains closer to one.

inflows, which according to our baseline database (SAM, 2003) is approximately the case. Fifth and finally, the Armington and CET elasticities used in the previous section are retained for the present analysis. In what follows, we assume that the additional remittance inflows boost savings of both rural and urban households. Before endeavouring on the simulations, a re-look at Table 9 in chapter 1 is necessary to clearly understand the pattern and evolution of remittance inflows into Kenya. The table shows that over the years remittance inflows to the Kenyan economy have grown in importance, even overtaking ODA inflows in 2003. During that year, the ratio of remittances to GDP was 3.6 percent compared to 3.5 percent the ratio of ODA to GDP. By the middle of the 2000s decade however, the share of the remittance flows to GDP started declining, culminating at 1.7 percent by 2010. Beginning 2011, the flows began to recover, perhaps as a reflection of the ebbing of the economic and financial crisis that had hit the world towards the end of that decade. Consequently, the share of the remittances to GDP peaked at 2.3 percent by 2013[106]. To investigate how a surge in remittances may shock the Kenyan economy, we simulate an increase of remittances to a level equivalent to 5 percent of GDP, which is double the average share of the inflows received between 2003 and 2013.

Simulations and Discussion of Results

(a) Effects of Remittances Inflows Shock on Macroeconomic Variables

Tables 32 analyses the effects of remittances on some selected macroeconomic variables. These include real exchange rate, exports, imports, real GDP, private investment, private consumption and household income.

[106] It is worthy of note however, that official statistics more often than not understate the level of remittance inflows to developing countries (see e.g. Salahuddin and Gow, 2015 and OECD, 2006). However, For Kenya this may not be the case anymore with the entry of mobile money transfers in the recent past, which makes it easier for the authorities to capture remittances data.

Table 32: Macroeconomic Effects of Remittances Inflows Shock

		Period	% Change from baseline growth
Subsistence food share in consumption[f]			0.1
Export-weighted real exchange rate		to t=1	-7.6
		to t=5	-7.8
		to =10	-8.6
Total exports		to t=1	-12.4
		to t=5	-15.8
		to t =10	-19.7
Total imports		to t=1	3.4
		to t=5	1.4
		to t =10	-1.0
Trade balance (% of GDP)		to t=1	-22.3
		to t=5	-22.7
		to t =10	-23.2
Real GDP		to t=1	-3.7
		to t=5	-5.9
		o t=10	-8.7
Private Investment	Food	to t=1	8.7
		to t=5	7.3
		to t =10	4.8
	"Others"	to t=1	4.9
		to t=5	3.9
		to t =10	1.6
	Services	to t=1	1.5
		to t=5	-1.0
		to t =10	-4.8
	Manufacturing	to t=1	2.1
		to t=5	-1.0
		to t =10	-5.2
	Cash Crops	to t=1	-2.2
		to t=5	-11.3
		to t =10	-21.2
	Total	to t=1	2.7
		to t=5	0.5
		to t =10	-2.9
Private consumption		to t=1	2.2
		to t=5	1.4
		to t =10	-3.4
Indirect tax revenue		to t=1	8.8
		to t=5	6.4
		to t =10	3.6
Government consumption (% of GDP)		to t=1	7.6
		to t=5	7.7
		to t =10	8.0

Source: Author's Computations Based on CGE Model

As is discernible in Table 32, a surge in remittances leads to an appreciation of the real exchange rate, which rises to 7.2 percent over the baseline by the tenth year. The reason for this appreciation is because of the rise in domestic prices that is brought about by the excess demand on non-tradable goods generated by remittances. In an earlier section of this thesis, we described how appreciation of the real exchange rate may harm the economy, including

inflicting Dutch disease effects on an economy. Needless to say, a major effect of the disease is loss of international competitiveness of domestic firms, which leads to a decline in export volumes. Our results show this to be the case; there is a steep deterioration of exports growth as the simulated economy evolves so that by the tenth year, it decreases to -19.7 percent relative to the base. Another consequence of the Dutch disease is the increase in import volumes resulting from the spending effect as real incomes increase. For this reason therefore, as remittance inflows to Kenya increase, we observe a positive effect on the growth of import volumes in the short and medium term, increasing to 3.4 and 1.4 percent in the first and fifth year respectively. However by the tenth year, the growth declines modestly to -0.1 percent below the baseline. The poor export performance coupled with the surge in imports contributes to the worsening of the trade deficit, which moves from -22.3 percent of GDP in the short run to -23.2 percent in the long run[107].

Focusing on investment, our analysis shows a mixed outcome for the various productive sectors. A surge in remittances generally boosts investment in the non-tradable sectors (food and "others") while it leads to a reduction in investment in the tradable sectors (cash crops and manufacturing). The services sector also has its investment declining although it may be difficult to say whether it is a tradable or non-tradable sector[108]. A closer look at Table 32 reveals an interesting pattern in the change of sectoral investment; initially, most of the sectors start off quite well, however the positive effect seems to diminish as the economy evolves. This outcome resonates with the Dutch disease literature, which as we mentioned earlier posits that a switching of resources from the tradable sector to the non-tradable sector (the resource movement effect) leads to an expansion of the non-tradable sector at the expense of the tradable sector. In the SAM under which our CGE model is grounded, building and construction forms a major component of the "others" sector, which implies, plausibly, that it is the key driver of the rise in investment witnessed in that sector. Some of the literature on remittances in Kenya asserts that apart from increasing consumption, the flows are invested in the development of real estate among other activities (see e.g. www.centralbank.go.ke). Apparently, the rise in investment of the non-tradables is strong enough to dominate the decline in investment of the tradables, so much so that the growth of total private investment is

[107]Trade balance deteriorates in this case to keep the current account balance in equilibrium in the face of an increase in remittances.

[108] Most studies categorize services as a non-tradable sector; however in many countries including Kenya, the sector produces both tradables (e.g. trade, tourism, hotels and transport) and non-tradables (e.g. finance and insurance)

positive at least in the short and medium term. Several factors may explain why investment increases following a surge in remittance flows. As some of the literature (e.g. Lartey, 2011) suggest, remittances are instrumental in alleviating credit constraints in a country. Accordingly, well-functioning financial intermediaries mobilize savings and facilitate transactions, allowing the transfer of funds from savers to investors at lower costs, and hence serve to channel remittances into high-return projects, thereby enhancing investment. Another channel through which remittances may boost investment is consumption smoothing. As observed in Table 32, remittances lead to the growth of private consumption, even though this growth ebbs as the simulated economy evolves. This acts as a stabilizer of the macroeconomic framework of the receiving country, which then creates a favorable environment for investment. It is evident from the results that a surge in remittances leads to a reduction in economic performance, notwithstanding the boost in private investment. There is a significant decline in the growth of real GDP, which moves to a long run level of -8.7 percent relative to the baseline growth. This outcome is consistent with some of the literature which argues that the Dutch disease phenomenon could be harmful to the long run growth of the recipient economy (Amuedo-Dorantes and Pozo, 2004; Acosta et al., 2009). As the literature shows, economic growth declines because resources are re-allocated from the tradable sector to the non-tradable sector. Another important reason why performance of the economy worsens is because of what some writers regard as the "boomerang effect", which leads to deterioration of the current account balance that is a repercussion of the widening trade balance that we observed above[109].

As mentioned in the foregoing, remittances, by stimulating excess demand for non-tradable goods induce inflation in the economy, which is deleterious to economic growth because it not only reduces the level of investment, it also affects the efficiency of factors of production[110]. Moreover, because remittances take place under asymmetric information and economic uncertainty, it could be that there exists a significant 'moral hazard' problem leading to a negative effect of remittances on economic growth. As Lartey (2011) argues, a surge in remittances adds to households' income which makes workers feel they can now afford to trade off work for more leisure hence diminishes labour supply and reduce economic growth.

[109]The negative effects of the worsening current account deficit dominate the positive effect of a rise in private investment.

[110]Our results corroborate several other studies that have found a negative correlation between inflation and economic growth. Some of these studies are cited in Andres and Hernado (1997) and include Grimes (1991), Smyth (1994), Cardoso and Fishlow (1989) as well as Bruno (1993).

Another interesting outcome of remittance inflows is the increase in the growth of public consumption, which steadily increases over time. Although it may be difficult to administer direct tax on remittances, the flows may affect aggregate private-sector demand through its main components; including consumption, investment and imports, which as we have already observed portray an increasing trend in the short and medium term. Thus, a surge in remittances has a positive effect on indirect tax revenue, whose growth moves to a long run growth of 3.6 percent relative to the baseline growth, which explains the increase in public expenditure observed in Table 32. In a nutshell, our results augment the findings by Kiiru (2010) and Simiyu (2013) on the effects of remittance inflows into Kenya.

(b) Effects of Remittances Inflows Shock on Sectoral Output

Table 33 analyses the effects of a surge in remittances on Kenya's productive sectors.

Table 33: Effects of Remittances on Sectoral Output (% Change from Base)

Sector	period	Effect
Food	to t=1	1.8
	to t=5	1.8
	to t=10	1.6
"Others"	to t=1	2.7
	to t=5	5.7
	to t=10	9.3
Services	to t=1	2.3
	to t=5	-0.1
	to t=10	-3.1
Cash crops	to t=1	-12.3
	to t=5	-15.8
	to t=10	-19.6
Manufacturing	to t=1	1.1
	to t=5	-0.3
	to t=10	-2.1

Source: Author's Analysis Based on CGE Model

As is to be expected, the impact on sector output closely mimics the impact on sectoral investment that was analysed in the previous section. There is a marked growth in output for non-tradable sectors (food and "others"), reflecting the increase in investment in the two sectors that we observed in the foregoing section. The analysis shows the "others" sector benefiting most from a surge in remittances, with its growth increasing to 9.3 percent over the baseline by the tenth year. As noted earlier, this outcome corroborates the existing literature which asserts that a big chunk of remittance inflows to Kenya goes to boosting investment in real estate and hence increase production in the sector.

On the flip side, tradable sectors (cash crops and manufacturing) as well as services perform relatively poorly, reflecting the reduction in investment that results from a surge in remittances. The long run negative effects on production are relatively more intense in the cash crops sector, in which case its growth declines to -23.0 percent below the baseline. On the other hand, output of services and manufacturing decreases to -3.1 and -2.1 percent.

5.2.3 Modeling Foreign Direct Investment Shocks in Kenya

In most applied models, FDI is not modelled explicitly due to data limitations especially on sales, labour and capital inputs of foreign affiliates (Lejour and Rojas-Romagosa, 2006). Thus, for this reason and the fact that the benchmark dataset (SAM, 2003) we use in our analysis does not distinguish between foreign and domestic investment, we have to look for a good method of measuring the impact of FDI in Kenya albeit implicitly. As already noted, most of the studies on FDI flows into Kenya have used econometrics in their analysis, which because of its partial approach to economic analysis, may not capture aspects of Inter-industry or multi-sector backward/forward linkages that are a key feature of the economy. The CGE approach that we use here is an attempt to circumvent this problem. Earlier, we observed in the literature review that FDI inflows may affect the economy mainly in two ways; stimulation of domestic private investment (addition to capital stock) and spillovers effects (via technological transfer). We also noted in an earlier section that the SAM database under which our model is grounded does not include FDI data; hence it is not possible to directly model FDI inflows. The review of literature has shown evidence of the presence of spillovers due to FDI in a majority of African countries, including Kenya; however, the literature is divided on the question of whether FDI spillovers impact the economy positively or negatively. For the purpose of this study therefore, FDI spillovers are an appropriate variable to use as proxy to indirectly measure the impact of FDI inflows into Kenya. In the ensuing simulation, we assume that FDI spillovers are transmitted throughout the economy via the services sector. This assumption is informed by the literature that shows that the services sector has a major role in improving the productivity of other sectors of the economy, especially manufacturing. For instance, Vincenti (2007) and Baumol (2002) argue that the services sector produces positive externalities on manufacturing, through innovations brought about by R&D activities as well as the learning-by-doing process that takes place in the services sector. Hermes and Lensink (2003); Borensztein et al. (1998) and Bell and Marin (2006) argue that technological spillovers will happen in a country only if human capital is well-developed. The authors posit that “advanced”

industries such as the ones in the services sector are more likely to generate spillovers than "traditional" industries since these employ skilled labour that is relatively more capable of absorbing new technology. Gorodnichenko et al. (2015) suggest that the services sector is relatively more receptive of FDI spillovers since it is where methods and skills of production are relatively visible and transferable.Voorpijl (2011) in a case study of Naivasha, Kenya posits that a large proportion of FDI inflows to the country are in the cash crops and services sectors. The author concludes that FDI in the services and horticulture sectors has generated both positive and negative externalities for the country. It is logical therefore, that we focus on the services sector in the ensuing simulations.

