



Determinants of Kenya's Beef Export Supply

David Otieno

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**THE KENYA INSTITUTE FOR PUBLIC POLICY
RESEARCH AND ANALYSIS (KIPPRA)**

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Determinants of Kenya's Beef Export Supply

David Otieno

Productive Sector Division
Kenya Institute for Public Policy
Research and Analysis

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**The KENYA INSTITUTE for PUBLIC
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Abstract

Beef cattle production is important for livelihood sustenance, especially in the Arid and Semi Arid Lands (ASALs) of Kenya, besides contributing a significant share of the agricultural Gross Domestic Product. Export trade in beef is one of the pathways through which increased foreign exchange earnings could be achieved to facilitate acquisition of equipment, knowledge, capital and development of domestic agricultural processing capacity in Kenya. However, Kenya's beef export supply has generally declined over the last three decades. The situation is exacerbated by periodic shocks such as drought and disease outbreaks that often significantly affect a considerable herd size, leading to famine, misery and extreme poverty especially in northern parts of the country. This paper analyzes the main determinants of the volume of beef supplied for export. The study uses annual time series data from 1965 to 2004 and a single equation model. Results show that the key determinants of beef export supply are domestic beef production, livestock development expenditure as a ratio of GDP, operation of the Kenya Meat Commission and occurrence of Foot and Mouth Disease, and Rift Valley Fever. The study recommends prioritization of disease control in order to eradicate especially Foot and Mouth Disease, and Rift Valley Fever, as the most critical intervention; increased budgetary allocation for enhancing domestic beef production; focus the mandate of the Kenya Meat Commission on regulatory functions; promote public-private investments in market infrastructure development; establish a vibrant livestock research and beef export coordinating department; review and harmonize the legal framework to improve disease surveillance and streamline imports of beef cattle; and apply safeguard measures in beef trade. Further research is suggested on estimation of trade potentials in specific export markets.

Abbreviations and Acronyms

ADF	Augmented Dickey-Fuller
AGOA	African Growth and Opportunity Act
AI	Artificial Insemination
ALRMP	Arid Lands Resource Management Programme
ARDL	Auto Regressive Distributed Lag
ASAL	Arid and Semi-Arid Land
AU-IBAR	African Union International Bureau for Animal Research
BSE	Bovine Spongiform Encephalopathy
CBPP	Contagious Bovine Pleuro-Pneumonia
DFZ	Disease Free Zone
EAC-CU	East African Community Customs Union
ECT	Error Correction Term
EPC	Export Promotion Council
EPZ	Export Processing Zone
EPZA	Export Processing Zones Authority
ERC	Economic Research Center
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
EU	European Union
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
HCDA	Horticultural Crops Development Authority
IGAD	Inter-Governmental Authority on Development
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KDB	Kenya Dairy Board
KELRI	Kenya Livestock Research Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KLIB	Kenya Livestock Inspectorate Board
KLMB	Kenya Livestock Marketing Board
KLMC	Kenya Livestock Marketing Council
KMC	Kenya Meat Commission
KNCCI	Kenya National Chamber of Commerce and Industry
LMD	Livestock Marketing Division
MoA	Ministry of Agriculture
NAFTA	North America Free Trade Area
PIC	Public Investment Committee
RVF	Rift Valley Fever
SRA	Strategy for Revitalizing Agriculture
USDA	United States Department of Agriculture

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1. Introduction

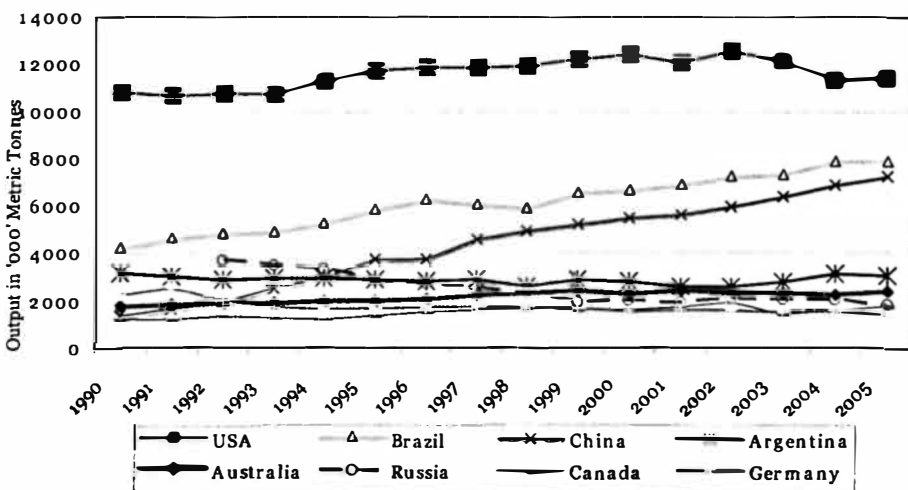
1.1 Overview of Global and Domestic Beef Industry

Livestock production is one of the main livelihood sources for most households in developing countries. In the developed nations, a few households derive a greater share of their incomes from global livestock trade. Cattle, sheep, goats, poultry and pigs are the main species kept worldwide. Subsistence and commercial farmers obtain food, incomes, and other products/services from livestock enterprises, which are crucial for sustenance (Winrock, 1992). Livestock and livestock products comprise about 17 per cent of the value of global agricultural trade and the demand for these products has been steadily rising (Delgado *et al.*, 2001; USDA, 1997).

Beef cattle production accounts for nearly 40 per cent of total livestock production in the world (FAO, 2005). In order of importance, the main beef producers in the world are United States of America, Brazil, China, Argentina, Australia, Russia, Canada and Germany, which together provide over 60 per cent of the global beef output. The contribution of each of these countries is shown in Figure 1.

The world's five largest beef exporters (from own production and imports) are Brazil, Australia, Argentina, USA and Canada, which

Figure 1: Main beef producers worldwide, 1990-2005



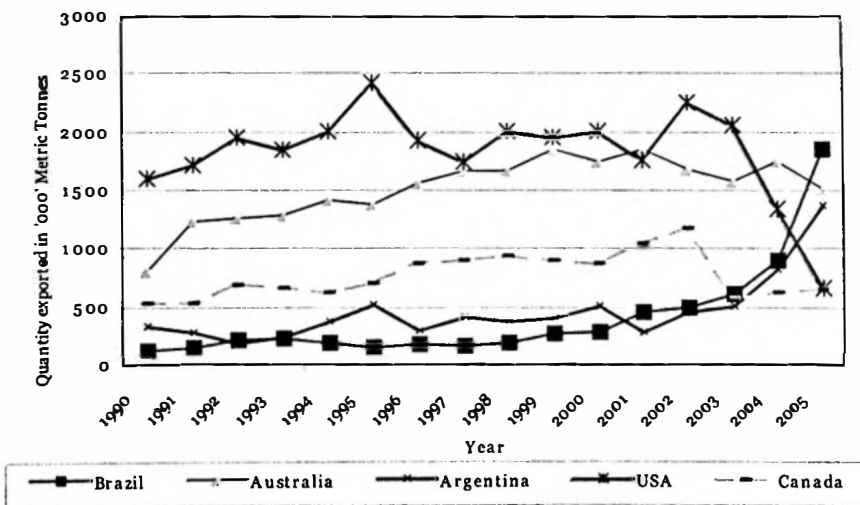
Source: FAOSTAT data (2006)

supply about 80 per cent of world exports (Figure 2). In terms of beef exports from domestic production, Argentina is the main supplier and, therefore, its export price represents the average competitive beef price in the world market. Trade forecasts show a rising trend in world exports from the major beef suppliers. Brazilian beef exports are expected to rise to 21 per cent of its production (over 2 million tonnes), while Argentina expects its exports to grow by over 6 per cent by the year 2010. China and India, though currently not among the top five beef exporters, are expected to export above 900,000 tonnes and 700,000 tonnes, respectively, by the same period. Other main suppliers expected in the beef export markets include New Zealand, supplying 650,000 tonnes and Uruguay 500,000 tonnes (Perry *et al.*, 2005).

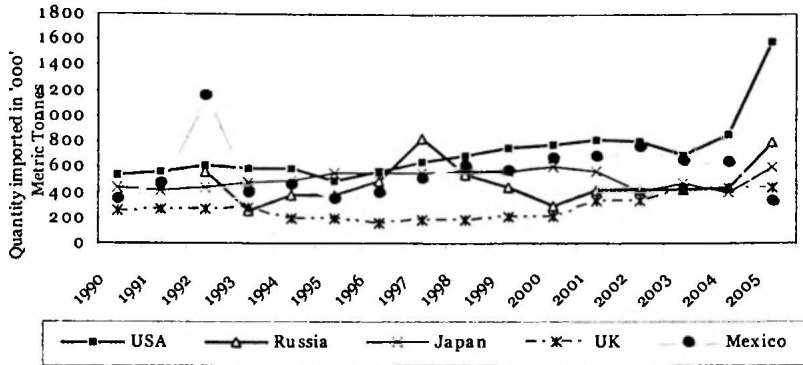
The leading importers of beef in the world include USA, Russia, Japan, United Kingdom (UK) and Mexico, which import about 75 per cent of global beef exports (Figure 3).

In Africa, the main beef producers and exporters are Namibia, Botswana and South Africa, which represent models of successful export-led livestock systems in the continent (Halderman and Nelson, 2005). The livestock sub-sector in sub-Saharan Africa contributes an average of nearly 60 per cent of the combined agricultural Gross Domestic Product (GDP) of the Inter-Governmental Authority on

Figure 2: Major global exporters of beef, 1990-2005



Source: FAOSTAT data (2006)

Figure 3: Leading importers of beef, 1990-2005

Source: FAOSTAT data (2006)

Development (IGAD) member states, ranging from 20 per cent in Uganda to nearly 90 per cent in Somalia, and directly supports the survival of over 40 million poor people in the region (IGAD, 2006).

