Cass Business School
CITY UNIVERSITY LONDON

Commodity futures trading in Kenya - Are we ready for the future?

Dissertation by: Sahib Singh Khosla (110044470)
Supervisor: Dr. Ioannis Kyriakou
Submitted: 31 August 2012

Dissertation submitted for the award of the
MSc in Actuarial Management (2011-2012)
Faculty of Actuarial Science and Insurance
Cass Business School
City University, London

Abstract

Commodity futures markets are growing in popularity worldwide. There is an increase in the volumes of commodity futures contracts traded as well as increased specification of new futures contracts with different underlying commodities. This dissertation empirically studies the link, if any, between commodity futures markets development and economic growth in the agricultural sector, through dynamic panel modeling. The results suggest that commodity futures market development has a significant positive impact on economic growth in the agricultural sector.

This dissertation is motivated in the interest of using innovations and development in the financial sector to enhance the welfare of Kenya's large agricultural communities.

Acknowledgements

I would like to acknowledge and extend my heartfelt gratitude to the following persons who have made the completion of this dissertation possible:

My tutor, Dr. Ioannis Kyriakou for his critical analysis, constructive and timely feedback, guidance and ever positive support;

Mahjbeen Taki, for the constant reminders, thought provoking and much needed motivation;

George Gachiri for the software tutoring and inspiration he extended;

Most especially to my family;

And to God, who made all things possible.

Contents

1. Introduction

Kenya is an emerging economy that has a large agricultural sector. A large proportion of the commodities traded in Kenya are grown i.e. they are soft commodities. This includes cash-crop and horticultural exports bringing in large amounts of foreign exchange. For the year ending 2011, the agricultural sector generated 23% of the country's Gross Domestic Product (World Bank, 2012). This sector is fundamental as it has been the cornerstone of economic growth in Kenya since independence i.e. it is a key component of the GDP year on year.

As of 2011, 78% of Kenyans live and work in rural areas (World Bank, 2012). They are primarily involved in agriculture. A key concern for this population set is the price volatility associated with the commodities they trade in. Currently, they sell their produce at local spot markets where the contracts are immediately settled, with money and the commodity changing hands. Their work as small scale farmers leaves them unable to build excess capacity achievable through improved land productivity or by building storage facilities. At the same time, the speed at which their produce deteriorates means that they are unable to control the price that they receive for it on the market. Export produce is sold on the international markets via a chain of middlemen. In competing with other nations selling similar products, the price obtained cannot be set or controlled by exporters. Instead, they are exposed to the price volatility of international markets.

The report presents an overview of commodity futures markets and their beneficial role in risk management and price discovery. These features of commodity futures markets make them very beneficial for the Kenyan producers and exporters. A commodity futures market enables risk transfer amongst farmers and other market participants. By entering into futures contracts, farmers can effectively set the price that they will receive for their produce at a future date. This enables the farmers make prudent decisions on the whole production process ranging from the cost of production to the final quantity produced. This should ultimately lead to less dissatisfaction and increased agricultural productivity.

However, Kenyan agricultural commodity producers and exporters continue to be plagued by repeated cycles of price and revenue fluctuations. This leads to dissatisfaction and lowers farm productivity. Contribution to GDP by the agriculture sector has been on the decline (World Bank, 2012).

The aim of this report is to investigate whether the establishment and development of a commodity futures market leads to economic growth in the agricultural sector. In investigating the link between commodity futures market development and economic growth, we use a statistical estimation technique - Generalized Method of Moments (GMM). This technique has been used in numerous empirical studies which postulate a relationship between financial development and economic growth (Beck and Levine, 2004). Analyzing this relationship is critical, as establishing a positive link may lead to government policy encouraging the development of a commodity futures market.

2. Background

2.1 Commodity

2.1.1 Definition and types

A commodity is a good produced to fulfill wants or needs (Marx, 1987). These commodities are traded on the international markets and have fungibility; that means that the international market treats the commodities as equivalent no matter who produces them. As an example, a kilogram of grade 1 tea produced in Kenya is equivalent to a kilogram of grade 1 tea produced in India (Marx, 1987).

Commodities can be split into hard and soft commodities. Hard commodities are like iron ore and gold that are extracted via mining. Soft commodities are like cash crops (tea, wheat, etc.) that are grown. The key difference in the two types is the sensitivity of soft commodities to spoilage, which changes the way soft commodity prices behave. Soft commodities are also affected by weather and climate changes much more than hard commodities leading to less consistent prices over time (Finweb, 2012). Therefore, most agricultural markets are naturally volatile given the relative dependence of production on climatic conditions.

2.1.2 Production and price volatility

Liberalization of agricultural products has largely increased since the Marrakech Agreement in 1994. Under the agreement for agriculture " fairer markets for farmers'', it disallowed countries from using various market mechanisms that had previously caused agricultural trade to became highly distorted (WTO). These mechanisms included the use of import quotas and export subsidies. The Marrakech Agreement of 1994 lead to the establishment of the World Trade Organization in 1995.

Agricultural production has been increasing worldwide as improved ways of farming are used. This includes using better seeds and pesticide control. Figure 1 shows the rising net production index as compiled by the Food and Agricultural organization (FAO).

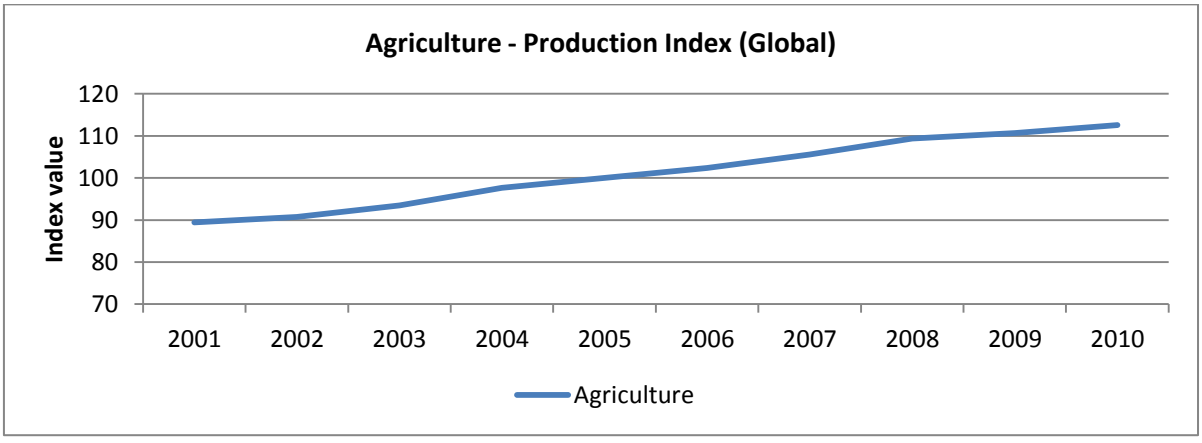

Figure 1 (Net production index trend 2001-2010)

***Source**: Food and agriculture organization of the United Nations: Data (online)*
Available from: http://faostat.fao.org/site/612/DesktopDefault.aspx?PageID=612#ancor

Price volatility in agricultural markets:

Agricultural commodity demand and supply is inelastic: Inelasticity is when price change has little or no effect on the supply and demand of a commodity. Recent research by Abbott et al. (2011) indicate that many agricultural commodities have become more inelastic suggesting larger price swings from a given supply shock. Supply shock occurs when there are shortages or abundance relative to the underlying norm.

Thinness of agricultural markets cause price volatility: By the process of trade, moving goods from a surplus zone to a deficit zone with higher demand, large price variability can be mitigated. For this to work efficiently, markets must not be thin. Market thinness is mainly measured using the proxy exports as a share of production. Thin markets are characterized by asymmetric information, few transactions per period, relatively low volumes, high transaction costs and agents with market power. These characteristics lead to inefficient and volatile prices (Liapis, 2012). However, a study by Liapis (2012) showed that selected agricultural markets in the study sample had not become thinner over time negating the assertion that current market price volatility is due to the thinness of agricultural markets.