To model the FDI spillovers, we follow Adam and Bevan (2006) and assume presence of a learning-by-doing externality in the services sector, which generates a Hicks-neutral technical progress[111] to TFP in that sector. To paraphrase the two authors, equation 5.3 assumes that $A_{it} = A_i$ for non-spillover sectors, while in the spillover sector, denoted by s, TFP evolves according to:

$$A_{st} = A_{s0}[1+\psi(\ln E_t^p - \ln \overline{E_t^p})] \quad \text{.....5.3}$$

where $E_t^p = \sum_{j=1}^{\infty} \beta^j E_{t-j}$ is the discounted sum of exports in the spillovers sector up to and including t-1 period and $\overline{E_t^p}$ is the cumulative exports under the baseline trajectory for the economy. The term $\psi \geq 0$ is the elasticity of TFP in services with respect to A_{st} and measures the extent of spillovers, while $\beta = (1+\rho)^{-1} < 1$ is the discount factor, and A_{s0} is the value of A_{st} in the baseline calibration. Thus in our model, ψ is assumed to scale up the production function shift parameter and hence enhance the productivity of the production function. In this case therefore, we set ψ to 0.2, which is the same value used by Adam and Bevan (2006) for Uganda[112].

[111] This was put forth in 1932 by John Hicks in his book "The Theory of Wages" and refers to a situation where a change in the production function changes the technology parameter but leaves the capital-labour ratio intact.
[112]Adam and Bevan (2006) use also a value equal to 0.45 for the purpose of a sensitivity analysis. This value according to the authors is a very high level of elasticity.

Simulations and Discussion of Results

(a) Macroeconomic Effects of FDI Spillovers in Kenya

Table 34 reports the macroeconomic outcomes of some selected variables following FDI spillovers.

Table 34: Macroeconomic Effects of FDI Spillovers in the Services Sector

		Period	% Change from baseline growth
Export-weighted real exchange rate		to t=1	0.0
		to t=5	0.8
		to =10	3.0
Total exports		to t=1	-0.6
		to t=5	-1.9
		to t =10	-1.5
Services exports		to t=1	0.5
		to t=5	11.4
		to t =10	45.3
Cash crops exports		to t=1	-1.0
		to t=5	-5.2
		to t =10	-11.4
Manufacturing exports		to t=1	0.3
		to t=5	2.1
		to t =10	5.4
Total imports		to t=1	-0.4
		to t=5	-1.4
		to t =10	-1.1
Trade balance (% of GDP)		to t=1	-15.3
		to t=5	-15.4
		to t =10	-15.4
Real GDP		to t=1	-0.5
		to t=5	-1.8
		to t=10	-2.3
Private Investment		to t=1	0.0
		to t=5	2.4
		to t =10	10.3
Private Consumption	Rural	to t=1	0.1
		to t=5	0.9
		to t =10	2.7
	Urban skilled	to t=1	-2.3
		to t=5	-10.3
		to t =10	-17.6
	Urban unskilled	to t=1	-2.4
		to t=5	-11.2
		to t =10	-20.0
	Total	to t=1	-1.0
		to t=5	-4.5
		to t =10	-7.1
Nominal income	Rural	to t=1	-0.1
		to t=5	-1.0
		to t =10	-2.6
	Urban skilled	to t=1	-2.6
		to t=5	-13.3
		to t =10	-25.4
	Urban unskilled	to t=1	-2.5
		to t=5	-12.4
		to t =10	-23.0
	Total	to t=1	-1.3
		to t=5	-6.6
		to t =10	-12.7

Source: Author's Computations Based on CGE Model

As is to be expected, an increase in FDI spillovers in the services sector enhances efficiency of productive sectors, particularly those producing non-tradable goods, which lead to an increase in output. This in turn causes disinflation, which leads to a depreciation of the real exchange rate that increases to 5.1 percent over the baseline in the tenth year. Consequently, there is a decline in the volume of imports, as these now become more expensive in the domestic market. The analysis in table 34 indicates a sluggish performance in total exports, which is contrary to what one would expect. Nonetheless, the services sector, which by design is our spillover sector has its exports increase to 45.3 percent over the baseline in the tenth year. This is because the sector benefits from increased international competitiveness (arising from disinflation) and enhanced productivity[113] that starts to be felt by the middle of the simulation horizon. For this same reason, manufacturing exports experience reasonable growth in the long run, although at a lower level than the exports in services (5.4 percent compared to base growth).

Interestingly, cash crop exports decline following an increase of FDI in services, and this situation deteriorates as the simulated economy evolves. Suffice it to say that this outcome is responsible for the sluggish performance of total exports already noted. The reduction in the growth of cash crop exports, which declines to -11.4 percent below the baseline by the tenth year, reflects the poor performance of the sector in terms of output that is discernible in Table 35. The decline in cash crops output (and hence exports) is as a result of labour migrating from the sector to other sectors. Enhanced efficiency of labour in the spillover sector has a positive ripple effect on other sectors, especially those that use services more intensively such as, manufacturing and "others"[114]. Thus, the enhanced productivity in these sectors leads to an increase in wages for workers employed there (recall our assumption that labour is paid a wage equal to its marginal product). Eventually, workers migrate to the now-better-paying sectors at the expense of the cash crop sector, which utilizes services less intensively[115]. Another plausible reason why there is a reduction in cash crop exports is the decline in the imports of

[113] Arguably, Kenya has a relatively well developed human capital base. Workers employed in the services sector are therefore capable of absorbing spillovers in terms of acquiring new technology and transforming it into production.

[114] This is consistent with the findings by Fernades and Paunov (u.d) that an increase in FDI in services leads to a significant increase in TFP for firms using services intensively.

[115] Transport infrastructure is the main type of service utilized by the cash crop sector in Kenya, at least for the main crops like coffee and tea. This being a rural sub-sector may not benefit much from such developments as new technologies in telecommunications.

farm inputs such as fertilisers[116], which comes about as a result of the depreciation of the exchange rate. An analysis of the results in table 34 reveal that although total exports and imports decline following an increase in FDI in services, the former decreases faster than the latter. This leads to a worsening of the trade deficit, which moves from 15.2 percent of GDP in the base year to 15.6 percent in the tenth year. This outcome contradicts the theoretical literature we reviewed earlier that predicts that FDI spillovers can improve trade performance of the host economy (e.g. Blake and Pain, 1994; Barry and Bradley, 1997; Krautheim, 2008 etc)[117]. It is important to note that whether FDI spillovers have a positive or negative effect on an economy depends on various determinants (see Table 10), key among them being the absorptive capacity of workers to assimilate new technologies.

Focusing on economic growth, the analysis indicates that FDI spillovers could be immiserising, in line with the findings by Adam and Bevan (2006) who however examine the impact of manufacturing spillovers. As seen in Table 34, growth of real GDP declines from -0.5 percent below the baseline in the first year to -2.3 percent in the tenth year. A couple of factors may explain this outcome. First, the worsening current account balance; itself a consequence of the widening trade deficit negates any gains that may arise from the boost in private investment, which as we observe increases to 10.3 percent over the baseline in the tenth year. Second, depreciation of the real exchange rate makes imports dearer in the domestic market, which dissuades producers from importing the requisite industrial inputs and machinery. This then explains the decline in domestic production that is evident in Table 35. The cumulative effect on real income and consumption predictably follows the same pattern as that of real GDP. Compared to the baseline growth, the long run growth of real income and total private consumption decreases to -12.5 and -71 percent respectively. Interestingly, the spillover effect is more immiserising to urban than rural households, with the urban skilled households being affected most.

[116] According to Levin (2010), fertiliser use in Kenya has increased over time. The author also notes that there is lack of a locally produced substitute for chemical fertilizers in the country; hence an increase in the import price would have a major effect on production.

[117] A comparative analysis based on empirical literature may not be useful as the results depend on the parameters and assumptions under which the CGE model is grounded.

(b) Sectoral Effects of FDI Spillovers in Kenya

Table 35 analyses the effects of an increase in FDI spillovers in services on Kenya's productive sectors.

Table 35: Effects of FDI Spillovers on Sectoral Output (% Change from Base)

Sector	Period	Effect
Food	to t=1	-0.2
	to t=5	-0.6
	to t=10	-0.2
Others	to t=1	0.9
	to t=5	5.0
	to t=10	11.7
Services	to t=1	-0.2
	to t=5	1.7
	to t=10	9.5
Cash crops	to t=1	-1.0
	to t=5	-5.1
	to t=10	-11.4
Manufacturing	to t=1	-0.2
	to t=5	-0.4
	to t=10	1.2

Source: Author's Analysis Based on CGE Model

Looking at Table 35, we observe some interesting outcomes on sectoral output due to FDI spillovers. The enhanced efficiency in the services sector yields gainers and losers, whereas the magnitude of the gain/loss intensifies as the simulated economy evolves[118]. The sector that gains most from spillovers in services is "others", with its output growth increasing to 11.7 percent over the baseline in the tenth year. It is followed by services (9.5 percent) and manufacturing (1.2 percent). On the other hand, cash crops and food sectors lose out but the former is affected more. Growth of cash crops output falls to -11.7 percent below the baseline in the tenth year while that of food falls marginally to -0.2 percent over the same period. We explained in an earlier section the reason why there is a reduction in cash crop output following an increase in FDI spillovers. It is basically because of the resource movement effect and the increase in the cost of imported raw materials such as fertilizers. These results point to a conclusion that FDI spillovers may result in efficiency losses rather than gains, at least for some sectors. In the review of literature section, we noted arguments by some authors (see e.g. Aitken and Harrison, 1999; Bloom et al., 2007) that firm performance is affected by mostly

[118] This is because the spillover effect takes time to be felt as knowledge and skills are learnt and assimilated.

two countervailing FDI spillovers; positive externalities due to technological progress and negative externalities due to the 'market-stealing' effect, which leads to a crowding-out of firms.

5.2.4 Welfare Effects of Capital Inflows Shocks in Kenya

One of our objectives in the present chapter is to determine the effects of capital inflows shocks on welfare in Kenya. As we have seen in the ensuing analysis, these shocks lead to among others a change in the price of goods and services, which in turn have an impact on consumers' welfare. It is easy to fathom that an increase (decrease) in commodity prices makes a consumer worse (better) off than before the increase (decrease), however it is not as easy to answer the question "how worse off" the consumer has been rendered by the price increase. In Chapter 4 we described two direct measures of welfare; EV and CV that can be used to answer this question. Before explaining how we directly measure welfare, it is important to point out that the alternative method we could use to measure welfare (including poverty and income distribution) is the micro-simulation module that we described in Chapter 4, which as earlier noted, is usually linked to a CGE model. We also noted that for micro-simulation to work, the model should in essence be disaggregated as much as possible to be in harmony with survey micro data. The model we use in the current chapter, unlike the IFPRI model of Chapter 4 barely meets this requirement, as it is based on a highly aggregated database, whereby only three households are incorporated[119]. Were we to use the micro-simulation framework, we would have to link these three representative households in the SAM to the KIHBS survey data, which entails splitting households in the KIHBS into three groups that are equivalent to the number of households in the SAM, an exercise that is too time- consuming and skill intensive as to be beyond our scope. Given these methodological challenges therefore we resort to the direct measure of welfare. Thus, in the current model, consumption for each household type is defined by a CES linear expenditure system. The model also allows for household subsistence consumption irrespective of price or consumer's income. Thus we can assume households have a Stone-Geary utility function of the form:

[119] Recall that we chose this model for its suitability in analyzing the supply-side effects of capital inflows shocks, unlike the IFPRI model whose focus is the demand side.