In Kenya, the livestock sub-sector is dominated by smallholder producers, with majority of the livestock population concentrated in the Arid and Semi Arid Lands (ASALs), which cover about 75 per cent of the total land area. Pastoralists hold over 60 per cent of the national livestock herd, with a monetary value of between Ksh 60 and 70 billion (Government of Kenya, 2002). Livestock enterprises employ close to 50 per cent of the national agricultural labour force, and account for 90 per cent of employment and more than 95 per cent of family incomes in the ASALs (Gitu, 2005). The sub-sector contributes about 10 per cent of national GDP and close to 42 per cent of agricultural GDP (Government of Kenya, 2007). The livestock population in Kenya comprises an estimated 11.2 million chicken, 9 million beef cattle (about 70% in the ASALs), 3.2 million dairy cattle, 4 million goats, 1.3 million sheep, while pigs, donkeys and camels are about 800,000 in total (Odhiambo, 2006; FAO, 2005). The 2005 drought claimed nearly 30 per cent of the beef herd and, recently, there was a further drop due to the outbreak of Rift Valley Fever (RVF) in 2006/2007.

The average annual red meat production in Kenya is about 362,815 metric tonnes, 80 per cent being beef. The value of annual red meat is estimated at Ksh 43.2 billion: beef contributing nearly Ksh 34.4 billion, combined goat meat and mutton earning about Ksh 8.2 billion, while camel meat is worth close to Ksh 0.66 million (EPZ, 2005). The total

beef supply comprises 50 per cent from the Kenyan pastoralist cattle, 22 per cent from imported pastoral cattle, 25 per cent from the domestic dairy sub-sector as culls, and only 3 per cent from ranches. Annual per capita consumption of meat in Kenya for all types of red meat is estimated at 10.8kg and the total consumption is 326,000 metric tonnes. Average domestic beef demand is about 300,000 metric tonnes annually. Close to 22-26 per cent of the domestic demand is offset through imports, while exports are mainly sourced from domestic production (Agriconsortium, 2003).

Meat consumption in Kenya is highly income elastic, and urban consumption is almost double the rural consumption levels. Urban consumer prices for various beef categories are higher (between Ksh 150 to Ksh 300 per kg in Kisumu, Mombasa and Nairobi) relative to prices in regional markets. This often triggers inflows (about 40% of supply from pastoral areas) of cattle from Ethiopia, Tanzania and Somalia (Ackello-Ogutu *et al.*, 2006). The domestic beef market has been largely characterized by private sector operators since the closure of Kenya Meat Commission (KMC) in the 1980s.

Kenya mainly exports frozen boneless beef (canned beef), although live cattle and chilled boneless beef are also exported in relatively smaller quantities. The main export destinations are countries in the Common Market for Eastern and Southern Africa (COMESA) such as Tanzania (*currently in the process of rejoining the bloc*) and Uganda; and the Middle East countries such as Saudi Arabia, United Arab Emirates, Kuwait, Yemen, Jordan, Syria, Iran and Oman. Since 1993, some exports of canned beef (about 5 tonnes annually) to Tanzania, Rwanda, Somalia, Democratic Republic of Congo and Sudan have also been recorded (EPC, 2006). The critical policy issue for beef producing countries in Africa (such as Kenya) is to develop strategies that would improve and sustain their competitiveness in export trade (Belachew and Hargreaves, 2003).

1.2 Problem Statement

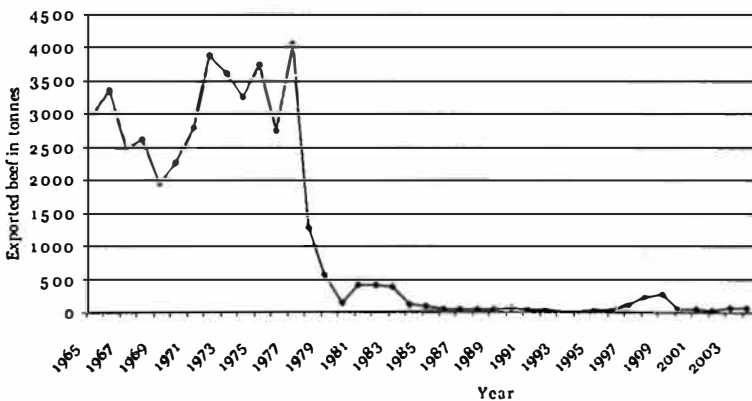
Kenya's beef export supply has been on a decline since late 1970s (Figure 4). The highest volume of beef exports was 4,029 tonnes in 1977, while the lowest was 3 tonnes in 1993. Since 1980, export supply has remained below 500 tonnes. Although the declining trend is often attributed to the country's inability to control trans-boundary notifiable

cattle diseases, the policy issue of concern is that other crucial factors that may explain export supply are not well documented. This gap limits decision making on policy formulation for the beef sub-sector in Kenya. Indeed, lack of reliable estimates of export supply elasticities hampers the evaluation of alternative policies in commodity markets (Newman *et al.*, 1995). The closure of the Kenya Meat Commission (KMC) factories in 1987, privatization of Artificial Insemination (AI) and clinical services in 1991 and 1994, respectively, and fluctuation in development expenditure in livestock over the years are possible causes of the drastic decline in export supply. However, there is no analytical evidence on how these variables affect beef export supply.

In addition, despite various proposals to establish Disease Free Zones (DFZs) in various pastoral areas in order to boost safe production of livestock products for export (Ackello-Ogutu *et al.*, 2006; Gitu, 2005), policy and institutional commitments are still lacking (for instance, establishment of DFZs is not incorporated in the current National Livestock Policy draft). Also, there is no clear system of prioritizing critical cattle diseases.

Imports of cattle into Kenya from neighbouring countries (especially Ethiopia, Sudan and Somalia), coupled with low commercial orientation in pastoral areas, hinder off take of the domestic beef herd into markets. The situation is exacerbated by low national budgetary allocation to

Figure 4: Kenya's beef export supply, 1965-2004



Source: FAOSTAT Data (2006)

the livestock sub-sector (only 33% of the total government budget allocation to entire agricultural sector goes to the livestock sub-sector). Thus, despite the livestock sub-sector's contribution of nearly 11 per cent to national GDP, only about 9 per cent of the GDP is re-invested in the sub-sector, with wide fluctuations in the allocations over time (Kenya National Development Expenditure Estimates, 1965-2004).

Consequently, pastoralists in the ASALs tend to hold large numbers of stock for too long (beyond market age), and this often results to natural resource depletion, conflicts over pasture/grazing lands and water, and massive herd die offs during droughts and disease outbreaks (Knips, 2004). As a result, there are high poverty levels in the pastoral areas and over-dependence on relief support, which is unsustainable for long-term development.

1.3 Objectives of the Study

The main objective of the study is to establish the key determinants of beef export supply. This is important in order to explore strategies of promoting beef exports. The specific objectives are to review the legal, institutional and policy framework in beef trade, and analyze the determinants of volume of export.

The study tests the null hypotheses that: domestic beef production increases export supply; operation of the Kenya Meat Commission raises the volume of beef exported; and that trans-boundary disease outbreaks reduce the quantity of beef exported.

Interventions towards improved beef export supply are envisaged to reduce poverty through stable incomes from market-oriented cattle production and reduced dependence on relief support in the pastoral areas (Stevens and Kennan, 2005). Growth of exports is considered in the *Economic Recovery Strategy 2003-2007* as one of the suitable alternatives towards achieving sustainable macroeconomic balance. Export earnings enable importation of capital equipment, raw materials and provide foreign exchange for servicing external debt (Ngugi, 2005). Considering the vital role of beef cattle in Kenya's economy and the need to improve livelihoods particularly in the ASALs, it is necessary to raise off-take rates and transform pastoralism from subsistence livelihoods to commercial orientation by addressing constraints to

export supply (Government of Kenya, 2005; United Nations, 2005; Mugunieri and Omiti, 2004).

Analysis of determinants of export supply would facilitate policy formulation on the main issues relevant to the revitalization of beef trade. For instance, the analysis would facilitate prioritization of interventions towards improvement of producers' compliance with required volumes and quality standards of beef for the international markets. Effective institutional restructuring for value addition, safe handling of exports, and management of macroeconomic variables that influence beef trade also require research insights. Furthermore, export supply analysis is critical in enabling Kenya's beef producers to utilize international market opportunities, for instance the combined annual average beef import demand of 527,000 metric tonnes in Algeria, Angola, Benin, Central Africa Republic, Cote d'Voire, Democratic Republic of Congo (DRC), Egypt, Gabon, Mauritius and South Africa (Ackello-Ogutuu *et al.*, 2006). In addition, beef suppliers could target the EU quota allocation of 142 tonnes that has never been achieved since the 1990s.

Appropriate information on determinants of beef exports would also provide useful insights to development initiatives in the ASALs, such as the Arid Lands Resource Management Programme (ALRMP) in targeting demand-driven investments in the marginal areas.

2. Legal, Institutional and Policy Framework in Kenya's Trade in Beef

The regulatory, institutional and policy arrangements provide a framework within which to address political, economic, social, technological, legal and environmental aspects relevant to competitive production and trade (Ministry of Agriculture, 2006). In beef export trade, the political issues include restructuring of existing organizations/creation of supportive departments and leadership framework that determines service delivery. Economic management strategies such as foreign exchange policies affect export earnings. Social and technological aspects, such as wage rates and the type of processing equipment also have a bearing on the capacity for value addition. Natural calamities (e.g. droughts) affect not only the production capacity but also result in environmental degradation. Changes in laws are essential in guiding trade in a dynamic global era. A review of the legal, institutional and policy issues is thus necessary in order to improve weak points in the beef export supply chain.