Further study into price volatility by OECD (2011) concludes in general that price volatility in agricultural markets was higher in the period 2006-2010 then in the 1990s, though it varies by commodity and over time. However, in comparison to the seventies, this difference in price volatility is not statistically significant. An empirical study by Cashin and McDermott (2002) concludes that ''although the rise in volatility in the early 1900s was due to greater amplitude of price movements, the further rise in volatility in the early 1970s was due to the increased frequency of large price movements.

Agricultural price volatility remains a major policy concern. Periods of sharp price rises and falls as in 2006-2010, cannot be ruled out with negative consequences for food prices, food security and farm incomes.

Agricultural policies are implemented internationally by governments with the goal of achieving a specific outcome such as a guaranteed supply level, price stability and product quality in the domestic agricultural product markets. Governments may provide agricultural subsidies to farmers as a supplement to their income. This influences the supply and cost of the commodities produced. They may also introduce price controls. These are government restrictions on the prices that can be charged for goods and services in a market. There are two types, a maximum price to be charged (price ceiling) or a minimum (price floor). Price ceiling's encourage lower production, as producers feel that they are selected against, leading to lower output from farms (Knutson et al. 2006).

Trade barriers limiting the quantity of imported goods or tariffs that raise the domestic price of imported goods are used by governments to protect their local producers. Tariffs and trade barriers can be effective only if a nation normally imports some of its supply.

2.2 Commodity derivatives

2.2.1 Definition & types

A derivative is a financial instrument which derives its value based on an underlying asset's price.

There are numerous types of derivative instruments traded today of varying complexity. These can be categorized with regards to the type of underlying asset – this can be a physical asset (e.g. commodities) or a financial asset (e.g. equities, foreign exchange, etc.); the market in which they trade – they may trade on an exchange traded platform (where, like stocks, they are standardized contracts) or an over the counter (OTC) market structure (non-standardized contract type) and the relationship between the derivative and the underlying asset – this is based on what the derivative contract specifies (e.g. options, futures, swaps). (Hull, 2006)

Therefore, commodity derivatives are contracts where the underlying asset is a commodity. Most of these contracts trade on organized exchanges. These include 1) Commodity options that are contracts that give the owner the right, but not the obligation, to trade a particular quantity of a given commodity at a pre-determined price on a future date. For this reason, options have a price associated with them. 2) Commodity futures that are an obligation to trade a particular quantity of a given commodity on or before a specific future date at a pre-determined price today and 3) Commodity swaps that are contracts used to hedge against the price of a commodity. Hedging is a strategy to reduce large substantial losses that may occur. In this case, one party fixes the maximum price it pays/receives for a commodity and the market price of the commodity determines the exchanged cash flows. (Hull, 2006)

Commodity forwards are similar to commodity futures in terms of the nature of the relationship between the derivative contract and the commodity. The difference is that commodity forwards trade on the OTC markets. They are therefore customizable contracts based on the wishes of the counterparties involved.

2.2.2 Brief history and Growth

Derivative instruments came to existence in the early 17th century with commodity derivatives being the very first type (Schaede, 1989). Simple commodity futures (rice futures) were the first ever such derivative contracts, traded on the Dojima Rice Exchange. The first modern organized derivative exchange to be established was the Chicago Board of Trade (CBOT) in 1848 where commodity futures were traded. In 1918, the first rival futures exchange, Chicago Mercantile Exchange (CME) was established and also dealt with futures on commodities. The first option exchange (Chicago Boards Option Exchange – CBOE) was established in 1973 after black & Scholes successfully developed the option pricing formula. A few years later, commodity swaps were introduced into the market as innovations in derivative research occurred. Today, there are numerous commodity exchanges all over the world trading in all types of commodity derivative instruments.

Figure 2 shows the cumulative growth of commodity futures and option contracts traded on commodity exchanges across the world. As figure 2 illustrates, the usage of exchange traded commodity derivatives has grown 8-fold for future contracts and approximately 4-fold for option contracts in the past two decades.

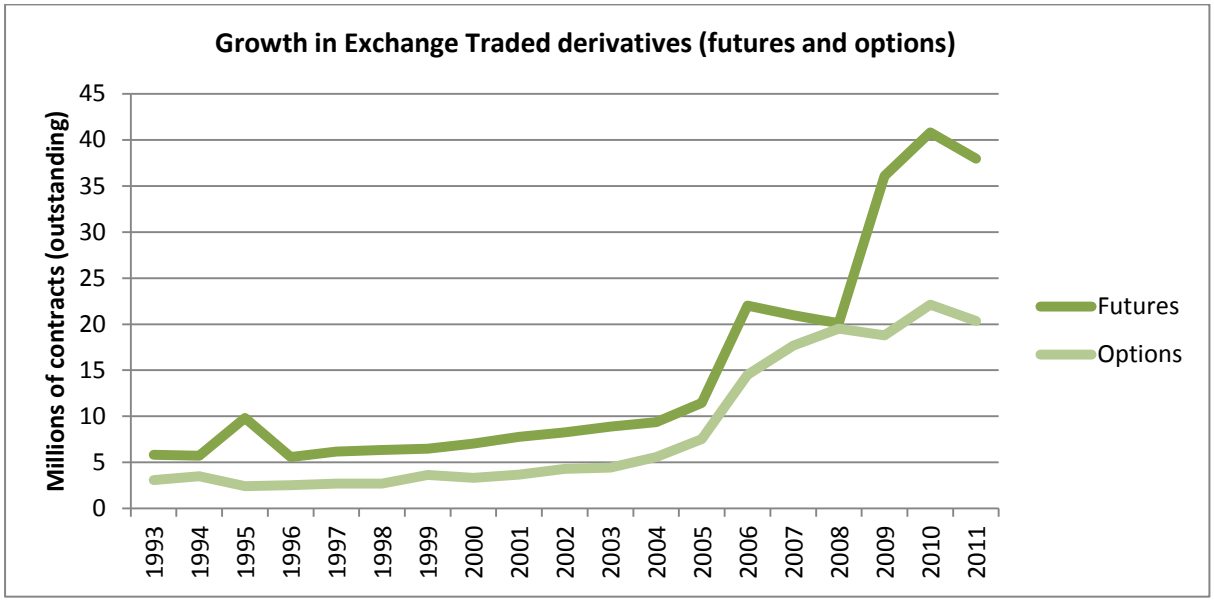

Figure 2 (Growth trend in exchange traded derivatives 1993-2011)

***Source**: Bank for International Settlements, Statistics on exchange traded derivatives, June 2012: Data (online)*
Available from: http://www.bis.org/statistics/extderiv.htm

Figure 3 shows the growth trends of the various commodity derivatives trading in OTC markets globally.

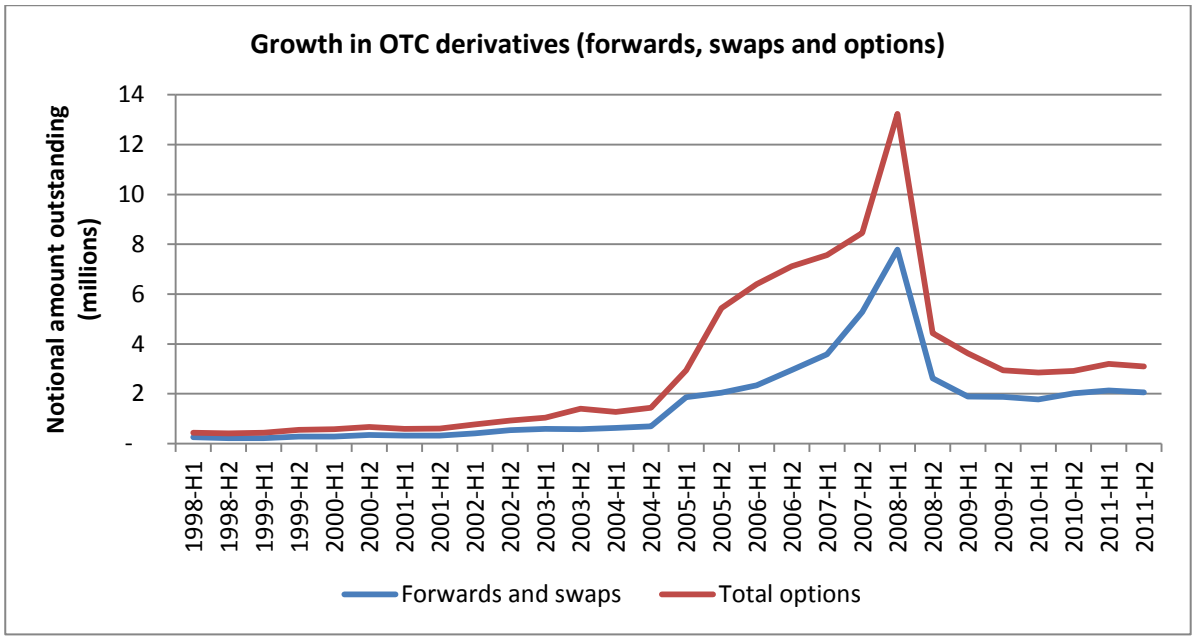

Figure 3 (Growth trend in OTC derivatives 1998-2011)