Maximize U = $\varphi \ln(A-\alpha)+(1-\varphi)\ln(B-\beta)$ subject to the budget constraint

$Y=AP_a+ BP_b$..... equation (5.4)

where φ is a share parameter, A and B are two goods, α and β are the subsistence levels of demand for A and B respectively. In addition, Y is income while P_k ($k=a, b$) are the prices of A and B. To determine the indirect utility function V (Y, $P1_,$ P_2), the following Marsharian demand curves are derived from equation (5.4):

$$A^* = \alpha + \frac{\varphi}{p_a}(Y - p_a\alpha - p_b\beta) \quad \text{and}$$

$$B^* = \beta + \frac{1-\varphi}{p_b}(Y - p_a\alpha - p_b\beta)$$

The sum of all the proportions of the goods consumed must equal 1. The first term on the right-hand-side of the equality is the subsistence consumption. A consumer will always consume this amount irrespective of their income or the price. The term $Y - p_a\alpha - p_b\beta$ is the income the consumer has left over, after the subsistence levels are met, which is actually the residual income. The amount households will purchase of A and B using this residual income is negatively affected by price and positively affected by its rank in the household budget. If φ increases, it implies that good A is relatively more important than good B. Accordingly, the consumer will, ceteris paribus, buy less of B and more of A. Thus to determine V (Y, $P_{1,}$ P_2), we substitute A* and B* back into the direct utility and get:

$$V\ (Y,\ P1_,\ P_{2)} = \varphi \ln[\frac{\varphi(Y - p_a\alpha - p_b\beta)}{p_a}] + (1-\varphi)\ln[\frac{(1-\varphi)(Y - p_a\alpha - p_b\beta)}{p_b}]. \text{.....equation (5.5)}$$

From equation (5.5) we are then able to compute the EV, given the income and price data obtained from the CGE model. It is important to note that the ensuing computations are done on the basis of some key assumptions. First, we assume a symmetric Stone-Geary utility function that has two consumption goods; food and a composite good comprising of manufacturing, private services and "others" goods (henceforth non-food items). Thus, we

follow Kamau et al. (2011) and assume the food share in total consumption is φ=0.48 and (1-φ) =0.52 for non-food items. According to Kamau et al. (2011), this proportion of food in total expenditure was found to be representative of low income (second quintile) households in Nairobi. Secondly, the demand function assumes that a certain minimum level of some good has to be consumed, irrespective of its price or consumer's income. Thus; we assume arbitrarily that α=10 while β=5. Third, since by definition EV is computed on the basis of a new utility and old prices, new utility is determined based on the assumption that consumers faced a vector of final (tenth) year prices and still have their old (initial) income. The following three steps clarify the method that we use to compute EV:

1. Solve for utility level (equation 5.5) using old (initial) income and new (final year) prices given in table 36;
2. Set the value found in step 1 equal to the utility function using base year (old) prices and unknown new income, and solve for new income; and
3. Subtract income found in step 2 from old income to get EV.

Table 36: Income and Price Vectors used To Calculate Equivalent Variation

Variable		Experiments						
		ODA Inflows					Remittances	FDI
		ODA_1*	ODA_2	ODA_3	ODA_4	ODA_5		
Initial income (Y) in million Kenya Shillings	Rural	297,019	297,019	297,019	297,019	297,019	297,019	297,019
	Urban unskilled	146,774	146,774	146,774	146,774	146,774	146,774	146,774
	Urban skilled	611,654	611,654	611,654	611,654	611,654	611,654	611,654
Price for food (P_a)	Base year	1.18	1.18	1.18	1.18	1.02	1.02	1.01
	Final year	1.31	1.07	1.07	1.07	0.89	1.02	1.01
Price for non-food items (P_b)	Base year	1.46	1.19	1.19	1.19	1.13	1.13	1.13
	Final year	1.71	1.06	1.05	1.05	1.00	1.10	1.08

Source: Simulation Results Based on the CGE Model

*Note that the scenarios involving ODA Inflows are as defined earlier, i.e.:

ODA_1 =Benchmark

ODA_2 = Neutral

ODA_3 = Export-biased

ODA_4 = Domestic-biased

ODA_5 = Domestic- biased with LES

Table 37: Equivalent Variation (Percentage of Total Income)

Scenarios		Households		
		Rural	Urban skilled	Urban unskilled
1.Doubling of Foreign aid inflows	a. ODA_1	-3.5	-7.2	-1.7
	b. ODA_2	3.2	6.6	1.6
	c. ODA_3	3.3	6.9	1.6
	d. ODA_4	3.3	6.9	1.6
	e. ODA_5	3.9	7.9	1.9
2. Doubling remittances inflows		0.4	0.8	0.2
3. Increasing services spillovers		0.7	1.4	0.3

Source: Author's Computations

Discussion of results

Table 37 analyses the effects on welfare of the various experiments involving the three capital inflows shocks that we modelled earlier, that is; ODA, remittances and FDI. As noted in Chapter 4 of this thesis, EV tells us, at the old prices (before the change) how much money should be taken away from the consumer to get them to the same new utility level they would reach if they had their old income but faced the new prices. Put another way, EV is the amount of money that needs to be taken away, at the original price to reduce the welfare of the consumer by the same amount as the price change. Thus, it follows that a positive EV implies improvement in welfare while a negative outcome implies deterioration. The analysis in Table 37 suggests that capital inflows are generally welfare enhancing, and more so if well invested in the case of ODA. It is evident from the results that the impact of capital inflows on welfare closely reflects the effects discussed earlier. A closer examination of the results reveals that the impact of the capital inflows shock (whether negative or positive) is highest on urban households. Compared with other scenarios, ODA_1 has the most negative effect on welfare, a situation which can be attributed to the marked increase in domestic prices that result from Dutch disease effects. Needless to say, inflation erodes the purchasing power of money that, together with the drop in household real incomes leads to a massive reduction in welfare. On the other extreme end is the ODA_5, which registers the highest rise in household welfare. Welfare in this scenario improves as a result of the change in household consumption behaviour (now LES) and the effect is most intense on urban households[120]. The

[120] This is obviously because rural households suffer income loss due to the fall in food prices, unlike urban households who benefit.

consequential weakening of demand especially for food leads to a fall in domestic prices which, coupled with the substantial growth in real income causes welfare to improve. The rest of the scenarios (ODA_1 ODA_2 and ODA_4) also register a marked improvement in welfare, notwithstanding the increase in domestic prices. Apparently, the negative effect of inflation is offset by the massive rise in household real income, which as earlier observed is a common feature across all the three scenarios. Welfare increases in the case of remittances and FDI. Nonetheless, this increase in welfare is less intense for remittances than for FDI, an outcome that one may find somewhat interesting, since the popular brief is that remittances have a major impact on welfare as they augment household income. Additionally, the dim view that our results present regarding remittances run contrary to micro studies such as World Bank (2011) that found remittances to have a major positive effect on poverty reduction in Kenya. Unlike most of the micro studies on the subject, ours is a macro study, which takes into account all households, including those without relatives abroad and who thus do not receive remittances. Our results therefore suggest existence of some sort of a micro-macro paradox due to remittances: at the macro level, we find the increase in welfare being dampened by the rise in domestic prices and the sluggish growth in real income.

5.4 Summary and Conclusion

In this chapter we have applied a supply-side model that is a modification of the model in Adam and Bevan (2006). This model, unlike the IFPRI Standard Model we used in Chapter 4, focuses also on the supply-side of the economy, hence it is better to use since we are interested in evaluating the effects on both sides of the economy following a surge in capital inflows. Like the IFPRI Model, this model is calibrated on the basis of SAM (2003), however the database is now highly aggregated; it comprises of six sectors, 3 household types and 2 labour categories. It is worthy of mention that this SAM does not distinguish between foreign and domestic investment thus, we model FDI implicitly by using FDI spillovers as a proxy. Our model therefore assumes that FDI spillovers are transmitted through out the economy via the services sector, which is characterized by a learning-by-doing externality that generates Hicks-neutral technical progress to TFP in the services sector. In order to evaluate the welfare effects of capital inflows shocks, we have designed an appropriate method that involves computing equivalent variation (EV), which is a direct measure of welfare. Other methods such as CGE micro-simulation are not suitable in this instance as our model is highly aggregated, with only three household types. Following is a

summary and conclusion of key findings of this study. First, ODA inflow shock has varied effects on the Kenyan economy, depending on how the aid is invested. When the ODA is not put to productive use such that the effect is only felt on the demand side, the macroeconomic outcome is pessimistic. In this case, the upsurge in ODA in causes Dutch disease in the economy; the real exchange rate appreciates, leading to a substantial decline in exports, private investment and hence economic growth. When ODA is however used productively, the outcome on macro variables is optimistic. Now, there is a substantial growth in private investment and real GDP. The upsurge in ODA improves the fiscal balance, and by reducing the need for seignorage revenue, it 'crowds-in' the private sector, hence the growth in investment. Although the real exchange rate still appreciates as a result of the upsurge in ODA inflows, its impact on the economy is negated by a number of factors, key among them the fact that the 'now productive' aid eases the supply bottlenecks, which increases the economy's total output including exports. The increased productivity of the economy leads to a reduction in inflation, thereby militating against the negative effects of the change in relative prices. When ODA investment is biased towards production for exports the positive effect on economic growth is more pronounced, reinforcing the need for an export-oriented trade policy for Kenya. Moreover, when consumer behaviour changes such that we now have a LES, the effect on macro variables is positive and dramatic. In this instance, the change in consumer behaviour leads to a weakening of demand for food and hence a fall in domestic prices, which coupled with the favourable supply response, improves the macro variables. The distributive and welfare impact of an upsurge in ODA inflows closely mimic the macroeconomic outcome. When ODA is used unproductively, the outcome on household real incomes and welfare is negative. Additionally and for some reasons, the distribution of real household incomes is lopsided in this case, whereby that of urban dwellers declines faster than that of their rural counterparts. In the case when the ODA is used productively, such that Dutch disease is absent, the distributive impact is positive. The results indicate a more favourable distributive outcome when ODA investment is biased towards export production, compared to the domestic production bias and the neutral case. Welfare improves if the ODA is productively used, and it increases dramatically when household consumption behaviour changes to LES, which is concomitant to the remarkable growth in real incomes.

Second, an upsurge in remittances inflows, like in the case of ODA leads to an appreciation of the real exchange rate. A remittances shock brings about excess demand for non-tradable goods, which leads to a rise in domestic prices and hence appreciation of the real exchange rate. The resulting Dutch disease effect leads to a loss in international competitiveness of domestic firms, which causes a crowding-out of private investment and a decline in exports. At the same time, the

spending effect (due to the increase in real household income) of the remittances causes an increase in imports, which together with the reduction in exports leads to a "boomerang effect" that see to a deterioration of the current account deficit, which concomitantly leads to a decline in real GDP growth. When it comes to sectoral output, remittances inflow shock positively affects non-tradable sectors, whose output growth increases. On the other hand, tradables sectors are negatively affected. Additionally, an upsurge in remittances inflows is welfare enhancing, although not as much as in the case of productive ODA discussed above. Third and finally, an increase in FDI spillovers is generally immiserising as it generates a sluggish performance of macro variables. Growth of real GDP, exports and nominal income decline, while that of private investment improves, plausibly as a result of the increase in the productivity of the services sector. On the issue of sectoral performance, it is discernible that an increase in FDI spillovers yields mixed outcomes. The resource movement effect of enhanced spillovers is such that some sectors, such as 'others' gain while others like cash crops lose out. Another plausible reason why some sectors shrink is because of the crowding-out of firms due to the 'market-stealing' effect. Focusing on welfare, the results indicate a marginal improvement when FDI spillovers are increased, largely because of the falling of domestic prices resulting from enhanced productivity of non-tradable sectors.