2.1 Regulatory Issues

Various laws and regulations govern beef trade in Kenya. Some of the main regulations include (EPZ, 2005):

Animal Diseases Act of 1972, revised 1989 (Cap 364, Laws of Kenya)

This Act involves declaration of infected areas, issuance of provisions affecting infected areas (isolation, disinfections and movement of animals), search for infected animals and issuance of import/export licenses. The Act aims at preventing spread of diseases. However, the Act is weak in enforcement of inspection and quality assurance on movement of livestock and livestock products (Government of Kenya, 2007). This makes it difficult to control the spread of notifiable diseases from nomadic pastoral areas of neighbouring countries. Effective disease control measures are needed to prevent losses in government revenue, especially from notifiable cattle diseases (Box 1).

Box 1: Livestock diseases cost Government Ksh 2 billion annually

The Kenya government loses Ksh 2 billion annually due to preventable livestock diseases. According to the Permanent Secretary in the Ministry of Livestock and Fisheries Development, close to Ksh 1 billion is lost due to Foot and Mouth Disease, while another Ksh 900 million is lost as a result of East Coast Fever. Uncontrolled trans-boundary livestock movement impacts negatively on disease control efforts. The Permanent Secretary emphasized that "We must work on a policy to ensure that losses due to preventable diseases are contained. ...Towards this, the government has already commissioned a study to ascertain the actual loss caused by the recent outbreak of livestock diseases that nearly crippled the sector". In addition, the Director of Veterinary Services noted that weak policies and outdated legal framework have hindered the growth of the livestock sub-sector. Other factors that hamper growth include poor access to markets, weak monitoring and evaluation systems, weak institutional capacity, and inadequate information technology. The Director of Veterinary Services observed that research on control strategies is one of the main ways of addressing animal diseases.

Source: The Standard Newspaper, 28 April 2007, Nairobi, page 10

The Meat Control Act of 1972, revised 1977 (Cap 356, Laws of Kenya)

This Act aims at promoting supply of safe meat for both local and export markets. Some of the requirements in the Act are that:

- (a) Each export slaughterhouse be equipped with adequate sanitary facilities;
- (b) Inspection and maintenance of sanitary conditions be conducted regularly;
- (c) Carcasses and parts judged unfit for human consumption be disposed not later than 24 hours after inspection;
- (d) Re-inspection of all products be done at the time they leave an export slaughterhouse;

- (e) Export meat must be free from food additives and injurious substances prohibited by the receiving country; and
- (f) Appropriate export stamps, certificates and records must be maintained.

Hides, Skins and Leather Trade Act (Cap 359, Laws of Kenya)

This Act provides for the coordination and control of trade and development of the hides, skins and leather industry. The Act restricts the buying of hides, skins or leather for the purposes of resale, tanning, manufacturing of goods in Kenya or for export unless one is in possession of a legal buyer's license. The Act also gives guidelines on export and import of hides, skins or leather. Through its provisions, this Act enables estimation of actual domestic beef production capacity or volume of imports from the number of hides traded.

Kenya Stock Traders Licensing Act of 1962, revised 1983 (Cap 498, Laws of Kenya)

This Act stipulates that no persons shall carry on the trade or business of livestock without a license, except farmers who buy, sell or barter stock as farmers or residents in special areas set apart for their use. However, frequent violation of this Act by business agents (due to inadequate monitoring services) leads to influx of cheap stock from neighbouring countries. This depresses domestic prices and limits the development of livestock enterprises in pastoral areas. Analysis of the key determinants of beef export supply would provide insights on necessary amendments in the various legislations to improve disease surveillance, manage imports sustainably and improve competitiveness in beef export supply.

2.2 Institutional Arrangements

Institutions are essential (through rules, functions, governance structures and enforcement characteristics) in improving efficiencies in commodity value chains (Waiyaki *et al.*, 2006; Williamson, 2000). Institutional arrangements function alongside (and or facilitate the acquisition of) other critical development support elements such as inputs, incentives, information, investments and innovations. Indeed,

the New Institutional Economics (NIE) framework posits that greater competitive advantages are potential outcomes of well coordinated institutions (Porter, 1985).

Various public and private institutions perform different roles in Kenya's trade in beef. The Livestock Marketing Division (LMD) in the Ministry of Livestock and Fisheries Development operationalizes and manages livestock marketing information systems. However, it lacks a consistent database on livestock trade. Even the IGAD, which is supposed to collate regional agricultural marketing information, including from the livestock sector only provides information on trade in eggs from Kenya, besides general livestock trade data for Ethiopia, Somalia, Sudan and Uganda. The Export Promotion Council (EPC) maintains a database of exports and imports of all traded commodities. However, it lacks disaggregated data on specific beef export market conditions.

The Kenya Meat Commission was the sole organization responsible for coordinating Kenya's trade in meat in the pre-liberalization period. On the other hand, the Department of Veterinary Services (DVS) in the Ministry of Livestock and Fisheries Development (previously a department in the Ministry of Agriculture) has played a critical role in meat inspection and issuance of clearance certificates for trade in meat since independence in 1963. In addition, the Kenya National Chamber of Commerce and Industry (KNCCI) has a sub-committee responsible for identifying constraints to livestock marketing and suggesting policy measures to address the impediments. Before its closure in 1987, the KMC (Box 2) was the only licensed export abattoir that fulfilled international standards for export of canned beef, but it lacked the capacity to fully utilize export incentives, such as one-stop-shop trade facilitation service, and Tax Remission for Export Office offered by the Export Processing Zones Authority (EPZA).

Box 2: Kenya Meat Commission

The Kenya Meat Commission (KMC) is a state corporation that was established through an Act of Parliament in 1950 (Cap 363, Laws of Kenya). Its core functions were to process and market livestock and livestock products, and act as a strategic drought management tool and buyer of last resort. Due to poor management, old machinery and equipment, coupled with poor international markets from mid 1970s that adversely affected its performance, it was initially closed in 1987. Although it was reopened in July 1989, its performance continued to decline due to inadequate financial investments on compliance with high export standards and subsequent loss of overseas markets. The factory was closed for rehabilitation in 1992 and was put under receivership by the National Bank of Kenya. In 1999, however, the Public Investments Committee (PIC) recommended that the sale of KMC be stopped and instead the government liquidates all the debts owed by KMC and re-finances the institution to start operations. On 26 June 2006, the KMC factory at Athi River, with a capacity to process up to 1,000 head of cattle and 1,500 small stocks—sheep and goats—when fully utilized, was re-opened while the Kibarani factory in Mombasa (with a capacity to process up to 1,000 head of cattle and 1,500 small stock per day—sheep and goats— when fully utilized) was re-opened on 23 March 2007. The KMC also recently opened another depot on Landhies Road in Nairobi. The institution is currently finalizing its five-year strategic plan (2007-2012) that lays emphasis on developing meat product brands in line with changing consumer needs; improved veterinary services; sourcing of cattle from disease free zones; and issuance of permits for livestock movement.

Source: The Daily Nation Newspaper, Friday 27 April 2007, Nairobi, Page 38.

Upon the closure of KMC, private export abattoirs sprang up but had limited capacity to cope with volumes and stringent quality requirements in the export markets (Ackello-Ogutu *et al.*, 2006). Three private sector organizations emerged to fill the institutional void in promotion of livestock exports when the KMC was closed down in early 1990s. These include (Gitu, 2005):

(i) *Joint Kenya Arab Chamber of Commerce and Industry*

The Joint Kenya Arab Chamber of Commerce and Industry was formed in early 1990s to promote livestock trade between Kenya and the Arab world. It mainly coordinates trade delegations from Kenya to the Middle East, with a key focus on exports and imports of live animals.

(ii) *Red Sea Livestock Marketing Commission*

This is a Dubai-based organization established (with a sub-office in Nairobi) to promote livestock marketing in the Great Horn of Africa and Middle East, and to participate in joint efforts in eradication of diseases.

(ii) *Kenya Livestock Marketing Council*

Formed in 2004, the Kenya Livestock Marketing Council (KLMC) is located in the arid and semi-arid lands and promotes export of live animals (especially camels, goats and cattle) to the Middle East and Mauritius.

Although the private institutions play an important role in promotion of livestock marketing, they tend to over-concentrate on live animal trade with little specific focus on beef exports. They also face a myriad of challenges such as lack of adequate capacity (both physical and technical), duplication of efforts and weak market infrastructure. It is, therefore, imperative to explore strategies of enhancing institutional synergies between state-run entities such as KMC and non-state agencies. Some useful lessons may also be drawn from the horticulture and dairy sub-sectors in which the key institutions (Horticultural Crops Development Authority–HCDA; Kenya Dairy Board–KDB) have some degree of balance in the participation of public and private actors in the regulatory and marketing functions. These would stimulate public-private sector partnerships in sustainable and competitive beef export development.

2.3 Current Livestock Policy Focus

Livestock issues in Kenya fall within the mandate of the Ministry of Livestock and Fisheries Development. In line with the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC),

and the multi-sectoral Strategy for Revitalizing Agriculture (SRA), the Ministry in liaison with various stakeholders is currently developing a national livestock policy. The draft policy proposes various measures that will affect beef production and trade. Some of the proposed strategies include (Government of Kenya, 2007):

- (i) Establishment of Kenya Livestock Research Institute (KELRI) to address livestock and pastoral research needs. This will be instrumental in improving the research-extension linkages in the livestock sub-sector.
- (ii) Establishment of a National Livestock Extension Fund, while creating a favourable environment for private sector involvement in extension service delivery in highly commercialized areas. Extension service delivery was liberalized in 1991 (Omiti and Irungu, 2002), and therefore re-entry of direct public support may hinder private sector participation in competitive extension market. Nonetheless, the effect on beef export trade will depend on the nature of investments targeted by the National Livestock Extension Fund.
- (iii) Establishment of Kenya Livestock Inspectorate Board (KLIB) and Kenya Livestock Marketing Board (KLMB), while continuing to support revival of the KMC to full operation. Creation of the KLIB and KLMB is important in enforcing adherence to quality standards and provision of market services in beef trade. However, this would be too costly if undertaken concurrently with the on-going revival of KMC.