***Source**: Bank for International Settlements, Detailed tables on semiannual OTC derivatives statistics at end-December 2011, May 2012: Data (online)*
Available from: http://www.bis.org/statistics/derdetailed.htm

The figures for total options include netted values of option contracts bought and sold. The large drop in the OTC commodity market size in the year 2008 is attributable to the global financial crisis (IMF, 2012).

Table 1 shows that OTC commodity derivative markets are back on the path of recovery. Gold is a prime commodity traded on these markets and has a 31% growth over the period June 2010 – June 2011. On a whole, the options OTC market has greater growth over this comparison period.

Notional amounts outstanding	Mid-year		% change
(In millions of US dollars)	2010	2011	
Gold	396,564	521,243	31.44%
Precious metals	122,854	131,689	7.19%
Other commodities	2,402,572	2,438,070	1.48%
Forwards and swaps	2,011,022	2,051,851	2.03%
Total options	910,952	1,039,151	14.07%

Table 1 (OTC derivative markets growth rate: 2010-2011)

***Source**: Bank for International Settlements, Detailed tables on semiannual OTC derivatives statistics at end-December 2011, May 2012: Data (online)*
Available from: http://www.bis.org/statistics/derdetailed.htm

As noted by Basu and Gavin (2011), during the past decade, many institutional portfolio managers have added commodity derivatives as an asset class to their portfolios. This is to increasingly diversify their portfolios away from equity-only investment to include more varied asset types such as derivative securities. This includes commodity futures which are used to hedge against equity risk, as a result of negative correlation between returns on equity and return in commodity futures. Commodity derivatives' trading has increased alongside rapid expansion in trading in all major derivative markets. This is a result of the low interest rate environments and the search by both institutional and individual investors for higher yields. This leads to investment in more risker assets as the higher the risk, the higher the potential return. A study by Jiménez et al. (2008) using credit data from Spain showed that that bank borrowers were more likely to default if the loans were made when central bank interest rates were relatively low. As an example, commodity futures index funds that were developed in the 1980s and 1990s grew in popularity in the 2000s, as a result of the changing interest rate regime.

Derivative trading doesn't affect the fundamentals of supply and demand and is a zero-sum game, where for every winner, there is a loser and vice versa. Derivative regulation is in place to restrict and monitor large institutional investors from entering into large numbers of speculative trades that lead to two outcomes – one where they are in a heavily positive position and one where they are heavily negative. This heavily negative position is troublesome as governments needing to buffer these institutions from their losses leads to more burdens on individual taxpayers (Basu and Gavin, 2011).

The increasingly complex derivative instruments and their use in risk management can lead to good, bad, and ugly outcomes as noted by Dybvig and Marshall (1997). The good outcome is the opportunity for new ways to manage risk effectively. The bad outcome is the possibility of market participants not fully understanding these complex instruments in their use and possible ramifications. The ugly is market participants taking on large speculative trading in the OTC markets, away from the regulators and markets watch, leading to a buildup of opaque risks that eventually lead to a financial meltdown as witnessed in 2008.

2.3 Commodity trading

2.3.1 Spot trading - Definition and recent trends

By a complex chain process that involves production, assembly, sorting, packing, distribution and a retail stage, commodities find their way from the source to consumers via a series of middle men. This is spot trading and has taken place since the middle ages, when Central Asia was the economic center of the world (Beckwith, 2011). Spot trades are settled "on the spot", as opposed to at a set date in the future. They involve immediate physical delivery of the commodity.

Commodity spot markets have seen dramatic turbulence over the recent past. From early 2000 to mid-2008, there was a commodities boom, further followed by an unprecedented upward spike in the period 2007-2008 in world food prices. The boom was attributed to emerging economies having driven up demand for various commodities as a result of strong past economic growth, increased utilization of biofuels having boosted the demand for specific food crops, slow supply adjustment to increased demand amplifying price pressures and important linkages across commodities transmitting higher prices (For example, demand for biofuels has led to an increase in price of not only corn but also of other food products like meat (as corn is a factor of production in this case). (Baffes and Haniotis, 2010)

Low interest rates and effective dollar weakening were a supporting factor (this is because largely all commodity prices (spot & futures) are now determined by the futures market where speculators are also able to trade thereby linking this market to other financial markets). The unprecedented upward spike was further as a result of global stocks of many food commodities being down to levels of the early 1970s. This was caused by the combination of poor weather conditions and restrictive government policies (including export bans and taxation). The reversal of these factors coupled with the financial crisis of 2008 and the subsequent global economic downturn, brought about sharp price declines across most commodity sectors, but prices began to rise as demand recovered from late 2009 to mid-2010. (Baffes and Haniotis, 2010)

Baffes and Haniotis (2010) suggested that financial speculation caused by commodity index funds may have been partly responsible for the unprecedented upward spike, however a report by the Organization for Economic Co-operation and Development (OECD) shows that this is not the case and supports its findings by further pointing out that commodities without futures markets (example apples) also saw price rises during the same period (Buttonwood, 2010).

Disadvantages of Spot trading

Rukuižienė (2012) study concludes that rural farmers working largely independently cannot strive to build up production excesses as they don't have the capital to buy more land, improve land productivity and/or build storage facilities. This leaves them prone to dealing with the market at largely unfavorable terms as they are not able to control the price they sell their produce at.

These prices for all major commodities are determined on global commodity markets by the market forces of demand and supply. This leaves the commodity producers susceptible to significant price variations over time.

2.3.2 Derivative trading - Definition and recent trends

Commodities derivative trading involves commodity exchanges where futures, options and swap contracts on underlying commodities are traded. The traders involved in this market differ from the traditional spot markets where producers, middle men and consumers trade. On commodity exchanges, the market participants include hedgers, speculators and arbitrageurs. Hedgers are market participants trading to offset the risk of any large potential losses. Speculators are involved to profit from fluctuations of market price of derivative contracts and take up positions to absorb excessive risk and provide liquidity when other market participants do not want to be involved. Arbitrageurs aim to make riskless profits when fungible instruments trade at different prices on different markets, contradicting the law of one price (Hull, 2006).

Forwards are the most common instruments in the mining industry, whereas swaps are most common in the oil and utilities industries (Bartram et al. 2006).

As per Bartram et al. (2006) study on international derivative usage, from a sample of 7,292 non-financial firms (covering about 80% of the global market capitalization of non-financial companies), 59.8% used some kind of derivative. Most common is the use of foreign exchange rate derivatives (43.6%), followed closely by interest rate derivatives (32.5%) with commodity price derivatives a distant third (10.0%).

Figure 4 of global turnover on these contracts shows the popularity of these contracts.