CHAPTER SIX: SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Introduction

This chapter provides a summary of our key findings, main conclusions and policy recommendations. It also outlines the study's limitations and proposes areas for further research.

6.2 Summary

In this study, our overriding objective has been to evaluate the macroeconomic and microeconomic effects of external shocks. Principally, we have evaluated the economic effects on the Kenyan economy of terms of trade and capital inflows shocks, the results of which are discussed in chapters 4 and 5 respectively. As globalization continues to expand, countries especially those in Sub-Saharan Africa have become more and more vulnerable to external shocks and have had to continuously mitigate their economies against macroeconomic volatility associated with the shocks. However, the magnitude and scope of the impact of these shocks is not very well documented in the literature especially the one covering SSA countries. Our study is an attempt to address these gaps in the literature. Thus, to analyze the data we have adopted two different SAM-based CGE models to evaluate the impact of external shocks on economic growth and welfare, using Kenyan data. The first of the models, which we have applied in Chapter 4, is a variant of the IFPRI Standard CGE Model. Using this model, we have conducted simulations that entailed changing the world price of food and oil and determining the macro and sectoral effects of these TOT shocks. In order to evaluate the welfare and distributional impacts of the shocks, some variables of interest (including vector of prices, income and outputs) that are generated by the 'top' CGE model are passed onto a linked 'down' micro-simulation module, which then determines the FGT measures of poverty, factor income distribution and welfare. The second model, which we have applied in Chapter 5, is a modification of the model in Adam and Bevan (2006). This model, unlike the IFPRI Standard Model focuses on the supply-side of the economy, hence it is better to use since we are interested in evaluating not only the demand-side effects of capital inflows but also the supply-side effects. We have thus used the model to evaluate the macro and microeconomic effects of ODA, FDI and remittances inflows on the Kenyan economy. Both

models are calibrated on the basis of SAM (2003), a database developed for Kenya in 2006. The SAM under which the IFPRI Model is calibrated is highly disaggregated; comprising of 50 sectors, 20 household types, and 6 labour categories. On the other hand, the SAM underlying the Supply-side model is however highly aggregated; comprising six sectors, 3 household types and 2 labour categories. It is worthy of note that SAM (2003) does not distinguish between foreign and domestic investment, thus we model FDI implicitly by using FDI spillovers as a proxy. Our supply-side model therefore assumes that FDI spillovers are transmitted through out the economy via the services sector, which is characterized by a learning-by-doing externality that generates Hicks-neutral technical progress to TFP in the services sector. In evaluating the welfare effects of capital inflows shocks, we have designed an appropriate method that involves computing equivalent variation (EV), which is a direct measure of welfare. Other methods such as the CGE micro-simulation we used in Chapter 4 are not suitable in this instance as the supply-side model is highly aggregated as is already noted. Next is a summary of our key findings.

First, a favourable TOT in the food sector has mixed outcomes for the Kenyan economy at the macro level. While there is a slight decline in the growth of GDP (at market prices) and exports, growth in investment and private consumption improves, pushing up the absorption. The positive food price shock produces winners and losers in terms of sectoral productivity. In this case, the spending effect of the price shock leads to an expansion of the non-tradable sectors, to the detriment of the tradable sectors. In addition, a favourable food price shock has a positive effect on household incomes, which influences an improvement in welfare (as measured in terms of EV) and a reduction in poverty. Second, a positive oil price shock generally has the same effects as the positive food price shock, but the effect is more pronounced on the macroeconomic variables than on welfare. Additionally, like in the positive food price shock, the positive oil price shock yields winners and losers when it comes to sector productivity; the non-tradable sectors expand while the tradable sectors contract. This happens when the real exchange rate appreciates, leading to a lower export demand and the substitution effect of the TOT shock dominating the income effect. The distributive impact of the positive oil price shock is generally positive, with only a few types of labour losing out. This positive effect on income distribution is reflected on the effect on poverty reduction and welfare, which improve in tandem. Third, an adverse food price shock has little or no effect on the economy. However, an adverse oil price shock is quite deleterious to the economy; all macro variables worsen, apart from exports, which improve as a result of the depreciation of the real exchange rate. As far as sectoral productivity is concerned, the negative oil price shock results in an expansion of mostly the tradable sectors while nontradables sectors contract. Expansion of

the tradable sectors can be explained by the depreciation of the real exchange rate, which makes exports cheaper in the international market. On the flipside, non-tradables contract as a result of the increase in the cost of imported inputs. The distributive impact of the negative oil price shock is mixed across labour categories but definitely negative on capital and land. Rural labour is more negatively affected compared to urban labour, an outcome that should be understood in the context of how the negative oil price shock affects sector productivity. The welfare effects of the adverse TOT are substantially negative, as all FGT indices increase, implying a rise in poverty in all its dimensions. Welfare as measured in terms of EV also declines for all households, and it is more pronounced on rural households. The deleterious effect of the adverse TOT on economic growth, coupled with the reduction in the purchasing power of domestic production leads to a reduction in household real incomes and hence welfare. Fourth, ODA inflow shock has varied effects on the Kenyan economy, depending on how the aid is invested. When the ODA is not put to productive use such that the effect is only felt on the demand side, the macroeconomic outcome is pessimistic. In this case, the upsurge in ODA in causes Dutch disease in the economy; the real exchange rate appreciates, leading to a substantial decline in exports, private investment and hence economic growth.

When ODA is however used productively, the outcome on macro variables is optimistic. Now there is a substantial growth in private investment and real GDP. The upsurge in ODA improves the fiscal balance, and by reducing the need for seignorage revenue, it 'crowds-in' the private sector, hence the growth in investment. Although the real exchange rate still appreciates as a result of the upsurge in ODA inflows, its impact on the economy is negated by a number of factors, key among them the fact that the 'now productive' aid eases the supply bottlenecks, which increases the economy's total output including exports. The increased productivity of the economy leads to a reduction in inflation, thereby militating against the negative effects of the change in relative prices. When ODA investment is biased towards production for exports the positive effect on economic growth is more pronounced, reinforcing the need for an export-oriented trade policy for Kenya. Moreover, when consumer behaviour changes such that we now have a LES, the effect on macro variables is positive and dramatic. In this instance, the change in consumer behaviour leads to a weakening of demand for food and hence a fall in domestic prices, which coupled with the favourable supply response, improves the macro variables. The distributive and welfare impact of an upsurge in ODA inflows closely mimic the macroeconomic outcome. When ODA is used unproductively, the outcome on household real incomes and welfare is negative. Additionally and for some reasons, the distribution of real household incomes is lopsided in this case, whereby that

of urban dwellers declines faster than that of their rural counterparts. In the case when the ODA is used productively, such that Dutch disease is absent, the distributive impact is positive. The results indicate a more favourable distributive outcome when ODA investment is biased towards export production, compared to the domestic production bias and the neutral case. Welfare improves if the ODA is productively used, and it increases dramatically when household consumption behaviour changes to LES, which is concomitant to the remarkable growth in real incomes. Fifth, an upsurge in remittances inflows, like in the case of ODA leads to an appreciation of the real exchange rate. A remittances shock brings about excess demand for non-tradable goods, which leads to a rise in domestic prices and hence appreciation of the real exchange rate. The resulting Dutch disease effect leads to a loss in international competitiveness of domestic firms, which causes a crowding-out of private investment and a decline in exports. At the same time, the spending effect (due to the increase in real household income) of the remittances causes an increase in imports, which together with the reduction in exports leads to a "boomerang effect" that see to a deterioration of the current account deficit, which concomitantly leads to a decline in real GDP growth. When it comes to sectoral output, remittances inflow shock positively affects non-tradable sectors, whose output growth increases. On the other hand, tradables sectors are negatively affected. Additionally, an upsurge in remittances inflows is welfare enhancing, although not as much as in the case of productive ODA discussed above. Sixth and finally, an increase in FDI spillovers is generally immiserising as it generates a sluggish performance of macro variables. Growth of real GDP, exports and nominal income decline, while that of private investment improves, plausibly as a result of the increase in the productivity of the services sector. On the issue of sectoral performance, it is discernible that an increase in FDI spillovers yields mixed outcomes. The resource movement effect of enhanced spillovers is such that some sectors, such as 'others' gain while others like cash crops lose out. Another plausible reason why some sectors shrink is because of the crowding-out of firms due to the 'market-stealing' effect. Focusing on welfare, the results indicate a marginal improvement when FDI spillovers are increased, largely because of the falling of domestic prices resulting from enhanced productivity of non-tradable sectors.

6.3 Conclusion

Based on our research findings, we can safely conclude that Kenya is highly vulnerable to external shocks. For instance, our results have indicated that a supply-side shock (e.g. the one that is caused

by a steep rise in the world price of oil) leads to slower economic growth and reduces both real incomes and welfare. Conversely, an improvement in the terms of trade (e.g. the one that is caused by a rise in the world price of food) leads to an expansion of the economy and improvement in welfare. As earlier noted, there is a dearth of empirical literature focusing on the effects of terms of trade on the economy, especially in Sub-Saharan Africa. Our findings thus go a long way in contributing to the body of knowledge in this respect. Our results also indicate that if foreign capital inflows are well managed they could boost economic growth, enhance real incomes and hence improve welfare. On the contrary if the country's macroeconomic environment is not prudently managed (e.g. if use of foreign aid is unproductive and generates demand-side shocks), an upsurge in the inflows of foreign capital would cause an appreciation of the real exchange rate; an outcome consistent with the Dutch disease literature. Earlier on, we pointed out the presence of a foreign aid paradox, whereby majority of developing countries, Kenya included have over the years received large amounts of foreign aid, yet low levels of economic growth and high incidence of poverty remain key features of their economies. Our results help shed light as to why this paradox obtains. Additionally, we have observed that the boomerang effect of a surge in remittances leads to a lacklustre performance of the economy, although if well invested the inflows could be welfare enhancing. Our results thus indicate that remittances may be overhyped, at least as far as their contribution to economic growth is concerned. An important contribution to the body of knowledge that our findings impart is that an economy-wide study of remittances is imperative in order to also capture its indirect (multiplier) effects. Finally, another important observation we can draw from our findings is that positive FDI spillovers have a positive impact on domestic investment in Kenya. In the next section, we delineate various policy prescriptions that government can implement to cushion the economy against both the terms of trade shocks and the vagaries of international capital inflows.

6.4 Policy Recommendations

Several implications for policy arise from the findings of this study. We have noted that encouraging exportation of food during times when there is an upsurge of world food prices is good for poverty reduction, but this is at the risk of worsening the current account balance and hence dampening economic growth, which may be inimical to poverty reduction in the long run. A way out of this policy dilemma is for the government to put in place stabilization measures, akin to what was proposed by Dick, et al. (1983) in their study on Kenya; to have an endogenous

adjustment of domestic expenditure through a shift of resources from the food sector to the cash export sector such that adjustment pressures are spread more evenly over sectors in the domestic economy. Another important observation we have made concerning the negative oil shock is that it is generally detrimental to economic growth and welfare in Kenya. Until the country is in a position to exploit and utilize its own oil, it will, like other oil-importing countries continue to face economic challenges wrought by fluctuations in the international price of oil[121]. There are good prospects though for Kenya, since now large commercial deposits of petroleum and gas have been discovered in Turkana County with good prospects for more discoveries in other parts of northern Kenya. In the interim before the country starts to commercially exploit the oil resource, which some media reports state could be by 2020[122], the government should step up efforts to harness alternative sources of energy such as wind, solar and biogas. This will not only diversify the energy portfolio, it will also conserve the environment. It is imperative also that government puts in place measures to avoid the "oil curse" and Dutch disease-related problems usually experienced in oil producing countries. Apart from putting in place an appropriate policy and regulatory framework to steer oil production and marketing, the government can establish a sovereign wealth fund to militate against the pitfalls of Dutch disease effects.