3. Literature Review

3.1 Challenges and Competition in Global Trade in Beef

Beef trading countries in the world can be grouped into four broad categories (ILRI, 2005):

- (i) Domestic protective states such as the US and Canada: These countries provide subsidies, experience higher levels of domestic production, higher prices and consequently lower consumption. Their surplus exports tend to depress world prices, thus widening the price gap between the world and domestic markets.
- (ii) Net beef-importing states, for instance countries in the Middle East (e.g. Oman, Jordan, Yemen): They enjoy lower prices and higher consumption due to artificially depressed world prices, but experience reduced incentives to improve their domestic production.
- (iii) More competitive net exporters such as Argentina, Brazil, Australia, New Zealand, Botswana, Namibia and South Africa: Although they tend to lose due to artificial stimulus to production in the protecting states, the losses can be offset to some extent if the concerned countries have preferential access to markets in industrialized nations. The competitive countries generally gain more in terms of greater opportunities to benefit from their comparative advantage than they lose through lower prices for preferential exports to the protected markets.
- (iv) Less competitive exporters with significant preferences such as Kenya. They largely lose from trade since they are unable to meet stringent export requirements and their exports to industrialized country markets are limited by quotas in the preference arrangements, besides other trade-inhibiting factors.

There is an increasing worldwide trend in health consciousness among meat consumers, particularly concerns over *Bovine Spongiform Encephalopathy* (BSE) and residues from hormone implants in livestock from some major world producers. In addition, beef trade faces double standards in some developed country markets. It is often the case that exports are discriminated through stringent quality requirements, yet the same beef is consumed at various international events in the exporting countries. These requirements affect investments in beef sub-sector development and export growth (Stevens

and Kennan, 2005). Compliance with EU requirements is critical not only for improving exports to Europe but also to many other high-priced markets, which take the EU certification as a 'seal of approval' that adequate zoosanitary standards are maintained. International trade is also characterized by various forms of preferential access for different products depending on particular markets. The EU, for instance, allocates quotas for beef exports by African countries: for example Kenya 142 tonnes, Swaziland 3,363 tonnes, Zimbabwe 9,100 tonnes, Namibia 13,000 tonnes and Botswana 18,916 tonnes. However, none of these countries has consistently fulfilled its annual quota allocations over time (Perry *et al.*, 2005).

Zoosanitary standards stimulate competition, leading to winners and losers in trade. For example, when Argentina experienced international market-access challenges due to outbreaks of Foot and Mouth Diseases in its cattle herd in 2000 and 2001, Brazil's beef industry stepped in with aggressive marketing that substantially increased its exports. In the UK, beef exports to the rest of the world declined drastically in 1996 due to an outbreak of brain-wasting disease linked to BSE (mad cow disease). During this period, North America (Canada and USA) that has historically accounted for about 25 per cent of world beef exports was the major beneficiary as its world beef exports increased (Jaffee, 2005). About 50 per cent of North America's beef is sold within the North America Free Trade Area (intra-NAFTA), while the rest is exported to Japan, Korea and Mexico. However, occurrence of isolated but repeated incidents of BSE in Canada and USA between 2002 and 2004 reduced NAFTA's world beef market share to 13 per cent in 2005 and increased intra-NAFTA beef trade to 95 per cent. Following the ban on NAFTA beef during the BSE incident, Australia and New Zealand have maintained a stiff challenge to NAFTA's market share in Japan, Korea and Mexico despite NAFTA's efforts to manage the outbreak (Adcock *et al.*, 2006).

Epidemic diseases such as Rift Valley Fever (RVF), contagious bovine pleuro-pneumonia (CBPP) and Rinderpest reduce the productivity of livestock in all agro-ecological zones in the Horn of Africa. Sustainable control of these diseases is limited by inadequate vaccine production and supply facilities, while surveillance is hampered by lack of diagnostic capacity in these countries (Winrock, 1992). Consequently, outbreaks of livestock diseases often devastate pastoral livelihoods, for instance the decline in foreign exchange earnings by over 75 per cent in

Somali due to the outbreak of Rift Valley Fever in 1997/1998 (Otte *et al.*, 2004).

Animal disease control requirements often exclude many developing countries from world markets. For example, the USA permits imports of beef from only 33 countries. Due to enormous costs of establishing and maintaining Disease Free Zones (DFZs) certified by the World Organization for Animal Health (*Office International des Epizooties-OIE*), most low-income countries are restricted to trade in live animals rather than livestock products, for instance the intra-regional trade in live animals in West Africa, supplies of live animals from East Africa to the countries of the Persian Gulf, and recently the exports of live animals from Kenya to Mauritius in the 2005/2006 fiscal year. Trade in livestock products requires provision of hygienic slaughter in an abattoir, meat inspection and refrigerated transport (Jaffee, 2005). However, even in situations where the developing countries' capacities for animal disease control could be enhanced, they would still face stiff competition from well-established livestock product exporters (notably Argentina and Australia), which have reliable and standardized production systems with fewer animal health problems (Upton, 2001). In addition, trade protections and trade-distorting subsidies in industrialized countries prevent low-income countries from accessing high-value export markets. In line with the World Trade Organization (WTO) agreements, Kenya's meat and meat products may need to be included in the special products' list on the basis of food security, livelihood security and ASALs development considerations (KIPPRA, 2006a).

Trade in livestock products is also affected by economic reforms. For instance, market liberalization in Kenya contributed to significant improvement in market prices for milk and meat as a result of increased entry of competitive players and the removal of institutional impediments (Omiti and Irungu, 2002). However, privatization of Artificial Insemination (AI) services in 1991 and the privatization of clinical veterinary services in 1994 severely impacted on livestock production especially in the ASALs of Kenya. Specifically, the quality and efficacy of curative and preventive facilities, drugs and breeding services in livestock development declined due to hurried and uncoordinated private sector entry (Oruko *et al.*, 2000). These trends may have had some implications on Kenya's beef export supply.

There is, therefore, a real pressure for African beef producers and exporters to re-examine their export strategies if they are to tap global

opportunities, especially in niche markets. Southern African countries (e.g. Botswana, Namibia, South Africa and Zimbabwe) have adopted various strategies to access high-income export markets. For instance, in Botswana, about 25 per cent of rural households derive their livelihoods from cattle. In order to address a decline in export earnings (from US\$ 63 million in 1998 to US\$ 30 million in 2003), the Botswana Meat Commission (BMC) increased producer prices by 40 per cent while the government initiated policy amendments to stimulate beef exports (AGOA, 2006). In addition, although various export strategies are pursued by the country in different markets, single-channel marketing through the Botswana Meat Commission is preferred when exporting to the EU on the basis of high fixed costs of compliance with zoosanitary and supply chain requirements. To promote beef exports, producers in Botswana receive a 40 per cent external tariff and the country also places a ban on imports of cattle and fresh meat from South Africa (Stevens and Kennan, 2005).

The Southern African countries enjoy various tariff quotas in the EU and US markets due to their ability to supply free products that are free of Foot and Mouth diseases (Scoones and Wolmer, 2006). Furthermore, countries such as Ghana have been unable to increase their production substantially but have relied on importing live animals, which they process under their livestock processing zones and re-export to high-income markets (Gitu, 2005).

Huge market opportunities exist for Kenya's beef producers due to global excess demand and projections of further increases as per capita incomes increase. As the demand for high-value food products grows rapidly, it would be important for Kenya to incorporate compliance with animal disease control measures as part of an overall competitive strategy in the beef sub-sector, the same way the country has done in its relatively successful horticulture industry (Jaffee, 2003).

3.3 Previous Studies on Beef Exports

In Kenya, most livestock studies have been on dairy cattle production and marketing issues (Omiti, 2004). Studies on the country's beef industry have seldom analyzed export determinants. Empirical studies on the beef sub-sector elsewhere have tended to focus on demand and supply responses in domestic markets. For instance, ILRI (2005) estimated the beef supply response in Zimbabwe using a polynomial

weighting function of price (almon model) and a geometric weighting approach. These models showed the short run and long run price elasticity of domestic beef demand within Zimbabwe.

Other studies have estimated expenditure elasticity of beef demand. For instance, Hanrahan (2001) used a Bayesian methodology based on Markov chain Monte Carlo posterior density simulators to estimate the demand for Irish beef in the United Kingdom (UK). The results showed that as expenditure on beef increased in the UK, the Irish share of that expenditure increased proportionately. In addition, some studies have estimated export potentials for beef and beef products in the developed countries. For example, Cao and Johnson (2006a&b) used gravity models to analyze the influences of different economic forces on meat trade between New Zealand and other countries, and to determine the impact of meat hygiene regulations on New Zealand meat trade. The previous studies showed that some of the key determinants of beef export trade in developed countries include:

- (i) Macroeconomic variables such as tariffs, quotas, GDP, exchange rates;
- (ii) Price elasticity of demand in different markets;
- (iii) Stability of domestic supply; and
- (iv) Trade in other related products (substitutes and complementary products).

Typically, estimation of trade potentials through a gravity model would provide insights on export supply and demand variables in specific markets (Helmets and Pasteels, 2005). Some studies on export supply (e.g. Koshal *et al.*, 1992; Goldstein and Khan, 1978) also estimate the demand for and supply of exports from a country simultaneously. However, due to lack of consistent destination-specific data on Kenya's beef export trade that would be relevant to gravity estimation or simultaneous supply and demand models, this study only focuses on a general export supply analysis.

In Kenya, beef export supply estimation has not been done before. One of the most recent studies on Kenya's export performance (Were *et al.*, 2002) only estimates the export supply elasticities of tea, coffee and non-beef agricultural commodities. The foregoing caveat is addressed in this paper by using a single equation model to analyze the determinants of beef exports. Haynes and Stone (1983) used this

approach to study aggregate export supply, while Athukorala and Rajapatirana (2000) used the same approach to analyze the determinants of the supply of manufactured exports from Sri Lanka. Koshal *et al.* (1992), who analyzed aggregate export supply from India, and Gunawardana *et al.* (1995), who estimated the export supply of citrus from Australia, used a similar approach but excluded industry capacity variable. Tambi (1999) included exchange rate as an additional explanatory variable in the estimation of export supply of cocoa, coffee and cotton from Cameroon.