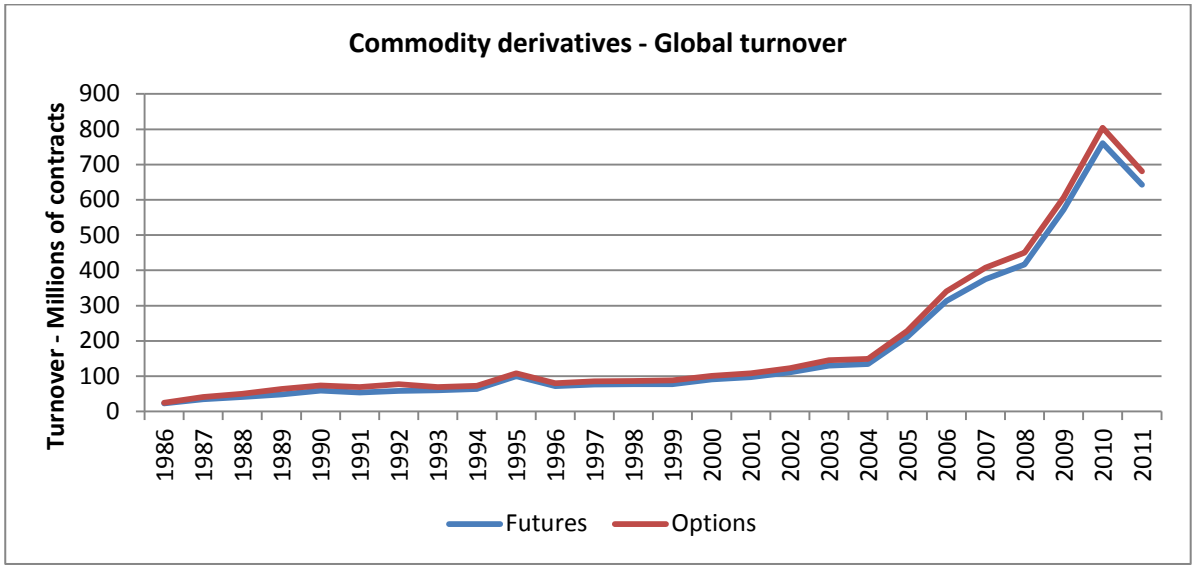

Figure 4 (Growth in exchange traded derivatives 1986-2011)

***Source**: Bank for International Settlements, Statistics on exchange traded derivatives, June 2012: Data (online) Available from: http://www.bis.org/statistics/extderiv.htm*

Commodity exchanges deal in derivatives on both hard and soft commodities. In this study we deal with soft (agricultural) commodity futures contracts. Soft commodities are further broken down into grains, foodstuff, and non-grains amongst other subdivisions. We examine foodstuff futures contracts in further detail. There are 14 countries that have commodity exchanges dealing with this class of futures contracts worldwide (Bloomberg data). The figure 5 shows the relative size of the market for a block of countries based on the aggregate value of contracts traded in the first seven and a half months (34 weeks) of the year 2012. 41% of all foodstuff commodity futures trading take place in India making it the largest player in this market. This is based on total aggregate value of contracts traded which is calculated by multiplying the futures daily price by the volume of contracts traded on a daily basis and summing it up over the period.

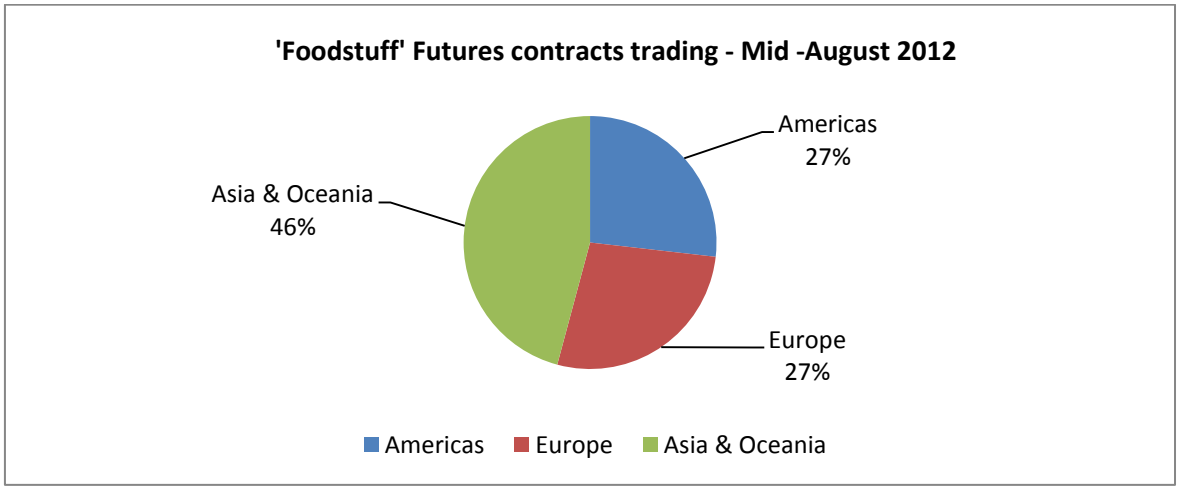

Figure 5 (Global trade proportion)

***Source**: Bloomberg: Data (online)*

Benefits of commodity derivative trading

The price and revenue volatility problems faced by commodity producers in the spot markets are overcome by trading in derivative contracts on commodity exchanges. Commodity futures markets functioning as a forum for the activities of both hedgers and speculators and bring about advantages like: (Schofield, 2008)

Risk Reduction/Redistribution

The primary role of commodity derivatives markets is to facilitate the transfer of risk amongst market participants. The various derivative instruments provide this in different packages. The organized, standardized, and centralized nature of exchanges means that risks are borne by others, such as speculators, in return for a premium. This process is known as hedging. Various papers have discussed optimal hedging strategies in commodity markets incorporating price uncertainty, production uncertainty, and price–quantity correlation considerations. Using world coffee price data from 1980 to 1989, Claessens and Coleman (1991) demonstrated that a hedging strategy using futures contracts could reduce the intra-year variability of coffee prices from 10.5 percent on average to 0.4 percent, indicating that the producers are almost entirely insulated from intra-year price fluctuations. Rolfo (1980) examined cocoa producers and demonstrated that for a risk-averse producer, the optimal hedge position is much less than the expected output when both price and production are uncertain. Telser (1981) showed that complete price insurance is only possible if spot and futures prices move exactly together. If not, then perfect insurance is not feasible (Thompson 1985).

Among market-based instruments, commodity futures and options could eliminate the short-term price exposure of agricultural products, whereas commodity swaps could be used for long-term price exposures related to mineral and energy commodity products (Masuoka, 1990).

Price Discovery

The introduction of commodity derivatives into any market is expected to increase information flows in that market, leading to a price-discovery function. Futures prices contain information about anticipated demand that can feed into production decisions. Beelders and Massey (2003) analyzed the interrelations between the gold index of the Johannesburg Stock Exchange, and its corresponding index futures contracts traded on the South African Futures Exchange after electronic trading was introduced. They found that the index and its futures prices were co-integrated. Using a vector error-correction model (VECM) they showed that, after the introduction of electronic trading, the spot and futures markets responded more quickly to their own shocks and shocks from other markets.

However, the futures markets may be used to provide price support. This is when exporters collectively trade futures in an attempt to support spot market prices. This involves purchasing futures contracts and holding the commodity in an amount sufficient to create upward pressure on futures- and spot-market prices. However, long-run prospects for successful price manipulation through futures trading are poor.

Cost

Trading in futures and options incurs a smaller transaction cost than does trading in the spot market. This makes them the economically sound tools to be introduced to a market.

Price Stabilization

It is hypothesized that futures markets reduce spot price volatility. However, Lien and Zhang (2008) summarize that theoretical and empirical research reveals that there are many different aspects of the relationship between spot and derivatives markets in different economies.

Challenges of establishing a commodity derivatives exchange

(Jagadharini and Putran, 2003) study of derivatives markets in India underlined that commodity derivative exchanges need to ensure fairness, transparency and efficiency in thier operations to attract market participation. The most common problems that constrain the development of local commodity derivatives markets are relatively underdeveloped underlying spot markets, weak or inadequate legal and market infrastructures, and restrictions on the use of derivatives.

The underlying spot markets need to be organized. This helps in the spot price discovery process. Only when the underlying spot markets are large, competitive and transparent can a successful commodity derivatives market be set up.

The exchange Structure should be set-up as a tax paying firm where management is in the hands of professionals. Initially, commodity exchanges were set-up as a mutual, but over time, the demutualized corporate structure is seen as more desirable. There should be a nation-wide trading facility with price dissemination on a real time basis. This implies an automated trading mechanism which provides equal access to all market participants across the country.