The IMF defines a sovereign wealth fund as a government-owned investment fund that comprises of financial assets such as stocks, bonds, property etcetera. It is set up for a variety of macroeconomic purposes, an important one being the need to insulate the economy against commodity price swings. The investment fund created for this purpose is called a stabilization fund and aims to reduce the volatility of government revenues, to counter the boom-bust cycles' adverse effect on government spending and the national economy. As our results show, a foreign aid shock could, via Dutch disease effects be deleterious to economic growth if the aid is invested unproductively. To militate against this, it is important that government addresses some of the production constraints of the tradable sectors by, for example, providing extension services and new technology to enhance productivity. Aid should be invested in productive projects, such as infrastructure development and using a proportion of the aid to finance operations and maintenance. We have also observed that a sudden surge in remittances could be detrimental to the economy, as far as economic growth is concerned. In 2014, the government came up with a

[121] It is important to note that Kenya's bid to produce oil comes amidst falling crude prices in the international markets, as noted elsewhere in this study. However, according to 'The Daily Nation' of 2nd January 2016 "some analysts have expressed optimism that 2016 is a good year to begin production as the global oil prices are set to start recovering".

[122] See "The Daily Nation" of 2nd January 2016

Diaspora policy that aims to tap the potential of Kenyans abroad in national development through among other ways, reducing the costs of remittances. For these flows to be beneficial to the economy there is need for the monetary authorities to put in place a good macroeconomic environment, including measures to address appreciation of the exchange rate. Setting up a sovereign wealth fund alluded to in the foregoing could be one way to control appreciation of the real exchange rate, as any excess foreign exchange in the market would be invested in the fund. Finally, we have observed that FDI inflows to Kenya generally have a positive effect on the economy, including enhancing welfare. To build on these gains, it is necessary that strategies be sought to address factors inhibiting investment, including negative perception by foreign investors about political instability, poor governance and corruption, inadequate infrastructure, insecurity, crime and policy instability.

6.5 Study Limitations and Areas for Further Research

A number of limitations have been encountered in the course of this study. First and foremost the SAM database used to calibrate the two models applied in the study is more than a decade old, a period in which the structure of the Kenyan economy may have changed. Furthermore the SAM was built on the basis of a 1997 household budget survey, which further weakens our study. Secondly, like many other studies using the CGE approach in sub-Saharan Africa a major weakness of this study is its failure to adequately capture the dual nature of the Kenyan economy in the models. This gap emanates from the lack of data on the informal sector of the economy. Another weakness in our study is the aggregative nature of the database used in chapter 4. In order to be able to apply the supply-side model, we collapsed the 50 sectors in the SAM (2003) into 5 sectors, which mask the finer details of the study findings. Thus, in view of these weaknesses, this study proposes that future work in this area attempt to simulate the Kenyan economy based on an updated SAM. As the new SAM would essentially reflect the prevailing structure of the economy, it would be interesting to see whether our results are replicated in this proposed study. The Kenya National Bureau of Statistics has, through the *Economic Survey, 2015* officially released a new SAM, based on the latest supply and use tables as well as the KIHBS (2007) data. Future research should also focus on modelling the Informal sector in a general equilibrium setting to capture its contribution in national development. This is a very important sector of the Kenyan economy as it is a major contributor to GDP and employs a large proportion of workers. Modelling the informal

sector in a CGE requires that its output data is incorporated in the SAM. This however has not been possible, since disaggregation of national output between the formal and informal sectors has proved difficult to researchers.

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ANNEXES

Table A1: 2003 Social Accounting Matrix for Kenya (billion Shillings)

	astap	acash	alive	aoagr	afood	aoind	aprvs	apubs	cstap	ccash	clive	coagr
astap									75,697			
acash										152,914		
alive											47,633	
aoagr												12,409
afood												
aoind												
aprvs												
apubs												
cstap	7,335					25,356	105					
ccash		13,225	5,047			13,293	975					
clive			5,533		8,496	3	891					
coagr			17	16	67	145						
cfood			1,806		3,908		1,461					
coind	16,220	22,136	11,390	1,800	22,068	287,875	103,141	54,260				
cprvs	23,064	31,019	1,025	33	3,650	27,688	194,934	25,630				
cpubs					6	195	2,785	2,114				
Trc									5,950	10,341	2,927	2,767
labr	31,016	55,655	36,647	1,221	1,035	8,134	8,679	15,176				
labi			255	33	1,057	11,685	34,007	1,214				
labf			317	930	1,544	48,443	101,779	75,733				
capr	8,169	14,485	7,408	1,185	5,638	24,781	41,654					
capi	259	459	12,132	21	320	14,195	50,468					
capf	510	1,693	5,262	7,448	2,622	95,297	155,107	51,621				
land	18,732	31,140										
entr												
enti												
entf												
hhdr												
hhdu												
stax									53	2,072		
dtax												

mtax									1,985	200		
gov												
s-i												
dstk												
row									20,119	3,848		
total	105,306	169,812	86,839	12,687	50,409	557,090	695,985	225,747	103,803	169,375	50,559	15,176

Table A1: 2003 Social accounting Matrix for Kenya (billion Shillings) (cont'd)

	cfood	coind	cprvs	cpubs	trc	labr	labi	labf	capr	capi	capf	land
Astap												
Acash												
Alive												
Aoagr												
Afood	50,409											
Aoind		551,077										
Aprvs			695,985									
Apubs				225,747								
Cstap												
Ccash												
Clive												
Coagr												
Cfood												
Coind												
Cprvs					112,845							
Cpubs												
Trc	9,427	81,433										
Labr												
Labi												
Labf												
Capr												
Capi												
Capf												
Land												
Entr									103,320			

Enti										77,854		
Entf											315,261	
Hhdr						157,564						46,760
Hhdu							48,250	228,746				3,112
Stax	8,096	94,283	6,407									
Dtax												
Mtax	123	18,477										
Gov											4,299	
s-i												
Dstk												
Row	1,141	317,779	63,787	9,772								
Total	69,196	1,063,049	766,178	235,520	112,845	157,564	48,250	228,746	103,320	77,854	319,560	49,871

Table A1: 2003 Social accounting Matrix for Kenya (billion Shillings) (cont'd)

	entr	enti	entf	hhdr	hhdu	stax	dtax	mtax	gov	s-i	dstk	row	total
Astap				29,348	261								105,306
Acash				16,807	92								169,812
Alive				38,908	299								86,839
Aoagr				247	31								12,687
Afood													50,409
Aoind				5,847	166								557,090
Aprvs													695,985
Apubs													225,747
Cstap				34,402	22,714				2,181	391	853	10,465	103,803
Ccash				7,615	16,113				3,516	621	1,360	107,610	169,375
Clive				34,782	38				685	132			50,559
Coagr				11,048	3,090					795			15,176
Cfood					46,864							15,157	69,196
Coind				86,254	150,694				4,835	177,178	15,307	109,890	1,063,049
Cprvs				61,022	242,497				4,294	53		38,425	766,178
Cpubs				16,005	27,879				186,537				235,520
Trc													112,845
Labr													157,564
Labi													48,250

Labf													228,746
Capr													103,320
Capi													77,854
Capf													319,560
Land													49,871
Entr													103,320
Enti													77,854
Entf									41,385			4,890	361,537
Hhdr	79,259	13,147							3,163			46,836	346,730
Hhdu		37,110	157,384						8,636			54,124	537,362
Stax													110,911
Dtax			36,994	4,831	28,780								70,605
Mtax													20,784
Gov			7,329			110,911	70,605	20,784				5,651	219,579
s-i	24,061	27,596	152,550	-385	-2,157				-35,828			30,852	196,689
Dstk										17,520			17,520
Row			7,281						176				423,902
Total	103,320	77,854	361,537	346,730	537,362	110,911	70,605	20,784	219,579	196,689	17,520	423,902	

Table A2: SAM 2003 Accounts (Commodities and Activities)

	Activity	Commodity	Description		Activity	commodity	Description
1	Amaiz	Cmaiz	Maize	26	abake	cbake	Bakery and confectionary
2	Awhea	Cwhea	Wheat	27	abevt	cbevt	Beverages and tobacco
3	Arice	Crice	Rice	28	aomfd	comfd	Other food manufactures
4	Abarl	Cbarl	Barley	29	atext	ctext	Textiles
5	Acott	Ccott	Cotton	30	afoot	cfoot	Footwear
6	Aogrn	Cogrn	Other grains	31	awood	cwood	Wood and Paper
7	Asugr	Csugr	Sugar	32	aprnt	cprnt	Printing and Publishing
8	Acoff	Ccoff	Coffee	33	apetr	cpetr	Petroleum
9	Atea	Ctea	Tea	34	achem	cchem	Chemicals
10	Aroot	croot	Roots and Tubers	35	amach	cmach	Machinery
11	Aoils	coils	Oils and Pulses	36	anmet	cnmet	Non-metallic manufactures
12	Afrui	cfrui	Fruits	37	aoman	coman	Other Manufactures
13	Avege	cvege	Vegetables	38	awatr	cwatr	Water
14	Acutf	ccutf	Cutflowers	39	aelec	celec	Electricity
15	Aocrp	cocrp	Other Crops	40	acons	ccons	Construction
16	Abeef	cbeef	Beef	41	atrad	ctrad	Trade
17	Adair	cdair	Dairy	42	ahotl	chotl	Hotels
18	Apoul	cpoul	Poultry	43	atran	ctran	Transport
19	Agoat	coliv	Goats	44	acomm	ccomm	Communication
20	Aoliv	cgoat	Other livestock	45	afsrv	cfsrv	Financial services
21	Afish	cfish	Fish	46	arest	crest	Restaurants
22	Afore	cfore	Forestry	47	aosrv	cosrv	Other Services
23	Amine	cmine	Mining	48	aadmn	cadmn	Administration
24	Ameat	cmeat	Meat and dairy processing	49	aheal	cheal	Health
25	Amill	cmill	Milling	50	aeduc	ceduc	Education

Table A3: SAM 2003 Accounts (Factors and Institutions)

Account	Description	Account	Description
	Labour		**Households**
lab101	Rural informal high skilled	h10	Rural 1st Per capita expenditure quintile
lab102	Rural informal semi-skilled	h11	Rural 2nd Per capita expenditure quintile
lab103	Rural informal unskilled	h12	Rural 3rd Per capita expenditure quintile
lab111	Rural formal high skilled	h13	Rural 4th Per capita expenditure quintile
lab112	Rural formal semi-skilled	h14	Rural 5th Per capita expenditure quintile
lab113	Rural formal unskilled	h15	Rural 6th Per capita expenditure quintile
lab201	Urban informal high skilled	h16	Rural 7th Per capita expenditure quintile
lab202	Urban informal semi-skilled	h17	Rural 8th Per capita expenditure quintile
lab203	Urban informal unskilled	h18	Rural 9th Per capita expenditure quintile
lab211	Urban formal high skilled	h19	Rural 10th Per capita expenditure quintile
lab212	Urban formal semi-skilled	h20	Urban 1st Per capita expenditure quintile
lab213	Urban formal unskilled	h21	Urban 2nd Per capita expenditure quintile
	Capital	h22	Urban 3rd Per capita expenditure quintile
cap1	Rural Capital	h23	Urban 4th Per capita expenditure quintile
cap2	Urban Informal Capital	h24	Urban 5th Per capita expenditure quintile
cap3	Urban Formal Capital	h25	Urban 6th Per capita expenditure quintile
Lnd	Land	h26	Urban 7th Per capita expenditure quintile
	Taxes	h27	Urban 8th Per capita expenditure quintile
Stax	Commodity taxes (Excise and VAT)	h28	Urban 9th Per capita expenditure quintile
Dtax	Direct taxes (Personal income and corporate)	h29	Urban 10th Per capita expenditure quintile
Mtax	Trade Taxes		