4. Methodology

4.1 Conceptual Framework

The study is based on the theory of supply. The export supply of a commodity is a function of the price of exports, domestic price index, domestic production capacity, world income, taxes, subsidies, supply shocks (e.g. diseases and droughts) and exchange rate (Ganewatta *et al.*, 2005; Bullock *et al.*, 1993). Were *et al.* (2002) observed that the ratio of investment to GDP also influences the volume of exports. Since Kenya is a small country, its exports would always be below its potential demand, hence the domestic consumption level is excluded as an explanatory variable (Geda *et al.*, 2001). Due to unavailability of consistent data over the estimation period, taxes and subsidies are omitted in this study.

In this study, the volume of beef exported is postulated to depend on domestic production (which is influenced by inputs such as water, feeds, labour, veterinary and breeding services), macroeconomic variables (such as relative prices, development expenditures in livestock), institutional support (e.g. Kenya Meat Commission, privatization of AI) and disease outbreaks. Improvements in the domestic production capacity would contribute to increased output for the export market. Increased expenditure in livestock development (especially in market infrastructure, research, rehabilitation of holding grounds, extension and rangeland development) are expected to contribute to higher beef export supply. Privatization of artificial insemination (AI) services due to economic liberalization in 1991 is postulated to have contributed to a decline in beef export supply. The export supply of any country is influenced by the country's export price relative to the export prices of major suppliers to the common international market. For instance, the export prices of the US and Canadian beef affect the supplies of other exporters to the North American Free Trade Area (NAFTA), Korean and Japanese markets. In the EU and Middle East where Kenya has unutilized quota and lower tariffs, respectively, for beef exports, the country's export supply would depend on its price relative to the export prices of Argentina, Australia, New Zealand and Brazil, which are the main exporters to these markets (Adcock *et al.*, 2006). A higher export price relative to world price would make a country's exports more expensive compared to export supplies

from competing countries in the world market. Lack of competitiveness reduces a country's export supply to the world market.

Institutional support is critical for improving producer/exporters' ability to meet export requirements. Particularly, existence of the Kenya Meat Commission would facilitate compliance with zoosanitary standards, enhancing value addition in beef and thus increasing the volume of exports. It is assumed that the Kenya Meat Commission played a pivotal role in increasing beef exports before it collapsed in the 1980s. It is, therefore, expected that following its revival in 2005, beef exports would increase. The finding on this particular variable would support the rationale for public investments in sustaining KMC's monopoly or justify arguments for complete privatization of beef export handling. Disease incidences discourage export supply. The magnitude of export decline from a disease incidence depends on the nature and severity of the disease.

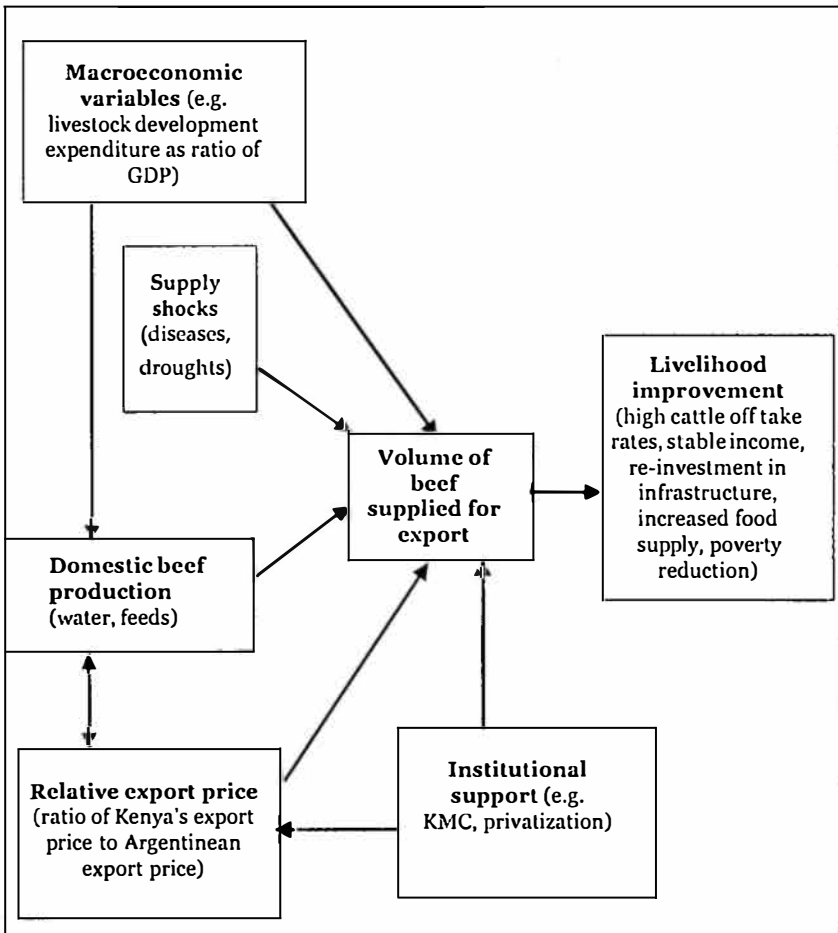
The assumption in the estimation is that long-run supply exhibits a lagged response to changes in the explanatory variables (Alemayehu, 1999; Nerlove, 1958). For instance, a severe outbreak of notifiable trans-boundary cattle diseases such as Foot and Mouth Disease (FMD), Anthrax, Rift Valley Fever (RVF), BSE and Rinderpest would be expected to reduce export supply in the immediate periods when they occur (due to health scare in both local and export markets, and often consequent export ban). The outbreak of these diseases would also negatively affect export supply in the subsequent periods/years until the export market is fully assured of safe beef supply from the affected country. In Kenya, the major notifiable trans-boundary diseases that affect cattle trade (and necessitate quarantines, burning of carcasses and mass inoculation during outbreaks) are Contagious Bovine Pleuro-Pneumonia (CBPP), Foot and Mouth Disease (FMD), Rift Valley Fever (RVF) and Rinderpest (Mbogoh *et al.*, 2005). However, due to insufficient observations for occurrence of Rinderpest (less than 30%) and lack of variation in the occurrence of CBPP over the period of study, these two notifiable diseases were omitted from the analysis.

Supply shocks (e.g. diseases, droughts) affect both domestic production as well as export supply. Macroeconomic variables and institutional support influence domestic output and prices, respectively, besides their effect on volume of exports. In addition, prices and domestic production exhibit causal relationships. However, this study assumes that *ceteris paribus*, beef export supply depends on domestic

production, relative prices, institutional support, macroeconomic variables and supply shocks.

Improvements in the export supply of beef are necessary to promote high off take rates, increased foreign exchange earnings, stable incomes and development of pastoral areas through re-investments in basic infrastructure (water, roads, energy and education) and food supply (Figure 5).

Figure 5: Determinants and outcomes of volume of beef export supply



Source: Adapted from Ganewatta et al. (2005); Gunawardana et al. (1995)

4.2 Data Types and Sources

The study estimated beef export supply function using annual time series data for the period 1965 to 2004. Data was gathered from secondary sources: FAOSTAT database, Annual Statistical Abstracts for Kenya, KIPPRA/Ministry of Agriculture—Agricultural Data Compendium, World Bank Development Indicators, Export Promotion Council, and Department of Veterinary Services in the Ministry of Livestock and Fisheries Development, among other sources. The empirical data covered key variables such as the volume of beef export from Kenya and various explanatory variables (Table 1). Although beef exports are usually measured in metric tonnes (MT) and valued in United States Dollar (US\$) equivalent, all the quantities and prices have been converted into kilograms (kg) and Kenya Shillings (Ksh), respectively, to allow uniformity in the units of estimation. Disease variables, privatization of AI services and the operation of KMC are measured by dummies (1 for existence and 0 otherwise).

Table 1: Definition of variables

Variable	Symbol (in levels)	Expected sign	Data source
Beef export volume	<i>BEEFEXP</i>	+	EPC, FAOSTAT
Beef production volume	<i>BEEFPROD</i>	+	FAOSTAT
Kenya's beef export price as a ratio of world (Argentinean) export price	<i>REXPW</i>	-	FAOSTAT
Livestock development expenditure as a ratio of GDP	<i>LGDP</i>	+	National development expenditure estimates
Privatization of AI services	<i>PRIVAI</i>	-	DVS
Operation of Kenya Meat Commission	<i>OPKMC</i>	+	DVS
Occurrence of Rift Valley Fever	<i>RVFOC</i>	-	DVS
Occurrence of Foot and Mouth Disease	<i>FMDOC</i>	-	DVS

- Kenya's export price as a ratio of world price (*REXPW*) was used as the best proxy for real exchange rate that would measure competitiveness of Kenya's beef exports relative to world exports. Currency conversions were based on the United States Dollar (USD) since it was the most common and consistently used standard currency of trade in the beef market (FAOSTAT, 2006).
- Livestock development expenditure figures were obtained from national development expenditure estimates (Government of Kenya, 1965-2004).
- *Real GDP* figures were extracted from the World Development Indicators data compendium that used year 2000 constant prices as the base (World Bank, 2006).

4.3 Analytical Framework

Both descriptive and econometric techniques are used in the analysis.

4.3.1 Descriptive analysis

Trends in beef production, export price, domestic price and national expenditure in livestock development, the frequency of occurrence of Foot and Mouth Disease and Rift Valley Fever, operation of the Kenya Meat Commission and privatization of artificial insemination services are highlighted using various descriptive measures.

4.3.2 Econometric tests

Various diagnostic tests are undertaken to determine the data properties in terms of stationarity, granger causality and existence of co-integration.