To effectively use commodity derivatives, the efficiency of the physical settlement process is a key element. Physical storage limits, commodity transit limits are important factors to bear in mind. A central warehousing system needs to be developed to overcome these challenges.

3. Current status quo in Kenya

3.1 Background

Gunnar Myrdal, Nobel Laureate in Economics quoted '*it is in the agricultural sector that the battle for long-term economic development will be won or lost*'.

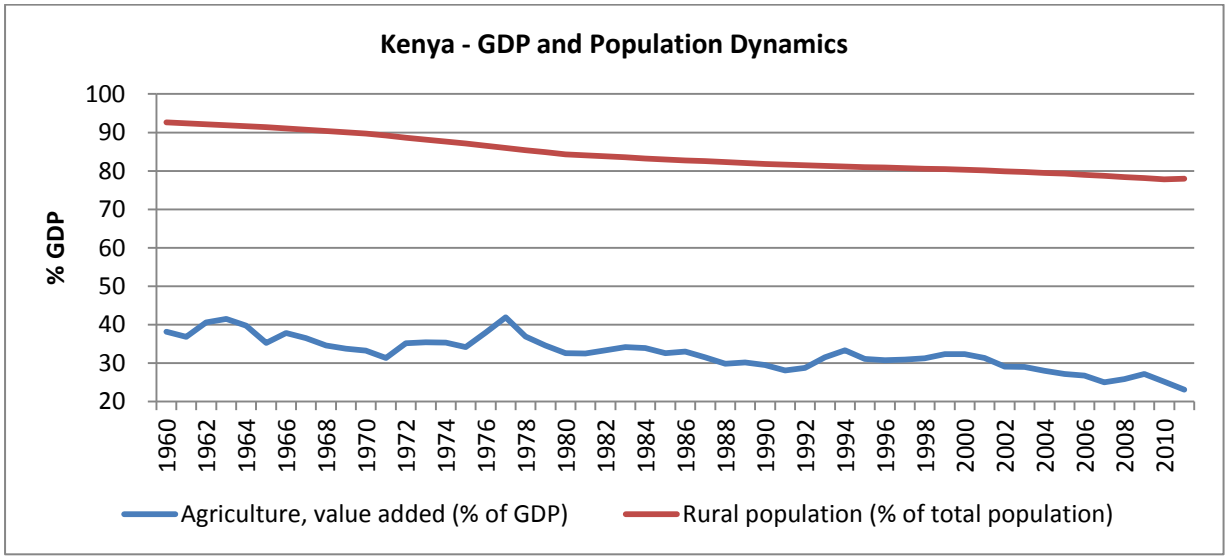

Figure 6 (Agricultural sector trends - 1960-2010)

***Source**: World databank, World Development Indicators (WDI) & Global Development Finance (GDF): Data (online) Available from:*
http://databank.worldbank.org/ddp/editReport?REQUEST_SOURCE=search&CNO=2&country=KEN&series=&period=

As of 2011, 78% of Kenyans lived in rural areas and were primarily involved in farming and related agricultural activities. It generated 23% of the Kenya's GDP in 2011 (World Bank, 2012). This signifies the importance of the agricultural subsector to the Kenyan economy and its future development. It also impacts significantly on social and welfare aspects of the large rural farming communities. The Kenya's Poverty Reduction Strategy Paper (PRSP) identifies the agricultural subsector as an essential subsector that will help in achieving the goals of poverty reduction and increased food security in Kenya.

The agricultural society of Kenya, a non-governmental organization actively runs agricultural trade shows. Its primary objective is to encourage and assist the agricultural sector in the promotion of research. Several other stakeholders are involved in improving this sector. Trading takes place in spot markets via middle men.

3.2 Commodity trading

Generally, in a spot market, a single market clearing price would be established for all the buyers and sellers in the market based on all bids to sell or buy. That is, for a given spot market and sale period, all sellers that bid to sell at or below the single market clearing price would be entitled to

receive the market clearing price for their produce grown and sold for use during that period of auction (Schofield, 2008).

But, in Kenya, there are supply side constraints including lack of access to markets (including inputs markets), lack of storage for crops leading to post-harvest losses and inadequate infrastructure to supply to the spot market that leads to inefficient producer spot price discovery.

Price volatility on export producers in Kenya is much greater than it is for those in developed economies, as they rely heavily on a few commodities for their export earnings, leaving them very vulnerable to commodity price shocks. A study by Ondieki-Mwaura et al. (2010) found that the price received by French bean farmers from the Kirinyaga region has remained constant for a long time yet the prices had doubled effectively reducing the income they earned. The study concluded that this reduction in real income for farmers over time has limited their ability to improve their welfare as would be expected.

Kenya has an organized local stock exchange, the Nairobi stock exchange (NSE) that was constituted as a voluntary association of stockbrokers in 1954. It is a well-functioning exchange. In November 2011 the FTSE NSE Kenya 15 and FTSE NSE Kenya 25 Indices were launched reflecting growing investor interest in Kenyan economy. The capital markets regulatory body has initiated the process of policy formulation and market development of a commodity derivatives exchange by recruiting relevant consultants and coordinators. This is a positive first step towards its development.

3.3 Production and price volatility

As per 2010 figures (FAO, 2012) Kenya was the largest producer of dried pyrethrum in the world. It was also the third largest producer of sisal and tea worldwide.

Figure 7 shows price fluctuations over the period 2003-2009 for the five top produced commodities in Kenya in year 2009. As seen, for some commodities, the prices trend was upwards as compared to previous years, for others it was downwards. This is indicative of price volatility in the local spot markets.

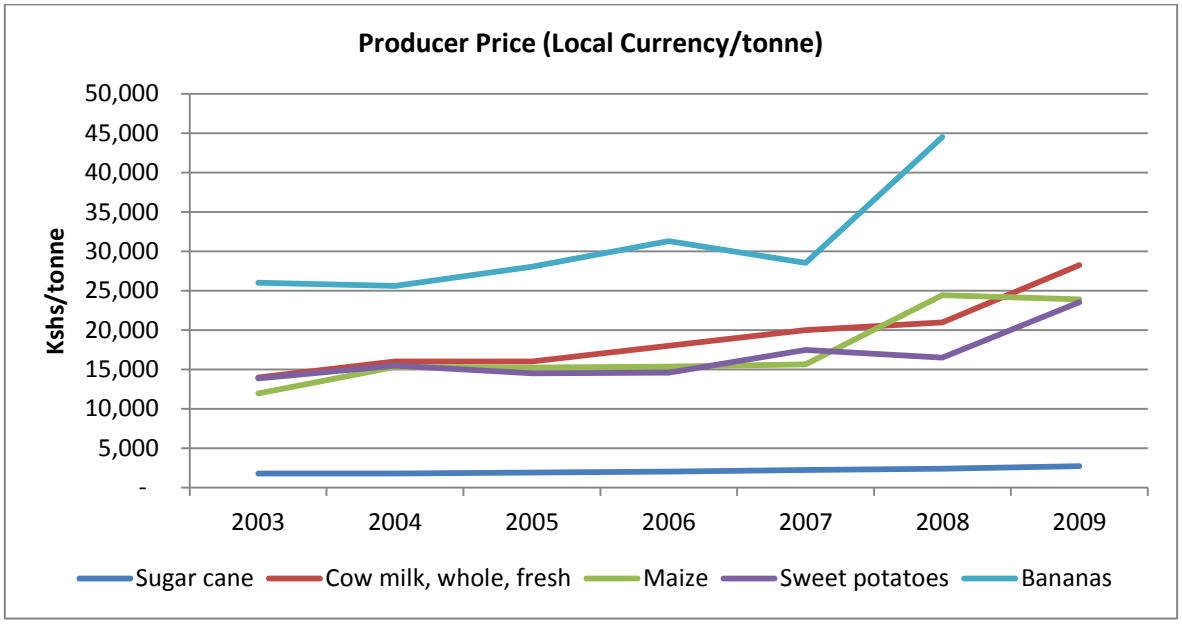

Figure 7 (Price volatility trend – local market – 2003-2009)

***Source**: Food and agriculture organization of the United Nations: Data (online)*
Available from: http://faostat.fao.org/site/567/default.aspx#ancor

Figure 8 shows price fluctuations over the period 2003-2009 for the top two exported commodities from Kenya in year 2009. As seen, there is considerable price volatility on the international markets.