Gov	Government		**Enterprises**
s-i	Savings-Investment	ent1	Rural
Dstk	Change in stocks	ent2	Urban Informal
Row	Rest of World	ent3	Urban Formal
	Transaction costs		
Trcd	Domestic transaction costs		
Trce	Export transaction costs		
Trcm	Imports transaction costs		

Table A4: Labour force growth projections

	2004	2005
Land	0.5	0.5
lab101	1.5	1.5
lab102	1.5	1.5
lab103	1.5	1.5
lab111	1.5	1.5
lab112	1.5	1.5
lab113	1.5	1.5
lab201	1.5	1.5
lab202	1.5	1.5
lab203	1.5	1.5
lab211	1.5	1.5
lab212	1.5	1.5
lab213	1.5	1.5

Table A5: Population growth projections

Households	Household population	2004	2005
Overall		1.27	1.27
h10	2,517,551	1.04	1.04
h11	2,468,005	1.04	1.04
h12	2,437,308	1.04	1.04
h13	2,457,956	1.04	1.04
h14	2,359,152	1.04	1.04
h15	2,268,226	1.04	1.04
h16	2,024,759	1.04	1.04
h17	1,883,383	1.04	1.04
h18	1,690,942	1.04	1.04
h19	1,138,331	1.04	1.04
H20	3,620	1.53	1.53
h21	53,902	1.53	1.53
h22	82,037	1.53	1.53
h23	61,063	1.53	1.53
h24	167,550	1.53	1.53
h25	266,474	1.53	1.53
h26	476,205	1.53	1.53
h27	637,529	1.53	1.53
h28	830,772	1.53	1.53
h29	1,378,128	1.53	1.53

Table A6: Sector Growth Rates for the Base Growth Path		
Sector	2004	2005
Maize	4.0	4.0
Wheat	4.0	4.0
Rice	5.0	5.0
Barley	1.0	1.0
Cotton	1.0	1.0
Other cereals	1.0	1.0
Sugar	5.0	5.0
Coffee	3.0	3.0
Tea	4.0	4.0
Roots	1.0	1.0
Oils	1.0	1.0
Fruits	5.0	5.0
Vegetables	5.0	5.0
Cut-flowers	6.0	6.0
Other crops	4.0	4.0
Livestock	4.0	4.0
Other agriculture	3.0	3.0
Mining	5.0	5.0
Food	5.0	5.0
Beverages	5.0	5.0
Textiles	5.0	5.0
Wood	3.0	3.0
Petroleum	5.0	5.0
Chemicals	3.0	3.0
Machinery	4.0	4.0

Table A6: Sector Growth Rates for the Base Growth Path		
Sector	2004	2005
Other manufacturing	4.0	4.0
Beverages	1.0	1.0
Man. Food	1.0	1.0
Textiles	1.5	1.5
Footwear	1.5	1.5
Wood	1.5	1.5
Printing	1.5	1.5
Petroleum	3.0	3.0
Chemicals	3.0	3.0
Machinery	4.0	4.0
Non Metals	3.0	3.0
Manufactures	3.0	3.0
Water	2.5	2.5
Electricity	2.5	2.5
Construction	4.0	4.0
Trade	4.0	4.0
Hotels	3.0	3.0
Transport	4.0	4.0
Communication	4.0	4.0
Financial Services	3.5	3.5
Real Estate	3.0	3.0
Other Services	3.0	3.0

Table A7: Production and Consumption Elasticities		
Sector	SIGMAQ& SIGMAT	Factor substitution
	Simulation elasticities	Production elasticities
Maize	3.0	1.50
Wheat	3.0	1.50
Rice	3.0	1.50
Barley	3.0	1.50
Cotton	3.0	1.50
Other Grain	3.0	1.50
Sugar	3.0	1.50
Coffee	3.0	1.50
Tea	3.0	1.50
Roots & Tubers	3.0	1.50
Oils	3.0	1.50
Fruits	3.0	1.50
Vegetables	3.0	1.50
Cut Flowers	3.0	1.50
Other Crops	3.0	1.50
Beef	3.0	1.50
Dairy	3.0	1.50
Poultry	3.0	1.50
Other Livestock	3.0	1.50
Goats	3.0	1.50
Fishing	3.0	1.50
Forestry	3.0	1.50

Table A7: Production and Consumption Elasticities		
Sector	SIGMAQ& SIGMAT	Factor substitution
	Simulation elasticities	Production elasticities
Mining	3.0	1.50
Meat	3.0	1.50
Milling	3.0	1.50
Bakery	3.0	1.50
Beverages	3.0	1.50
Other Man. food	3.0	1.50
Textiles	3.0	1.50
Footwear	3.0	1.50
Wood	3.0	1.50
Printing	3.0	1.50
Petroleum	3.0	1.50
Chemicals	3.0	1.50
Machinery	3.0	1.50
Non metals	3.0	1.50
Other manufactures	3.0	1.50
construction	3.0	1.50

Table A8: Commodities included in the poverty line

activity/ Commodity		Description	commodity	Description
Amaiz	cmaiz	maize	comfd	manufactured food
Awhea	cwhea	wheat	cpetr	petroleum
Arice	crice	rice	ctext	textiles
Aroot	croot	roots and tubers	cfoot	footwear
Aoils	coils	oils	cwood	wood
Afrui	cfrui	fruits	cprnt	printing
Avege	cvege	vegetables	cchem	chemicals
Abeef	cbeef	beef	cmach	machinery
Adair	cdair	dairy	coman	other manufactures
Apoul	cpoul	poultry	cwatr	water
Aoliv	coliv	other livestock	celec	electricity
Agoat	cgoat	goats	ctrad	trade services
Afish	cfish	fish	chotl	hotel services
Amill	cmill	milling	ctran	transport
	csugr	sugar	ccomm	communication
	cfore	forestry	cfsrv	financial services
	cmeat	meat	crest	real estate
	cbake	bakery	cosrv	other services
	cbevt	beverages		

Table A9: IFPRI CGE Model Equations			
Production and trade block			
Activity production function (CES technology)	$QA_a = \alpha_a^a * (\delta_a^a . QVA_a^{-p_a^a} + (1-\delta_a^a) * QINTA_a^{-p_a^a})^{-\frac{1}{p_a^a}}$	a ϵ ACES	(1)
Value added intermediate input ratio (CES technology)	$\frac{QVA_a}{QINTA_a} = (\frac{PINTA_a}{PVA_a} * \frac{\delta_a^a}{1-\delta_a^a})^{\frac{1}{1+p_a^a}}$	a ϵ ACES	(2)
Demand for Aggregate Value- Added (Leontief technology)	$QVA_a = iva_a * QA_a$	a ϵ ALEO	(3)
Demand for Aggregate Intermediate Input (Leontief technology)	$QINTA_a = \text{int}\, a_a * QA_a$	a ϵ ALEO	(4)
Value-Added and Factor Demands	$QVA_a = a_a^{va} * (\sum_{f \in F} \delta_{fa}^{va} * QF_{fa}^{-p_a^{va}})^{-\frac{1}{p_a^{va}}}$	a ϵ A	(5)
Factor Demand	$WF_f * \overline{WFDIST_{fa}} = PVA_a(1-tva_a) * QVA_a * (\sum_{f \in F} \delta_{fa}^{va} * QF_{fa}^{-p_a^{va}})^{-1} * \delta_{fa}^{va} * QF_{fa}^{-p_a^{va}-1}$	a ϵ A f ϵ F	(6)
Disaggregated Intermediate Input Demand	$QINT_{ca} = ica_{ca} * QINTA_a$	a ϵ A c ϵ C	(7)
Commodity Production and Allocation	$QXAC_{AC} + \sum_{h \in H} QHA_{ach} = \theta_{ac} * QA_a$	a ϵ A c ϵ CX	(8)
Output Aggregation Function	$QX_c = \alpha_c^{ac} * \left(\sum_{a \in A} \delta_{a\ c}^{ac} * QXAC_{a\ c}^{-p_c^{ac}} \right)^{-\frac{1}{p_c^{ac}-1}}$	C ϵ CX	(9)
First-Order Condition for Output Aggregation Function	$PXAC_{ac} = PX_c * QX_c * (\sum_{a \in A} \delta_{ac}^{ac} * QXAC_{ac}^{-p_c^{ac}})^{-1} * \delta_{ac}^{ac} * QXAC_{ac}^{-p_c^{ac}-1}$	aϵ A cϵ XC	(10
Output Transformation (CET) Function	$QX_c = \alpha_c^t * (\delta_c^t * QE_c^{p_c^t} + (1-\delta_c^t) * QD_c^{p_c^t})^{\frac{1}{p_c^t}}$	cϵ (CE∩CD)	(11

Table A9: IFPRI CGE Model Equations			
Export-Domestic Supply Ratio	$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} * \frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^t - 1}}$	$c \in (CE \cap CD)$	(12
Output Transformation for Domestically Sold Outputs Without Exports and for Exports Without Domestic Sales	$QX_c = QD_c + QE_c$	$c \in (CD \cap CEN) \cup (CE \cap CDN)$	(13
Composite Supply (Armington) Function	$QQ_c = \alpha_c^q * (\delta_c^q * QM_c^{-\rho_c^q} + (1-\delta_c^q) * QD_c^{-\rho_c^q})^{-\frac{1}{\rho_c^q}}$	$c \in CM \cap CD$	(14
Import-Domestic Demand Ratio	$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} * \frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}}$	$c \in (CM \cap CD$	(15
Composite Supply for Non-imported Outputs and Non produced Imports	$QQ_c = QD_c + QM_c$	$c \in (CD \cap CMN \cup (CM \cup CDN)$	(16
Demand for Transactions Services	$QT_c = \sum_{c' \in C'} (icm_{cc'} * QM_{c'} + ice_{cc'} * QE_{c'} + icd_{cc'} + QD_{c'})$		(17
Institutions block			
Factor Income	$YF_f = \sum_{a \in A} WF_f * \overline{WFDIST_{fa}} * QF_{fa}$	$f \in F$	(18
Institutional Factor Incomes	$YIF_{if} = shif_{if} * [(1-tf_f) * YF_f - trnsfr_{rowf} * EXR]$	$i = INSD$ $f \in F$	(19
Income of domestic, Nongovernment Institutions	$YI_i = \sum_{f \in F} YIF_{if} + TRII_{ii'} + trnsfr_{igov} * \overline{CPI + trnsfr_{irow}} * EXR$	$i \in INSDNG$ $f \in F$	(20