(i) Unit root/stationarity of variables

The asymptotic theory (convergence of sample moments to constants) upon which classical regression is based presupposes stationarity of variables (absence of unit roots). This condition is critical to prevent severe consequences of non-stationarity, such as (Bhaskara, 1994):

- (a) non-standard sampling distributions;

- (b) inability to use the *t*-and *F*-distributions in statistical inference;
- (c) invalidation of normal hypothesis testing; and
- (d) the tendency to reject the null of no association between specific and all regressors jointly tested.

The study uses the Augmented Dickey Fuller (ADF) test for stationarity (Dickey and Fuller, 1981). This involves the search for the data generating process from pure random walk or random walk with drift or random walk with drift and time trend.

(ii) Granger causality

Pairwise, granger causality tests were performed to establish the direction of causality between the dependent variable and each of the non-dummy independent variables. The causality tests were also carried out between pairs of independent variables to determine if any of the independent variables could be used as the dependent variable in estimation.

(iii) Cointegration

The long run equilibrium relationship among the variables is determined through the *Johansen* co-integration test, assuming a linear deterministic trend (Johansen, 1995).

4.3.3 Export supply estimation

The study uses a single equation approach to obtain export supply elasticity estimates (Gunawardana and Karn, 1998). The export supply function for beef is defined as shown in equation 1.

$$x_t^s = f(Z, S, C, D, K, L) \dots\dots\dots(1)$$

where x_t^s is the quantity of beef supplied for export, Z is an index of annual domestic beef production, S is the relative export price of Kenya to the main exporter of own-produced beef (Argentina), C is the ratio of livestock development expenditure to GDP, D is a dummy for fatal outbreaks of various notifiable diseases, K is a dummy for operation of the Kenya Meat Commission, while L is a dummy for privatization of AI services.

The variables (except the dummies and proportions) are in logarithm form to allow interpretation of the estimated parameters as elasticities. Substituting the variable names in Table 1 into equation 1, the beef export supply model is specified as in equation 2.

$$\begin{aligned} \Delta \text{LNBEEFEXP}_i = & \beta_0 + \beta_1 \Delta \text{LNBEEFPROD}_{i-1} + \beta_2 \Delta \text{LGDP}_{i-1} + \\ & \beta_3 \text{PRIVAI}_{i-1} + \beta_4 \text{FMDOC}_{i-1} + \beta_5 \text{RVFOC}_{i-1} + \beta_6 \text{OPKMC}_{i-1} + \\ & \beta_7 \text{ECT}_{i-1} + \mu_i \dots\dots\dots (2) \end{aligned}$$

Where:

- LNBEEFEXP* = logarithm of beef export
- LNBEEFPROD* = logarithm of beef production
- LGPD* = Livestock development expenditure as a ratio of GDP
- PRIVAI* = Privatization of artificial insemination services
- FMDOC* = occurrence of Foot and Mouth Disease
- RVFOC* = occurrence of Rift Valley Fever
- OPKMC* = operation of Kenya Meat Commission
- ECT* = error correction term
- i* = 0, 1, 2...n

Estimation is through the Least Squares approach and *a priori* expectations are that $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 < 0$, $\beta_5 < 0$, $\beta_6 > 0$ and $\beta_7 < 0$.

5. Results and Discussion

5.1 Trends in Beef Export Development

Beef export supply has been on a gradual decline while production has steadily increased except during the drought shocks of 1980/81, 1992, 1999 and 2005. For instance, the lowest production of 106,000 tonnes was recorded in 1966, but the export supply was 3,317 tonnes in that year. In 1991, 1993 and between 2002 to 2004 when production was about 3,300 tonnes, export supply remained below 700 tonnes (FAO 2006). The general decline in beef export supply is consistent with the overall decline in Kenya's export performance (in most sectors) as noted by Wagacha (2000). Between 1965 and 2004, the average quantity of beef production in Kenya was 206,000 tonnes while its export supply was only 1,089 tonnes (Appendix 1). The downward trend in non-beef exports is mainly attributed to anti-export bias that resulted from various policies undertaken since the 1960s. These included import-substitution and economic liberalization, coupled with inability to utilize export incentives to improve competitiveness. The trends in beef exports are also consistent with the observed decline in the share of total exports of all tradable commodities in the gross national output from 21 per cent to 15 per cent from the period 1976 to 2003 (Wanjala and Kiringai, 2007).

Kenya's export price was lower than the domestic price from 1965 to 1988 (exports, however, rose during this period due to the country's obligation to fulfill export contracts in destination countries at the time), surpassed the domestic price level between 1989 and 1995, dropped between 1996 to 2000 and rose between the period 2001 to 2004. Compared to the world export price, Kenya's beef export price was generally higher throughout the period of analysis, showing lack of competitiveness in Kenya's beef exports. The livestock development expenditure to GDP ratio has been fluctuating over time. The allocations were generally on an upward trend from 1965 (about 6%) to the highest ratio in 1970 (23%). From 1971, there was a gradual decline in livestock development expenditure to 2 per cent in 1984 (the lowest ratio over time). Since then, livestock development expenditure as a ratio of national GDP has remained below 10 per cent (Figure 6). Beef export supply was on an upward trend from 1969 when development expenditure was on the rise, but began to fall drastically after attaining a peak in 1977 when further declines in development expenditure were experienced. The major decline in livestock development expenditure

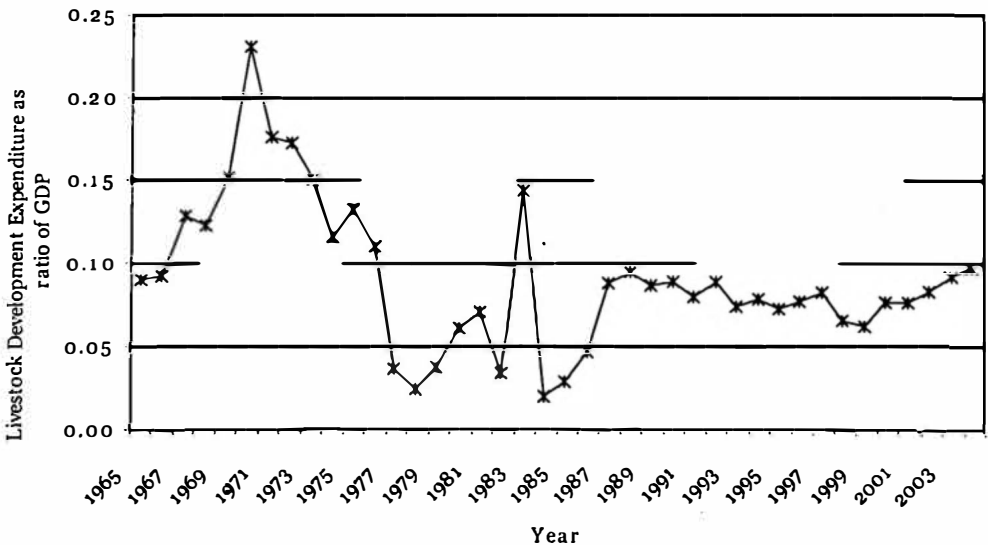
and consequent drop in beef export supply could be linked to the global oil crisis that severely affected GDP of agrarian economies in the 1970s, collapse of market infrastructure due to closure of the KMC in mid 1980s and withdrawal of government support from provision of most services, including privatization of veterinary clinical services in early 1990s. Attempts to revive the livestock industry through increased development expenditure from 1985 to 1997 began to realize some success with beef export supply recording marginal increase from 1998 onwards.

The Foot and Mouth Disease (FMD) had a higher frequency of occurrence (85%) than the Rift Valley Fever (RVF) (40%) over the 40-year period of analysis. The Kenya Meat Commission was operational for 55 per cent of the period of analysis (1965-1986), while privatization of the AI was in existence 35 per cent of the reference period (1991-2004).

5.2 Time Series Properties of Quantitative Data

All the variables used in the econometric analysis, except the ECT, are non-stationary at levels. This is derived from the unit root test results

Figure 6: Livestock development expenditure as a ratio of GDP, 1965-2004



Source: FAOSTAT data (2006)

that show lower ADF and joint test statistics. The estimated statistics for *LNBEEFEXP*, *LNBEEFPROD*, *REXPW*, *LGDP* and the *ECT* are all lower than the critical values for econometric tests involving either random walk with drift and time trend, or random walk with drift only (i.e. 6.73 and 4.86, respectively) (Appendix 2). However, the variables of estimation attain stationarity when differenced once, i.e. they are integrated of the first order or stationary at first difference (Appendix 3). This implies stability of coefficients after various adjustments in the long run.

In terms of granger causality, beef export supply is granger caused by domestic beef production and ratio of livestock development expenditure to GDP. However, relative export price is granger caused by beef exports. This suggests possibilities of existence of two dependent variables in the study (Appendix 4). Co-integration results of the maximum eigenvalue test indicate that there is one co-integrating equation at both 5 per cent and 1 per cent significance levels. The co-integrating equation is obtained as formulated below (standard errors are indicated in parentheses):

$$ECT = LNBEEFEXP*1 + LNBEEFPROD* \\ 2.52123 - LGDP*8.76228 - 64.579 \dots\dots\dots(3) \\ (1.1129) \qquad (4.400)$$

where:

ECT is the error correction term, which measures the speed of adjustment to disequilibrium in the beef export market. The outcomes of granger causality and co-integration tests lead to omission of *REXPW* from the estimated model of export supply since it does not granger cause export supply.

5.3 Factors that Determine Beef Export Supply

Changes in beef production in one previous year, ratio of livestock development expenditure to GDP (lagged twice), occurrence of FMD and RVF (two previous years), and operation of the KMC (lagged four times) are the key variables that significantly influence beef export supply (Table 2).