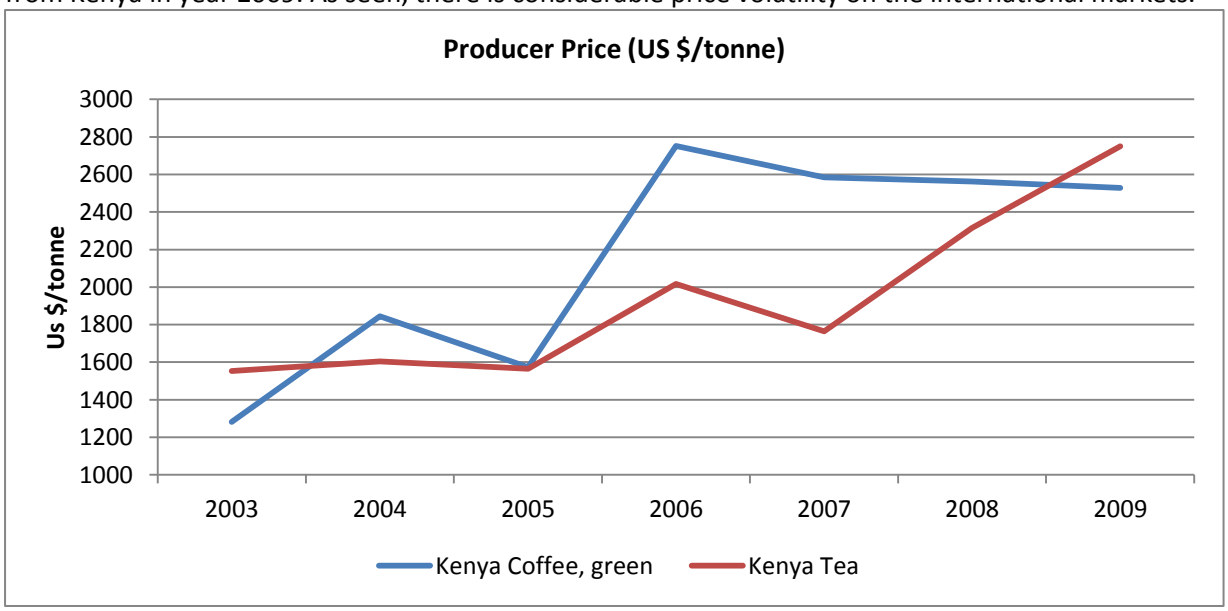

Figure 8 (Price volatility trend – International market – 2003-2009)

***Source**: Bank for International Settlements, BIS Quarterly Review: 'June 2012 Data (online)*
Available from: http://www.bis.org/statistics/extderiv.htm

4. Econometric analysis:

4.1 Literature review

Financial markets function to improve risk sharing. This enables the transfer of risk between different counterparties, the borrowers and the lenders. Borrowers are able to improve their access to capital by tailoring their risk portfolios. Lenders are able to make more funds available for borrowing by better risk diversification. This leads to efficient capital allocation that leads to economic growth.

All derivatives, as part of financial markets, are mechanisms for risk transfer and efficient capital allocation. As an example, futures markets are dispensers of equilibrium prices (reflecting demand and supply conditions) and this enables prudent decision making by all parties involved. Producers can hedge price risk by going 'short' at given prices - this fixes the price at the future date at which they will sell their produce. Consumers can go 'long' at certain prices, fixing the price in the future at which they will buy the commodity. Thus the parties take positions that best reflect optimum conditions for their individual investments. This leads to investments becoming more productive which translates to economic growth.

The link between financial development and economic growth has been studied in much depth, both theoretically and empirically. Goldsmith (1969) study was the first to show a positive link between financial development and economic growth.

Theoretical studies of this nature are numerous and include Acemoglu and Zilibotti (1997) that shows that investors can have a positive return on growth by investing in high return projects and this is possible through portfolio risk diversification. Krebs (2002) shows an increase in growth can be achieved by lowering diversifiable risk of businesses as this leads to a lowering of the ratio of physical to human capital requirement. Angeletos and Calvet (2006) illustrate that savings and medium run growth improve as new market instruments for risk transfer and hedging are borne, that enable better entrepreneurial risk management.

Empirically, King and Levine (1993) built on the initial Goldsmith's study by using more than twice the sample for a period of 30 years (1960-1989) for 77 countries. They also added other control factors that affect long-run growth. These factors include income per capita, interest rates, inflation, education and political stability amongst others. As a proxy to financial development, King and Levine focused on financial deepening (size of financial intermediaries). These empirical specifications have been used widely in most subsequent studies of the same nature.

Beck et al. (2000) and Şendeniz-Yüncü et al. (2007) further examined the relationship between banking sector development (financial intermediary development) and economic growth. Rousseau and Wachtel (1998) further studied the relationship between stock market development and economic growth. This was to improve on the previous models as now the introduction of these new measures meant that information on the independent impact of stock markets on growth was known.

Other studies summarize the major discoveries of cross-section analyses. A cross-section analysis is a class of research methods that involve observation of the representative sample at one specific point in time. A large proportion of the studies conclude that there is a positive relationship between financial development and growth.

A longitudinal study is a correlational study that involves repeated observations of the same variables over long periods of time. These studies differ from cross-section studies both in making a series of observations repeatedly on the sample and observing this sample over a period of time, and not just at a point in time.

To overcome problems associated with cross-section regressions, Levine et al. (2000) used the generalized-method-of moments (GMM) to investigate the impact of financial development (both stock markets and banks) on economic growth. The GMM method was developed for dynamic panel data as shown by Arellano and Bond (1991). The GMM panel enables us exploit the time-series and cross-sectional variation in the data.

The outcome of the above studies is that well-functioning financial intermediaries like banks and stock markets better information transmission, risk management and capital allocation thus leading to overall economic growth.

This relationship between the banking sector, stock market and economic growth has been extensively researched as the literature above shows, however, very few studies in comparison exist that investigate the relationship between development of derivative markets and economic growth.

Merton (1992) theoretical study argued that economic growth and efficiency were being driven by the phenomenal growth in the derivatives market. Tsetsekos (2000) was the first empirical study to relate derivative market development with economic growth. Related studies were by Nam et al. (1998) who studied the readiness of the Korean stock exchange to deal with derivative products. Fernandez (2003) study showed that legal barriers were the factor behind heterogeneous derivative market development in Latin America. Şendeniz-Yüncü et al. (2007) explored the link between futures market development and economic growth using dynamic panel GMM estimation.

In this study, we use dynamic panel GMM estimation approach to examine the relationship between commodity futures market development and economic growth in several developed and emerging economies.

This is an important relationship to diagnose as establishing the relationship between the commodity futures market development and economic growth will enable governments take precise actions to develop these commodity futures markets if the study shows a positive link between the two variables, to promote growth. This is especially true for emerging economies that are producer nations for who risk sharing is unavailable and are less efficient at capital allocation than developed economies.

4.2 Data and Variables

This section describes the data and defines the variables. We are going to use annual observations for 13 countries in the period 2007-2011 to examine the relationship between commodity futures market development and economic growth. To measure commodity futures market development, we use the total value of commodity (foodstuff) futures contracts to nominal Gross Domestic Product (GDP) – Agricultural sector ratio to proxy for the commodity futures market development for each country in our data set.

Variables: Conditioning information sets

The conditioning information set controls for other variables that affect economic growth. The use of conditioning information sets is to capture the influence of other factors other than commodity futures market development on economic growth. Beck and Levine (2004) used the variable for banking sector development as the volume of credit provided by deposit money banks to the private sector divided by GDP. This is the traditional indicator of financial development in cross-country studies as noted earlier. We also use Inflation (measured by the consumer price index (CPI)) and Foreign Direct Investment (FDI) as a percentage of GDP as other control variables affecting economic growth in the study. This ratio of Foreign Direct Investment (FDI) to GDP measures the degree of openness of the local economy and the Consumer Price Index (CPI) acts as a control measure for inflation in the economies.