Table A9: IFPRI CGE Model Equations			
Intra-Institutional Transfers	$TRII_{ii'} = shii_{ii'} * (1 - MPS_{i'}) * (1 - TINS_{i'}) * YI_{i'}$	$i \in INSDNG$ $i' \in INSDNG'$	(21
Household Consumption Expenditures	$EH_h = \left(1 - \sum_{i \in INSDNFG} shii_{ii'}\right) * (1 - MPS_h) * (1 - TINS_h) * YI_h$	$h \in H$	(22
Household Consumption demand for Marketed Commodities	$PQ * QH_{ch} = PQ_c * \gamma^m_{ch} + \beta^m_{ch} * \left(EH_h - \sum_{c' \in C'} PQ_{c'} * \gamma^m_{c'h} - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} * \gamma^h_{ac'h}\right)$	$c \in C$ $h \in H$	(23
Household Consumption Demand for Home Commodities	$PXAC_{ac} * QHA_{ach} = PXAC_{ac} * \gamma^h_{ach} + \beta^h_{ach} * \left(EH_h - \sum_{c' \in C'} PQ_{c'} * \gamma^m_{c'h} - \sum_{a \in A} \sum_{c' \in C'} PXAC_{ac'} * \gamma^h_{ac'h}\right)$	$a \in A$ $c \in C$ $h \in H$	(24
Investment Demand	$QINV_c = \overline{IADJ} * \overline{qinv_c}$	$c \in CINV$	(25
Government Consumption Demand	$QG_c = \overline{GADJ} * \overline{qg_c}$	$c \in C$	(26
Government Revenue	$YG = \sum_{i \in INSIDNG} TINS_i * YI_i + \sum_{f \in F} tf_f * YF_f + \sum_{a \in A} tva_a * PVA_a * QVA_a + \sum_{a \in A} ta_a * PA_a * QA_a$ $+ \sum_{c \in CM} tm_c * pwm_c * QM_c * EXR + \sum_{c \in CE} te_c * pwe_c * QE_c * EXR + \sum_{c \in C} tq_c * PQ_c * QQ_c + \sum_{f \in F} YIF_{gov_f}$ $+ trnsfr_{gov_{row}} * EXR$		(27
Government Expenditure	$EG = \sum_{c \in C} PQ_c * QG_c + \sum_{i \in INSDNG} trsfr_{i\,gov} * \overline{CPI}$		28)
Price block			

Table A9: IFPRI CGE Model Equations			
Import Price	$PM_c = pwm_c * (1+tm_c) * EXR + \sum_{c' \in CT} PQ_{c'} * icm_{c'c}$	$c \in CM$	29)
Export Price	$PE_c = pwe_c * (1-te_c) * EXR - \sum_{c' \in CT} PQ_{c'} * ice_{c'c}$	$c \in CE$	(30
Demand Price of Domestic Non traded Goods	$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} * icd_{c'c}$	$c \in CD$	(31
Absorption	$PQ * (1-tq_c) * QQ_c = PDD_c * QD_c + PM_c * QM_c$	$c \in (CD \cup CM)$	(32
Marketed Output Value	$PX_c * QX_c = PDS_c * QD_c + PE_c * QE_c$	$c \in CX$	(33
Activity Price	$PA_a = \sum_{c \in C} PXAC_{ac} * \theta_{ac}$	$a \in A$	(34
Aggregate Intermediate Input Price	$PINTA_a = \sum_{c \in C} PQ_c * ica_{ca}$	$a \in A$	(35
Activity Revenue and Costs	$PA_a * (1-ta_a) * QA_a = PVA_a * QVA_a + PINTA_a * QINTA_a$	$a \in A$	(36
Consumer Price Index	$\overline{CPI} = \sum_{c \in C} PQ_c * cwts_c$		(37
Producer Price Index for Nontraded Market Output	$DPI = \sum_{c \in C} PDS_c * dwts_c$		(38
System Constraint Block			
Factor Markets	$\sum_{a \in A} QF_{fa} = \overline{QFS}_f$	$f \in F$	(39
Composite Commodity Markets	$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c$	$c \in C$	(40

Table A9: IFPRI CGE Model Equations			
Current-Account Balance for the Rest of the World, in Foreign Currency	$\sum_{c \in CM} pwm_c * QM_c + \sum_{f \in F} trnsfr_{row\,f} = \sum_{c \in CE} pwe_c * QE_c + \sum_{i \in INSD} trnsfr_{i\,row} + \overline{FSAV}$		(41
Government Balance	$YG = EG + GSAV$		(42
Direct Institutional Tax Rates	$TINS_i = \overline{tins_i} * (1 + \overline{TINSADJ} * tins01_i) + \overline{DTINS} * tins01_i$	$i \in INSDNG$	(43
Institutional Savings Rates	$MPS_i = \overline{mps_i} * (1 + \overline{MPSADJ} * mps01_i) + DMPS * mps01_i$	$i \in INSDNG$	(44
Savings–Investment Balance	$\sum_{i \in INSDNG} MPS_i * (1 - TINS_i) * YI_i GSAV + EXR * \overline{FSAV} = \sum_{c \in C} PQ_c * QINV_c + \sum_{c \in C} PQ_c * qdst_c$		(45
Total Absorption	$TABS = \sum_{h \in H} \sum_{c \in C} \sum_{h \in H} PXAC_{ac} * QHA_{ach} + \sum_{c \in C} PQ_c * QG_c + \sum_{c \in C} PQ_c * QINV_c + \sum_{c \in C} PQ_c * qdst_c$		(46
Ratio of Investment to absorption	$INVSHR * TABS = \sum_{c \in C} PQ_c * QINV_c + \sum_{c \in C} PQ_c * qdst_c$		(47
Ratio of Government Consumption to Absorption	$GOVSHR * TABS = \sum_{c \in C} PQ_c * QG_c$		(48

Source: Lofgren, et al. (2002)

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
$a \in ACES(\subset A)$	a set of activities with a CES function at the top of the technology nest
a_a^a	efficiency parameter in the CES activity function
δ_a^a	CES activity function share parameter
p_a^a	CES activity function exponent
$a \in ALEO(\subset A)$	a set of activities with a Leontief function at the top of the technology nest
iva_a	Quantity of value-added per activity unit
$\text{int}\, a_a$	Quantity of aggregate intermediate input per activity unit
$f \in F(=F')$	A set of factors
tva_a	Rate of value-added tax for activity a
$c \in C$	A set of commodities (also referred to as c' and C')
$c \in CM(\subset C)$	A set of imported commodities
$c \in CT(\subset C)$	A set of domestic trade inputs (distribution commodities)
PM_c	Import price in local currency units (LCU) including transactions costs
pwm_c	c.i.f import price in foreign currency units (FCU)
tm_c	Import tariff rate
EXR	Exchange rate (LCU/FCU)
PW_c	Composite commodity price (including sales tax and transaction costs)

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
$icm_{c'c}$	Quantity of commodity c' as trade input per imported unit of c
$c \in CE (\subset C)$	A set of exported commodities (with domestic production)
PE_c	export price (LCU)
pwe_c	f.o.b. export price (FCU)
te_c	export tax rate
$ice_{c'c}$	quantity of commodity *c.* as trade input per exported unit of *c*.
$c \in CD (\subset C)$	a set of commodities with domestic sales of domestic output
PDD_c	demand price for commodity produced and sold domestically
PDS_c	supply price for commodity produced and sold domestically
$icd_{c'c}$	quantity of commodity *c.* as trade input per unit of *c* produced and sold domestically
QQ_c	quantity of goods supplied to domestic market (composite supply)
QD_c	quantity sold domestically of domestic output
QM_c	quantity of imports of commodity
tq_c	rate of sales tax (as share of composite price inclusive of sales tax)
PX_c	aggregate producer price for commodity
QX_c	aggregate marketed quantity of domestic output of commodity
QE_c	quantity of exports

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
$c \in CX\ (\subset C)$	a set of commodities with domestic output
$a \in A$	A set of activities
PA_a	activity price (gross revenue per activity unit)
$PXAC_{a\,c}$	producer price of commodity *c* for activity *a*
$\theta_{a\,c}$	yield of output c per unit of activity *a*.
$PINTA_a$	aggregate intermediate input price for activity *a*
$ica_{c\,a}$	quantity of *c* per unit of aggregate intermediate input *a*
ta_a	tax rate for activity
QA_a	quantity (level) of activity
QVA_a	quantity of (aggregate) value-added
$QINTA_a$	quantity of aggregate intermediate input
PVA_a	price of (aggregate) value-added
$cwts_c$	weight of commodity c in the consumer price index
$\overline{CPI}$	consumer price index
$dwts_c$	weight of commodity *c* in the producer price index
DPI	producer price index for domestically marketed output
a_a^{va}	Efficiency parameter in the CES value-added function

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
δ_{fa}^{va}	CES value-added function share parameter for factor f in activity a
QF_{fa}	Quantity demanded of factor f from activity a
p_a^{va}	CES value-added function exponent
WF_f	Average price of factor
$\overline{WFDIST_{fa}}$	Wage distortion factor for factor f in activity a
$QINT_{ca}$	Quantity of commodity c as intermediate input to activity a
$QXAC_{a\,c}$	Marketed output quantity of commodity c from activity a
QHA_{ach}	Quantity of household home consumption of commodity c from activity a for household h
a_c^{ac}	Shift parameter for domestic commodity aggregation function
$\delta_{a\ \ c}^{ac}$	Share parameter for domestic commodity aggregation function
p_c^{ac}	Domestic commodity aggregation function exponent
a_c^t	A CET function shift parameter
δ_c^t	A CET function share parameter
p_c^t	A CET function exponent
$c \in CEN (\subset C)$	Non-exported commodities (complement of CE)
$c \in CDN (\subset C)$	Commodities without domestic market sales of domestic output (complement of CD)

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
a_c^q	An Armington function shift parameter
δ_c^q	An Armington function share parameter
$c \in CMN(\subset C)$	An Armington function exponent
QT_c	Quantity of commodity demanded as transactions service input
YF_f	Income of factor f
$i \in INS$	A set of institutions (domestic and rest of the world)
$i \in INSD(\subset INS)$	A set of domestic institutions
$YIF_{i\,f}$	Income to domestic institution i from factor f
$shif_{i\,f}$	Share of domestic institution i in income of factor f
tf_f	Direct tax rate for factor f
$trnsfr_{i\,f}$	Transfer from factor f to institution i
$i \in INSDNG(= INSDG' \subset$	A set of domestic non-government institutions
YI_i	Income of institution i (in the set INSDNG)
$TRII_{ii'}$	Transfers from institution i' to i (both in the set INSDNG)
$shii_{ii}$	Share of net income of i' to i ($i \in INSDNG), i' \in INSDNG'$
MPS_i	Marginal propensity to save for domestic nongovernment institution (exogenous variable)

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
$TINS_i$	Direct tax rate for institution i ($i \in INSDNG$)
$i \in H (\subset INSDNG)$	A set of households
EH_h	Household consumption expenditures
QH_{ch}	Quantity of consumption of marketed commodity c for household h
γ^m_{ch}	Subsistence consumption of home commodity c for household h
γ^h_{ach}	Subsistence consumption of home commodity c from activity a for household h
β^m_{ch}	Marginal share of consumption spending on marketed commodity c for household h
β^h_{ach}	Marginal share of consumption spending on home commodity c from activity a for household h
$QINV_c$	Quantity of fixed investment demand for commodity
$\overline{IADJ}$	Investment adjustment factor
$\overline{qinv_c}$	Base-year quantity of fixed investment demand
QG_c	Government consumption demand for commodity
$\overline{GADJ}$	Government consumption adjustment factor
qg_c	Base-year quantity of government demand
YG	Government revenue
EG	Government expenditure
$\overline{QFS_f}$	Quantity supplied of factor

Table A10: Definitions of Sets, Parameters and Variables for the IFPRI CGE Model	
$qdst_c$	Quantity of stock change
$\overline{FSAV}$	Foreign savings
$GSAV$	Government savings
$TINS_i$	Rate of direct tax on domestic institutions i
$\overline{tins_i}$	Exogenous direct tax rate for domestic institution i
$\overline{TINSADJ}$	Direct tax scaling factor (=0 for base)
$tins01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
$\overline{DTINS_i}$	Change in domestic institution tax share (=0 for base)
mps_i	Base savings rate for domestic institution i
$\overline{MPSADJ}$	Savings rate scaling factor (=0 for base)
$MPS01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
$DMPS$	Change in domestic institution savings rate (=0 for base)
$TABS$	Total nominal absorption
$INVSHR$	Investment share in nominal absorption
$GOVSHR$	Government consumption share in nominal absorption

Source: Lofgren, et al. (2002) Notes: Endogenous variables in the table are shown as upper-case Latin letters without a bar. Exogenous variables are upper-case Latin letters with a bar, while parameters are lower-case Latin letters (with or without a bar) or lower-case Greek letters (with or without superscripts). Set indices are lower-case Latin letters as subscripts to variables and parameter.