Positive changes in beef production in the previous one year contribute about 28.57 per cent increment in beef export supply, *ceteris*

Table 2: Main variables that explain beef export supply

Variable	Coefficient	Std. error	t-statistic	Prob.
C	0.4649	0.7823	0.5942	0.5573
<i>DLNBEEFEXP(-2)</i>	0.1159	0.1503	0.7712	0.4618
<i>DLNBEEFPROD(-1)</i>	0.2857	0.1320	2.1634	0.0395**
<i>DLGDP(-2)</i>	0.2442	0.0906	2.6969	0.0119**
<i>PRIVAI(-1)</i>	0.1789	0.7347	0.2435	0.8095
<i>FMDOC(-2)</i>	-0.3186	0.1317	-2.4191	0.0225**
<i>RVFOC(-2)</i>	-0.2847	0.1475	-1.9298	0.0642***
<i>OPKMC(-4)</i>	0.1865	0.0904	2.0627	0.0421**
<i>ECT(-1)</i>	-0.0975	0.0411	-2.3737	0.0385**
R-squared	0.445148	Mean dependent var	-0.10406	
Adjusted R-squared	0.280748	S.D. dependent var	0.789675	
S.E. of regression	0.669714	Akaike info criterion	2.248385	
Sum of squared residuals	12.10995	Schwarz criterion	2.644265	
Log likelihood ratio	-31.47093	F-statistic	2.707705	
Durbin-Watson statistic	2.022391	Prob(F-statistic)	0.024987	

** significant at 5%, *** significant at 10%, n = 36 after adjustment

paribus. This is plausible, considering that previous output provides the stock/reserve, which forms the basis of trade decisions (i.e. target markets, volumes, negotiations and market arrangements). Unit positive changes in the ratio of livestock development expenditure to GDP are necessary, as they lead to significant increments (about 24.42%) in the export supply over the subsequent two years. This finding is consistent with the observation that development expenditures are essential in improving the business environment and competitiveness in trade (KIPPRA, 2006b). The relevance of investments from previous periods stems from the fact that infrastructural improvements and market development, which are critical prerequisites for stable export trade participation take considerable time due to huge resource requirements and lags in institutional reforms (Knips, 2004). In the beef sub-sector, investments are required to rehabilitate holding grounds for cattle, stock routes, watering points, quarantine stations and market yards that have deteriorated due to poor beef export performance over time. Other potential investment opportunities would include establishment of more beef processing units to enhance value addition, dipping services and animal feeds (EPZ, 2005).

An outbreak of FMD negatively affects beef export supply; nearly 31.86 per cent drop is experienced. The reduction in export supply due to FMD occurrence results from both the losses in beef production and health scare that contributes to declines in consumption in international markets (often occasioned by export bans on the basis of zoosanitary standards). The results also show that occurrence of the Rift Valley Fever reduces exports by 28.47 per cent. Indeed, recent incidences of the RVF in 2006 wiped out close to 30 per cent of the beef herd and led to a drastic fall in the domestic beef consumption in Kenya.

Operation of the Kenya Meat Commission would increase the volume of beef supplied for exports by about 18.65 per cent. This observation provides a justification for revival of the KMC. Part of this outcome could be explained by the need for state involvement in developing appropriate measures to ensure safe product standards for the export market. Furthermore, private sector institutions lack incentives to participate in improving market infrastructure that requires enormous capital, hence the relevance of KMC.

The Error Correction Term fulfills *a priori* expectations (negative) and is statistically significant at 5 per cent. The negative sign of the Error Correction Term implies that long run adjustments lead to convergence of beef export supply towards the mean. The magnitude of the Error Correction Term shows that Kenya's beef export supply adjusts to disequilibrium in export market by 9.75 per cent in each time period, i.e. complete stability in beef export supply would be achieved after about 10 to 11 years. This is longer than the period of adjustment in major beef exporting countries/trading blocs. For instance, the North American Free Trade Area took about four years to regain its beef export market share (about 25% annual adjustment) in Japan, Korea and Mexico due to the outbreak of *BSE* in 2003.

Although privatization of AI services has always been cited as a possible cause of low quality of cattle breeds kept in the ASALs, this study find its influence to be negative but insignificant. Perhaps this could be attributed to low levels of users of the service prior to privatization, as well as emergence of alternative competitive providers of the service to the main producers of beef in the post-liberalization period. However, utilization of AI services should be encouraged to improve the quality of beef cattle. This would require provision of cost-effective services using public-private channels depending on the ability and willingness of pastoralists to pay for the services.

6. Conclusions and Recommendations

6.1 Conclusions

The hypotheses of the study are all maintained and it is thus noted that both domestic beef production and operation of the KMC are significant in increasing Kenya's beef export supply, while occurrence of notifiable diseases derails the country's capacity to competitively participate in beef export trade. In addition, increased share of livestock development expenditure to GDP contributes to increased beef export supply. However, privatization of AI services has not had a significant influence on beef export supply. Kenya's beef export supply has a relatively low speed of adjustment to disequilibrium in the export market (9.75% annually compared to over 25% in North American countries). This implies that in order to attain complete stability in Kenya's beef export supply, it would take nearly thrice the amount of time required for such adjustments in developed countries.

Various weaknesses are observed in the current legal, institutional and policy framework in beef trade. There are specific weaknesses in the enforcement of inspection, quality assurance and monitoring of livestock movement (particularly the Animal Diseases Act, Cap 364 and the Kenya Stock Traders Licensing Act, Cap 498 Laws of Kenya). There are also weaknesses in disease control operations.

6.2 Policy Recommendations

Considering the important role of livestock in the national economy, the government has recently set up a taskforce to develop a livestock master plan for the next 20 years. The taskforce seeks to improve the quality of livestock production as well as control of diseases.

Besides this initiative, it is prudent to provide policies that facilitate improvement of livestock marketing, research and value addition. In order to improve the competitiveness and sustainability of beef export supply and pastoral livelihoods, the following are proposed:

- (i) Establishment of Disease Free Zones should be mainstreamed in the national livestock policy to enhance control of trans-boundary notifiable diseases. The priority focus in the DFZs should be eradication of Foot and Mouth Disease, and Rift Valley Fever;

- (ii) Budgetary allocation to livestock development should be increased in line with the sub-sector's contribution to agricultural as well as national GDP. An increment from the current allocation of about 9 per cent of national budget to 10 per cent is proposed (livestock income forms about 11% of national GDP). This implies an increment in livestock development expenditure allocation from the Ksh 9.834 billion proposed in the 2007/2008 national budget to Ksh 11.926 billion. Part of the incremental funding should be utilized to support investments in beef production inputs (water and feeds). Rehabilitation of holding grounds should also be hastened to stabilize beef output during droughts and disease outbreaks. In future national budgets, livestock development should be treated as a separate sector with an independent, adequate and stable budgetary allocation, rather than being nested within the agriculture budget;
- (iii) Complete revival of the Kenya Meat Commission should be facilitated as envisioned in the draft national livestock policy to allow implementation of its 2007-2012 strategic plan in order to restore some degree of export supply stability;
- (iv) The Kenya Meat Commission Act (Cap 363, Laws of Kenya) should be reviewed to focus its institutional mandate on regulatory aspects of the meat industry development (including beef trade) after 2012, in collaboration with the Department of Veterinary Services;
- (v) Laws that encourage joint investments in marketing by the proposed Kenya Livestock Marketing Board and private actors such as the Kenya Livestock Marketing Council should be enacted. Institutional incentives, for instance tax rebates to private investors in market infrastructure development, value addition (e.g. beef processing) and market promotion should also be provided;
- (vi) A vibrant research institute should be established in line with the Kenya Livestock Research Institute proposed in the draft national livestock policy;
- (vii) The legal provisions dealing with livestock imports (Cap 359; Cap 364; Cap 498) should be reviewed and harmonized to improve enforcement of disease surveillance and protect

domestic beef producers from unfair competition from cheap imports of beef cattle;

- (viii) Import-export strategies of successful African countries in beef trade should be adopted in Kenya. For instance, the Ghanaian model in which cheap high quality beef cattle are imported from neighbouring countries (when domestic production is depressed by supply shocks), processed in the country's export processing facilities and the beef is then re-exported to high-income markets could be applied in Kenya. In order to ensure compliance with the World Trade Organization (WTO) agreements, Kenya should apply safeguard measures such as a review and/or expansion of the special products' list in both bilateral and multilateral trade arrangements to include beef; and
- (ix) Provision of AI services through public-private channels. This would imply establishment of the National Livestock Extension Fund proposed in the draft national livestock policy to provide extension and AI services in marginal areas, while the government continues to provide supportive infrastructure (such as affordable loans, tax incentives, legislation) that would promote private sector investment in provision of these services in areas where commercial farming is more enterprising.

6.3 Suggestions for Further Research

There is need for concerted efforts among stakeholders in building a consistent and reliable database that would facilitate estimation of trade potentials for Kenya's beef in specific export markets. Research is also necessary to explore strategies of enhancing the competitiveness of Kenya's beef in various export destinations. This would enable targeting of investment interventions in value addition as enshrined in Kenya Vision 2030.