We collect a set of panel data from 13 countries over the period 2007–2011. This panel data is multi-dimensional data which contains observations on the several different variables observed over the 5 year periods for the same countries. The different variables include nominal gross domestic product (GDP) - Agricultural sector that represents sector economic growth. We use the natural logarithm of this variable, representing the dependent variable. A proxy is used for commodity futures market development, which is the independent variable in the study and several control variables including banking sector development ratio (volume of credit provided by deposit money banks to the private sector divided by GDP), Foreign Direct Investment (FDI) to GDP ratio and the Consumer Price Index (CPI).

We are using commodity futures market data derived from Bloomberg database. There are a total of 14 countries in both developed and emerging economies worldwide operating commodity derivative exchanges dealing in foodstuff commodity futures contracts. In the study, we select 13 countries. 1 country, New Zealand is left out of the study as agricultural sector GDP data was unavailable for it. Bloomberg provides futures data collectively for all instruments listed. This includes stocks, bonds, commodities, indices, etc. We narrow our data mining criteria to include only commodity futures. We further refine this to select only those exchanges on which soft commodity futures are traded. Soft commodities include subcategories: grains, foodstuff, and other grains amongst others. We choose the 13 exchanges on which 'foodstuff' commodity futures are traded. 'Foodstuff' subcategory includes futures on tea, coffee, milk, etc. and so forms a direct link to the research being undertaken. Table 2 shows the exchanges used and their classification as either developed or emerging and the total value of commodity futures contracts (Aggregate for all commodity futures

traded) to nominal Gross Domestic Product (GDP) - Agricultural sector ratio that proxy's for the commodity futures market development for each country.

	Classified	2007	2008	2009	2010	2011
FRANCE	*Developed economy*	-	-	-	0.0000002	0.0000003
GERMANY	*Developed economy*	-	-	0.0000006	0.0000090	0.0000503
JAPAN	*Developed economy*	0.0226589	0.0118628	0.0061699	0.0134357	0.0065316
NORWAY	*Developed economy*	-	-	-	-	0.0000161
SINGAPORE	*Developed economy*	-	-	-	-	-
SPAIN	*Developed economy*	-	-	-	0.0023280	0.0012718
U.K.	*Developed economy*	0.2600473	0.2906445	0.2203081	0.3381295	0.3719959
USA	*Developed economy*	0.0206495	0.6543957	0.0275325	0.0266617	0.0302262
BRAZIL	*Emerging economy*	0.0000023	0.0002865	0.0002714	0.0004166	0.0003859
CHINA	*Emerging economy*	0.0006887	0.0003906	0.0010238	0.0013860	0.0008763
INDIA	*Emerging economy*	-	0.0004134	0.0000081	0.0010057	0.0305963
INDONESIA	*Emerging economy*	-	-	-	0.0000964	0.0001191
RUSSIA	*Emerging economy*	-	0.0000004	0.0000002	0.0000274	0.0000944

Table 2 (Ratio: Commodity futures / GDP- 2007-2011)

***Source**: World databank and Bloomberg: Data (online)*
Available from: http://data.worldbank.org/ & Bloomberg terminals

As can be seen from the table 2, we had 8 developed economies in the study sample and 5 emerging economies. This classification is based on the methodology used in the creation of S&P Dow Jones Indices. Although this methodology is used for classifying equity markets, we use it as a proxy to classify our commodity futures markets.

Şendeniz-Yüncü et al. (2007) examined the link between futures market development and economic growth using dynamic panel GMM estimation used stock index futures data. Stock index futures are futures contracts on the stock index as a whole. The stock index is representative of the entire stock market, and thus a proxy based on futures contracts on the stock index are a good measure of the independent variable in this case. However, in this study, most commodity exchanges on which foodstuff commodity derivatives are traded do not have representative indices. They also do not have exchange traded funds (ETF's) or index funds - these are funds that track the movement of the index. Thus, no representative futures contracts exist.

Therefore, for each commodity exchange, the total value of a commodity futures contract is obtained by multiplying, for each commodity futures contract type traded, the volume of the contract traded by its contract prices (on a daily basis). This value is summed up to get a yearly total. An aggregate final value (for a year) is then calculated by summing up that year's total for all the commodities traded on that exchange. In this way, we have a representative variable indicating the total value of commodity futures traded for each market, for each period.

The proxy for commodity futures market development for each economy is the ratio:

$$\frac{\text{Total value of commodity futures contracts traded}}{\text{Nominal Gross Domestic Product (GDP) – Agricultural sector}}$$

In the original data collection spanning calendar year 2000 to 2011, only 3 countries, Japan, United Kingdom and United states had actively traded volumes on foodstuff commodity futures on their exchanges. For several emerging market commodity exchanges, there was a data limit. This was either as they began operations later on in the sample period or were in operation but had no volume of foodstuff commodity futures being actively traded. Thus an appropriate representative sample 2007-2011 was chosen.

For the conditioning set variables, Banking sector development (volume of credit provided by deposit money banks to the private sector - % of GDP), Foreign Direct Investment (FDI) - % of GDP and the Consumer Price Index (Inflation - annual %) data was obtained from the World Bank database.

The dependent variable, the natural logarithm of GDP - Agricultural sector, yearly data was also obtained from the World Bank database. This is provided as a % of nominal yearly GDP. Multiplying this by the yearly nominal GDP figures published and taking its natural logarithm provided us with our dependent variable that represents economic growth in the agricultural sector.

	GDP	FUTURES	FDI	INFLATION	CREDIT
Mean	24.36748	0.036046	0.028384	3.915134	1.307724
Median	24.77204	5.03E-05	0.021808	3.196243	1.243480
Maximum	27.23830	0.654396	0.219866	14.10775	3.378450
Minimum	18.07493	0.000000	(0.0003)	(1.3467)	0.000000
Std. Dev.	2.134215	0.111929	0.035301	3.347247	0.901769
Skewness	(1.7806)	3.745841	3.813006	0.919684	0.514714
Kurtosis	6.109759	17.71573	19.55299	3.582133	2.411515

Table 3 (Descriptive statistics)

Source*: E-views: (online)*
Available from: Licensed CASS terminals

Table 3 presents descriptive statistics for the dependent variable and the independent and control factors in the study. Banking sector development (volume of credit provided by deposit money banks to the private sector - % of GDP) is denoted as CREDIT. Foreign Direct Investment (FDI) - % of GDP is denoted as FDI and the Consumer Price Index (Inflation - annual %) is denoted as INFLATION. The dependent variable GDP is the natural logarithm of nominal GDP- Agricultural sector. The independent variable FUTURES is the proxy i.e. it is total value of commodity (foodstuff) futures contracts to nominal Gross Domestic Product (GDP) – Agricultural sector ratio.

In terms of FUTURES, USA had the highest value in 2008. China had the GDP in 2011, while Singapore had the lowest in 2008.

Table 4 presents group statistics (correlations) of all the variables.

	GDP	FUTURES	FDI	INFLATION	CREDIT
GDP	1.000000	0.008056	(0.56905)	0.207534	0.179442
FUTURES	0.008056	1.000000	0.009511	(0.05196)	0.313812
FDI	(0.56905)	0.009511	1.000000	0.027431	(0.19278)
INFLATION	0.207534	(0.05196)	0.027431	1.000000	(0.54648)
CREDIT	0.179442	0.313812	(0.19278)	(0.54648)	1.000000

Table 4 (Correlation statistics)

***Source**: E-views: (online)*
Available from: Licensed CASS terminals

4.3 Dynamic panel (Generalized-method-of-moments) model

Research hypothesis:

That there is a positive relationship between commodity futures market development and economic growth (for the agricultural subsector).

Methodology:

We employ the generalized-method-of moments (GMM) estimators developed for dynamic panel models by Arellano and Bond (1991) to investigate the relationship between commodity futures market development and economic growth.

In the estimation of the relationship, the dynamic panel GMM estimators have many advantages over the simple cross-sectional estimators. The GMM estimation allows us to study the time-series nature of the relationship between the variables with pooled cross-section and time-series data. Further we are able to control for country specific and year specific effects, removing any biases created by country specific unobserved effects. Additionally, the independent variable and all additional variables in the conditioning set may undergo an endogeneity problem, which is controlled by the GMM technique. This is done via lagged observations of the independent variables as instruments in the regressors. Thus, we view the dynamic panel GMM estimation technique as an efficient technique to examine the relationship between commodity futures market development and economic growth.