Table A11: Supply-Side Model Equations

The model:

Sectors*(i)*

Private (*ip*)

Food (*food*)

Cash crops (*cash*)

Manufacturing (*man*)

Services (*serv*)

Others (*others)*

Rural *(ir) {*food, cash, others*}*

Urban *(iu) {*man, serv, pub*}*

Public

Public services *(pub)*

Labour categories *(lc)*

Unskilled labour *(u)*

Skilled labour *(s)*

Households *(hh)*

Rural *(rur)*

Urban unskilled *(urbu)*

Urban skilled *(urbs)*

Equations		
Prices		
Import prices	$pm_i = E.pm_i^w(1+\tau_i^m)$	(1)
Export prices	$pe_i = E.pe_i^w(1-\tau_i^e)$	(2)
Composite consumption prices	$pc_i = \frac{pd_i.xd_i + pm_i.m_i}{q_i}$	(3)
Composite output prices	$pc_i = \frac{pd_i}{q_i}.xd_i + pm_i.m_i$	(4)
Value added prices	$pva_i = px_i - \sum_j a_{ij}.pc_j$	(5)
Capital goods prices	$pk_i = \sum_j b_{ij}.pc_j$	(6)
Composite labour price	$pl = \frac{\phi_{i,s}.w_s.L_{i,s} + \phi_{i,u}.w_u.L_{i,u}}{LC_i}$	(7)
Output and factor demands		
Production function	$x_i = A_i H_i^{ah_i} LC_i^{\alpha l_i} K_i^{\alpha k_i} KG^{\alpha kg_i}$	(8)
Labour market FOC	$LC_i = \frac{\alpha l_i.pva_i x_i}{pl_i}$	(9)
Labour aggregation	$LC_i = B_i\left[\omega_i L_{i,u}^{(\frac{\sigma l-1}{\sigma l}} + (1-\omega_i)L_{i,s}^{\frac{(\sigma l-1)}{\sigma l}}\right]^{\frac{\sigma l}{\sigma l-1}}$	(10)

Skill composition	$\left(\frac{L_u}{L_s}\right)_i = \left[\left(\frac{\omega}{1-\omega}\right)_i \left(\frac{\phi_{i,s} w_s}{\phi_{i,u} w_u}\right)\right]^{\sigma l}$	(11)
Labour market equilibrium	$\sum_i L_{i,lc} + L_{pub,lc} = \overline{L_{lc}}$	(12)
Composite output	$x_1 = C_i \left[\beta_i e_i^{\left(\frac{1+\sigma t}{\sigma t}\right)} + (1-\beta_i) xd_i^{\left(\frac{1+\sigma t}{\sigma t}\right)}\right]^{\left(\frac{\sigma t}{1+\sigma t}\right)}$	(13)
Relative supplies	$\left(\frac{e}{xd}\right)_i = \left[\left(\frac{1-\beta}{\beta}\right)_i \left(\frac{pe}{pd}\right)_i\right]^{\sigma t}$	(14)
Composite consumption	$q_i = D_i \left[\delta_i m_i^{\left(\frac{\sigma q-1}{\sigma q}\right)} + (1-\delta_i) xd_i^{\left(\frac{\sigma q-1}{\sigma q}\right)}\right]^{\left(\frac{\sigma q}{\sigma q-1}\right)}$	(15)
Relative demands	$\left(\frac{m}{xd}\right)_i = \left[\left(\frac{\delta}{1-\delta}\right)_i \left(\frac{pd}{pm}\right)_i\right]^{\sigma c}$	(16)
Demand		
Intermediate goods demand	$nd_i = \sum_j a_{i,j} x_j$	(17)
Final consumption	$cd_{i,hh} = \gamma_{i,hh} + \psi_{i,lc} \left[\frac{(1-\phi_{hh}) yd_{hh} - \sum_j pc_j (1+\tau_j^c) \gamma_{j,hh}}{pc_i (1+\tau_i^c)}\right]$	(18)

Consumption share	$\psi_{i,hh} = \frac{pc_i (1+\tau_i^c)^{(1-\sigma c)} \theta_{i,hh}^{\sigma c}}{\sum_j pc_j (1+\tau_j^c)^{(1-\sigma c)} \theta_{j,hh}^{\sigma c}}$	(19)
Capital formation	$pk_i dk_i = k_i (1+v(r_i - \bar{r}))[s - E\Delta Z - pk_{pub}(dk_{pub} + dkg)]$	(20)
Investment	$id_i = \sum_j b_{i,j}[dk_i + dkg]$	(21)
Government expenditure	$g = (pva_{pub} + \sum_j a_{pub,j} pc_j)\bar{g} + \sum_{lc} \phi_{pub,lc}.w_{lc}.L_{pub,lc} + \sum_i om_i (KG - KG_0)$	(22)
Income and saving		
Rural income	$y_{rur} = \sum_{ir} pva_{ir} x_{ir}$	(23)
Urban unskilled	$y_{urbu} = \sum_{iu} wa_u \phi_{iu,u} L_{iu,u}$	(24)
Urban skilled	$y_{urbs} = \sum_{iu} pva_{iu} x_{iu} - y_{urbu} + i^d \bar{B}$	(25)
Disposable income	$yd_{hh} = y_{hh}(1-\tau_{hh}^D) + E.rmit_{hh} + trns_{hh}$	(26)
Government revenue	$tr = \sum_i \left[E\left(\tau_i^m pm_i^w m_i + \tau_i^e pe_i^w e_i\right) + \tau_i^c pc_i \sum_{hh} cd_{i,hh} \right] + \sum_{hh} \tau_{hh}^D y_{hh}$	(27)
Household saving	$s_{hh} = \varphi_{hh} yd_{hh}$	(28)
Government saving	$s_G = tr - g - \sum_{hh} trns_{hh} - i^d \bar{B} - Ei^f \bar{F}$	(29)
Saving	$s = \sum_{hh} s_{hh} + s_G + E.aid$	(30)
Equilibrium conditions		

Balance of payments	$\sum_i \left(pm_i^w m_i - pe_i^w e_i \right) + i^f \overline{F} = aid + \sum_{hh} rmit_{hh} + \Delta Z$ (31)
Goods	$q_i = \sum_{hh} cd_{i,hh} + nd_i + id_i + \overline{g}_i + om_i (KG - KG_0)$ (32)
Variables	
E	exchange rate
pm^w	world price of imports
Pm	domestic price of imports
pe^w	world price of exports
Pe	domestic price of exports
Pd	price of domestic good
Pc	price of composite consumption good
Px	output price
Pva	value added price
Pk	capital price
Pl	price of composite labour
W	nominal wage rate
M	Imports
ϕ	wage distribution factor
τ^m	tariff rate
τ^d	direct tax rate
τ^c	indirect tax rate
τ^e	export duty rate

E	Exports
Q	composite supply
Xd	domestic sales
H	Land
LC	composite labour
L	skill-specific employment
$\overline{L}$	skill-specific labour supply
K	private capital stock
KG	public capital stock
A	input-output matrix
B	capital composition matrix
Nd	intermediate demand
Cd	final consumption demand
Θ	consumption shares
γ	subsistence consumption
Dk	private investment demand (by destination)
Dkg	public investment demand (by destination)
Id	investment demand (by origin)
R	sectoral profit rate
G	total government expenditure
$\overline{g}$	government consumption
Om	marginal o&m rates
$Rmit$	remittances
$Trns$	budget transfers

Y	gross factor income
Yd	disposable incomes
S	saving
φ	propensity to save
Tr	government revenue
i^d	domestic interest rate
i^f	foreign interest rate
Z	official reserves
Aid	net aid flows
$\overline{B}$	domestic debt stock
$\overline{F}$	foreign debt stock
Σl	elasticity of substitution (labour)
Σt	elasticity of transformation(output)
Σq	elasticity of substitution (demand)
Σc	elasticity of substitution(consumption)

Table A12 (a): Initial Macroeconomic Data

	FOOD	CASH	MAN	SERV	OTHERS	PUBLIC	TOTAL
Imports	24470	3726	305335	64039	8407	904	406882
Exports	20985	79970	123035	48824	8573	0	281387
total domestic output	352430	82324	402633	897576	31702	232974	1999638
capital stock by sector	773650	272725	857925	2442075	135675	594525	5076575
land rental	24647	0	3787	0	0	0	
land	17119	11315	0	0	0	0	
depreciation expenditure	30946	10909	34317	97683	5427	500	179782
domestic prices	1	1	1	1	1	1	
import duties	2398	163	18172	0	57	0	20790
export duties	0	0	0	0	0	0	
indirect tax by sector	21487	1917	99293	8942	173	0	131813
investment by sector of origin	619	500	24246	153087	830	0	179282
investment by destination	30946	10909	34317	97683	5427	500	179782
government final consumption	3352	2506	205	8965	213	187672	202913
value added by sector	144499	67994	149062	456602	39479	152764	1010400

*Note imports and exports are cif and duty inclusive while government consumption is at producer prices

Table A12 (b): Initial Macroeconomic Data (Equilibrium Situation)

total value added(GDP at FC)	1010400
indirect taxes	131800
subsidies	-10253
GDP at market prices	1131947
intermediate inputs	867691
gross inputs	1999638
imports of final demand	406882
total supply	**2406520**
exports	281400
consumption-private	875246
government consumption	202900
investment	179283
final demand	1538829
imports	-406882
GDP @market prices	1131947
intermediate inputs	867691
total domestic output	1999638
imports	406882
total demand	**2406520**

Table A13 (a): Private consumption

	Sector	Indirect Taxes	Consumption at Market Prices			indirect tax rate	urban skilled	urban unskilled	Consumption at Factor Cost		
			Rural	Urban	total				Rural	Urban	TOTAL
1	Food	21487	215695	35321	251016	0.094	16601	18720	197232	32298	229529
2	Cash Crops	1917	0	0	0	0.000	0	0	0	0	0
3	Manufacturing	99293	97472	180366	277838	0.556	84772	95594	62638	115907	178545
4	Services	8942	69383	253730	323113	0.028	119253	134477	67463	246708	314171
5	Others	173	20256	3022	23278	0.007	1420	1601	20106	2999	23105
					875246						745351

Table A13 (b): Capital Composition Matrix

	Food	cash crop	Manufacture	services	others	total private (sector of origin)	sector specific public	Infrastructure	total public
food	409	210	0	0	0	619	0	0	
cash crop	0	500	0	0	0	500	0	0	
Manufacturing	2982	1115	8971	11153	25	24246	1400	5599	6999
Services	27555	8462	25182	86530	5358	153087	2100	8399	10499
others	0	622	164	0	44	830	0	0	0
public	0	0	0	0	0	0	0	0	0
Depreciation (sector of destination)	30946	10909	34317	97683	5427	179282	3500	13998	17498

Table A13(c): Capital Stock

sector	Capital stock	depreciation	% depreciation
Private capital stock			
food	773650	30946	4.00
cash crop	272725	10909	4.00
manufacturing	857925	34317	4.00
services	2442075	97683	4.00
others	135675	5427	4.00
total private sector	**4482050**	**179282**	
public capital stock			
sector specific	87500	3500	4.00
infrastructure	348825	13953	4.00
total public sector	**436325**	**17453**	
Total economy	**4918375**		

Table A13 (d): Employment (Numbers)

Sector	total (unskilled &skilled)	Unskilled	Skilled
Food	93353	93353	0
Cash crops	186875	168188	18688
Manufacturing	239755	122275	117480
Services	431065	163805	267260
0thers	117200	67976	49224
Public	659052	309754	349298
Total	1,727,300	925351	801950

Table A13 (e): Wage Bill (millions)

Sector	Unskilled	Skilled	total
Food	502	60862	61364
Cash crops	120	26417	26537
Manufacturing	6729	39383	46112
Services	41962	121592	163554
Others	127	16563	16690
Public	98083	20487	118570
Total	147,523	285,304	432827