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Appendices

Appendix 1: Descriptive statistics

	<i>BEEFEXP</i>	<i>BEEFPROD</i>	<i>LGDP</i>	<i>REXPW</i>
Mean	1089202	2.06E+08	0.09075	1.76621
Median	166500	2.02E+08	0.085	1.558808
Maximum	4029000	3.65E+08	0.23	3.477027
Minimum	3000	1.06E+08	0.02	0.903392
Std. Dev.	1426128	68594628	0.043934	0.615575
Skewness	0.887924	0.46434	0.86403	0.709946
Kurtosis	2.095039	2.371675	4.148947	2.977186
Jarque-Bera	6.620985	2.0954	7.17712	3.36102
Probability	0.036498	0.350744	0.027638	0.186279
Observations	40	40	40	40

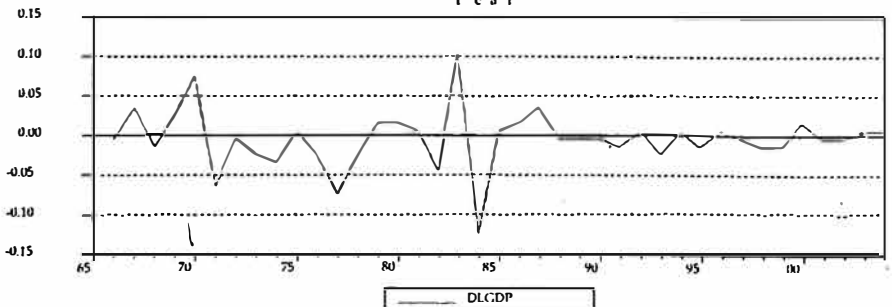
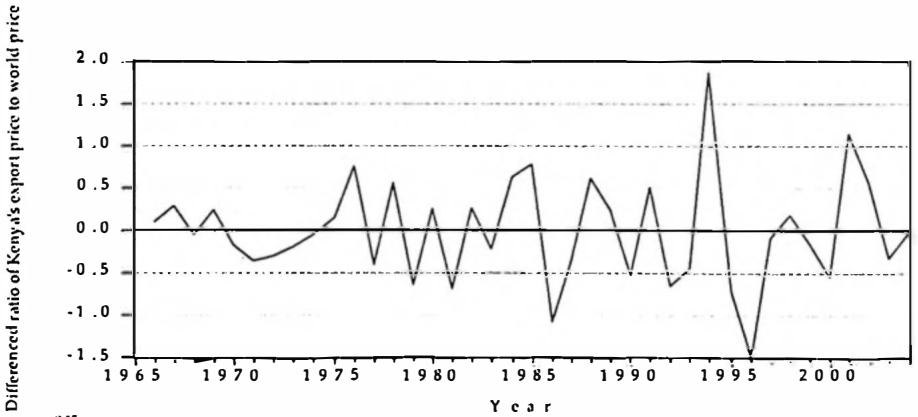
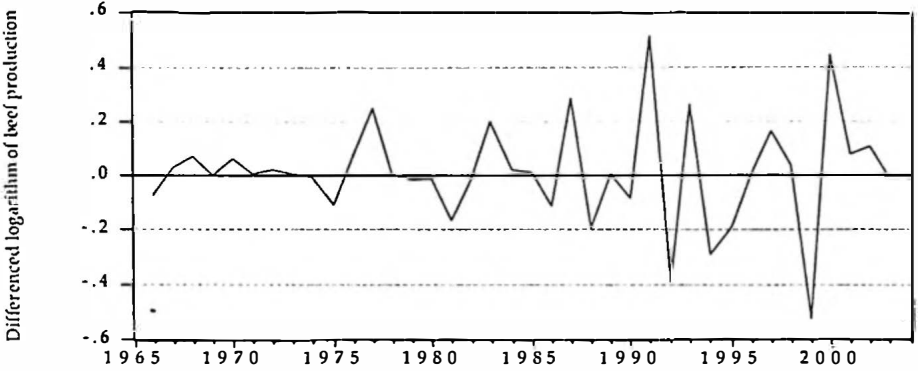
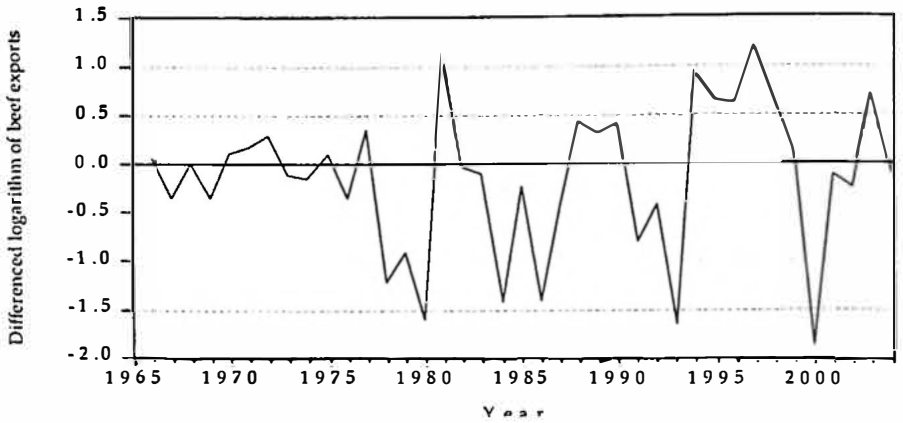
Appendix 2: Summary of unit root test results

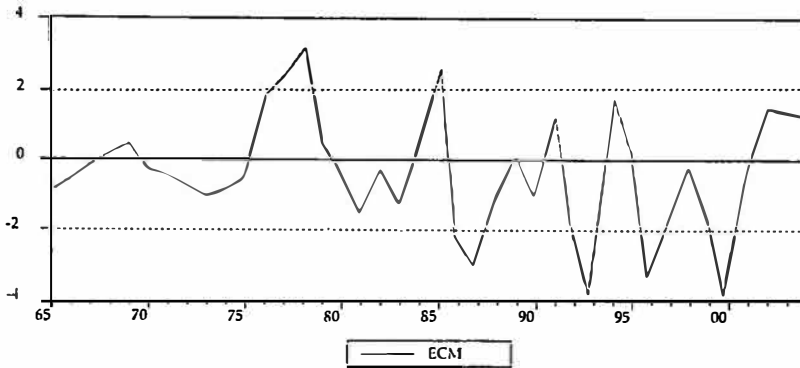
Variable	Model specification (test)	ADF statistic	Joint test (F-statistic)	Conclusion
<i>LNBEFEXP</i>	Intercept and trend (random walk with drift and time trend)	$t = -1.14$	$\Phi_3 = 0.84$	At 95% confidence interval and 50 observations, the critical value is 6.73. Therefore, we cannot reject the null of existence of unit roots (non-stationarity)
	Intercept (random walk with drift)	$t = -1.15$	$\Phi_1 = 1.12$	The critical value at 95% confidence interval is 4.86, therefore we cannot reject the null
	None (pure random walk)	$t = -1.14$		Stationarity exists at first difference I(1)

cont/-

Variable	Model specification (test)	ADF statistic	Joint test (F-statistic)	Conclusion
LNBEFPROD	Intercept and trend (random walk with drift and time trend)	$t = -2.31$	$\Phi_3 = 29.37$	Reject null and conclude there is stationarity at levels I(0)
	Intercept (random walk with drift)	$t = -1.12$	$\Phi_1 = 2.54$	Fail to reject the null. There is no stationarity at levels
	None (pure random walk)	$t = -1.84$		Reject null. There is stationarity only at 90% confidence interval
REXPW	Intercept and trend (random walk with drift and time trend)	$t = -3.38$	$\Phi_3 = 5.89$	Fail to reject null
	Intercept (random walk with drift)	$t = -2.18$	$\Phi_1 = 2.39$	Fail to reject null
	None (pure random walk)	$t = -0.44$		There is stationarity at first difference I(1)
LGDP	Intercept and trend (random walk with drift and time trend)	$t = -3.70$	$\Phi_3 = 17.40$	Reject null and conclude there is stationarity at levels
	Intercept (random walk with drift)	$t = -1.68$	$\Phi_1 = 1.10$	Fail to reject null. There is no stationarity at levels
	None (pure random walk)	$t = -1.26$		Reject null. There is stationarity at 90% confidence interval
ECT	Intercept and trend (random walk with drift and time trend)	$t = -6.93$	$\Phi_3 = 31.05$	Stationarity exists at levels
	Intercept (random walk with drift)	$t = -5.17$	$\Phi_1 = 10.21$	Stationarity exists at level
	None (pure random walk)	$t = -4.66$		Stationarity exists at levels

Appendix 3: Movement of variables at first difference





Appendix 4: Granger causality tests

Sample: 1965 2004			
Lags: 2			
Null hypothesis:	Obs	F-Statistic	Probability
LNBEFPROD does not granger cause LNBEFEXP	38	4.69757	0.01602
LNBEFEXP does not granger cause LNBEFPROD		0.47386	0.62677
LGDP does not granger cause LNBEFEXP	38	3.58674	0.03895
LNBEFEXP does not granger cause LGDP		0.29672	0.74521
REXPW does not granger cause LNBEFEXP	38	0.76026	0.47556
LNBEFEXP does not granger cause REXPW		7.03741	0.00285
LGDP does not granger cause LNBEFPROD	38	0.15006	0.86124
LNBEFPROD does not granger cause LGDP		1.08494	0.34967
REXPW does not granger cause LNBEFPROD	38	1.82599	0.17696
LNBEFPROD does not granger cause REXPW		7.37933	0.00224
REXPW does not granger cause LGDP	38	0.00243	0.99758
LGDP does not granger cause REXPW		0.74425	0.4829

Appendix 5: Co-integration test results

Included observations: 38				
Test assumption: Linear deterministic trend in the data				
Series: LNBEFEXP LNBEFPROD LGDP REXPW				
Lags interval: 1 to 1				
	Likelihood	5%	1%	Hypothesized
Eigenvalue	Ratio	Critical value	Critical value	No. of CE(s)
0.512221	50.96955	47.21	54.46	None *
0.319063	23.68966	29.68	35.65	At most 1
0.175554	9.086803	15.41	20.04	At most 2
0.045037	1.751154	3.76	6.65	At most 3
*(**) denotes rejection of the hypothesis at 5% (1%) significance level				
LR test indicates 1 co-integrating equation(s) at 5% significance level				

Other Related KIPPRA Papers

1. Were M, Ndung'u N S and Geda A (2002), *Analysis of Kenya's export performance: An empirical evaluation*, KIPPRA Discussion Paper No. 22.
2. Odhiambo W, Nyangito H O and Nzuma J (2004), *Source and determinants of agricultural productivity in Kenya*, KIPPRA Discussion Paper No. 34.
3. Onyango C H and Omiti, J (2008), *Scaling up domestic support for sustainable development of agriculture in Kenya*, KIPPRA Discussion paper No. 83.