To investigate the relationship between commodity futures market development and economic growth, we use the following model:

$$y_{i,t} = \alpha . y_{i,t-1} + \beta . x_{i,t} + u_i + \varepsilon_{i,t} \qquad (1)$$

Y represents the GDP. The vector X represents the set of independent variables including the commodity futures market development proxy measure and all control variables contained in the conditioning information set but excludes the lagged dependent variable. U is an unobserved

country-specific effect, ε is the time-varying error term, $_i$ and $_t$ are subscripts respectively for country and year.

The regression equation: of the growth model is as follows:

$$y_{i,t} - y_{i,t-1} = \alpha . y_{i,t-1} + \beta' . x_{i,t} + u_i + \varepsilon_{i,t} \quad (2)$$

The existence of country specific effects U_i makes the within-group estimators inconsistent even if the time varying error term $\varepsilon_{i,t}$ is not serially correlated, because U_i is correlated with the lagged dependent variable $y_{i,t-1}$. If we difference the above equation, we eliminate the country-specific effect (Arellano and Bond, 1991):

$$(y_{i,t} - y_{i,t-1}) - (y_{i,t-1} - y_{i,t-2}) = \alpha . (y_{i,t-1} - y_{i,t-2}) + \beta' . (x_{i,t} - x_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (3)$$

The difference equation however introduces two new econometric issues:

- There is correlation between the new error term $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ and the lagged dependent variable $y_{i,t-1} - y_{i,t-2}$;
- The endogeneity of the regressors.

Instrumental variables are needed to deal with these two issues. The first-differenced GMM estimators use lagged explanatory variables as the instrumental variables under two assumptions:

- The time-varying error term $\varepsilon_{i,t}$ is not serially correlated;
- The independent variables contained in $X_{i,t}$ are weakly exogenous. (i.e., the independent variables are uncorrelated with future error terms $\varepsilon_{i,t+n}$).

Arellano and Bond (1991) propose the following moment conditions to be used by the first-differenced GMM estimators:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \; for \; s \geq 2; \; t = 3, \dots, T \quad (4)$$

$$E[x_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \; for \; s \geq 2; \; t = 3, \dots, T \quad (5)$$

Specifically, to our analysis, these moment conditions imply that the twice and further lagged values of the dependent variable - nominal GDP (agriculture), the independent variable and all control variables contained in a conditioning information set can be used as instrumental variables to obtain the first-differenced GMM estimators.

However, statistically Alonso-Borrego and Arellano (1996) pointed out, delayed levels are weak instruments for difference equation regression when the explanatory variables are persistent over time. To deal with the potential bias and imprecision of the first-differenced GMM estimators, Blundell and Bond (1998) suggested using a GMM system estimator which combines difference regression with level regression. In the first stage, the terms of error are assumed to be independent and homoscedastic across countries and over time. In the second stage, residuals obtained in the first stage are used to build a consistent estimate of variance-covariance matrix, so relaxing suppositions of independence and homoscedasticity. The two step estimator is asymptotically more efficient than that obtained in the first step. Rousseau and Wachtel (1998), Şendeniz-Yüncü et al. (2007) use this estimator in their panel data analysis studying various financial developments and their effects on growth.

An additional condition is that the first differences of the independent variables are uncorrelated with country-specific effects U_i. The additional moment conditions for the level regression are:

$$E[(y_{i,t-s} - y_{i,t-s-1})(u_i + \varepsilon_{i,t})] = 0 \; for \; s = 1 \quad (6)$$

$$E[(x_{i,t-s} - x_{i,t-s-1})(u_i + \varepsilon_{i,t})] = 0 \; for \; s = 1 \quad (7)$$

Specifically, to our analysis, these moment conditions imply that the first lagged differences of the dependent variable - nominal GDP (agriculture), the independent variable and all control variables contained in a conditioning information set can be used as additional instruments. Hauk and Wacziarg (2009) study shows that to generate efficient parameter estimates when estimating growth regression, GMM estimators are ideal.

The GMM estimator's consistency depends mainly on the assumptions that the instruments are valid. A specification tests suggested by Blundell and Bond (1998) can be used to examine if the assumptions hold. This is the Sargan test.

.

- Sargan test: This checks the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. Under the null hypothesis that the instruments are valid, the test statistic is asymptotically distributed as chi-square with the degree of freedom being equal to the number of instruments minus the number of parameters estimated. If the null hypothesis is rejected, this means that the instruments are not valid.

Failure to reject the null hypotheses of this test implies that the assumptions of the estimation hold and gives support to our model.

4.4 Results of the analysis

The results of the GMM dynamic panel estimation are presented in this sub-section. Statistical software E-views was used to undertake this GMM estimation.

We computed the Arellano-Bond 2-step estimator as discussed in section 4.3. As can be seen in Figure 9, the positive co-efficient indicates that there exists a statistically significant positive relationship between commodity futures market development and economic growth (agriculture sector).

Dependent Variable: GDP
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 08/30/12 Time: 19:45
Sample (adjusted): 2009 2011
Periods included: 3
Cross-sections included: 13
Total panel (balanced) observations: 39
White period instrument weighting matrix
White period standard errors & covariance (no d.f. correction)
Instrument specification: @DYN(GDP,-1) FUTURES CREDIT FDI INFLATION @LEV(@SYSPER)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	0.160814	0.186909	0.860386	0.3962
FUTURES	0.134552	0.109882	1.224513	0.2300
CREDIT	0.642298	0.627796	1.023099	0.3142
FDI	0.146552	0.666159	0.219996	0.8273
INFLATION	0.005275	0.018522	0.284787	0.7777
@LEV(@ISPERIOD("2009"))	-0.119201	0.056634	-2.104751	0.0435
@LEV(@ISPERIOD("2010"))	0.137542	0.034223	4.019028	0.0003
@LEV(@ISPERIOD("2011"))	0.056572	0.020856	2.712529	0.0108

Effects Specification

Cross-section fixed (first differences)
Period fixed (dummy variables)

Mean dependent var	0.052919	S.D. dependent var	0.148270
S.E. of regression	0.128119	Sum squared resid	0.508845
J-statistic	8.499741	Instrument rank	13

Figure 9 (GMM 2-step estimator results – E-views)

***Source**: E-views: (online)*
Available from: Licensed CASS terminals

The top portion of the output describes the coefficient estimates, estimation settings and summary statistics. The standard errors that we report here are the standard Arellano-Bond 2-step estimator standard errors.

The statistically significant positive relationship between commodity futures market development and economic growth (agriculture sector) is supported by the facts that well-functioning commodity futures markets allow for greater and more efficient risk sharing and this enables effective risk management amongst the agricultural sector, which leads to riskier project appraisals and, hence, promotes growth. Furthermore, as a result of the commodity futures market operations there is an enhancement of information available that enables informed decision making. This accompanied by the lower transaction costs leads to efficient resource allocation, thus leading to economic growth within this sector.

Figure 9 also depicts the results of the variables in the conditioning set:

- Foreign Direct Investment (FDI/GDP): the expected sign is positive, which is confirmed by the estimations. It has a statistically significant positive effect on economic growth.
- CPI (inflation): the expected sign is negative, however, the coefficient of the variable signifies otherwise. But, as seen in Figure 9, it has a statistically insignificant effect on economic growth (very small magnitude of the co-efficient estimate).
- Banking sector development variable: the expected sign is positive, and the coefficient of this variable is positive and statistically significant.

The bottom portion of the output displays additional information about the estimation method and further summary statistics. From here, we conclude that, under the null hypothesis of the Sargan test, the instruments are valid. The test statistic is asymptotically distributed as chi-square with the degree of freedom being equal to the number of instruments minus the number of parameters estimated as seen in figure 9. This gives a positive p-value (degrees of freedom 13-8=5).

In conclusion, the empirical results prove that there exists a strongly positive and significant relationship between commodity futures market development and economic growth in the agricultural sector.

.

5. Conclusion

Commodity futures are derivative contracts that enable the purchaser, usually farmers (producers) to fix the price that they will receive at a given future date for a given quantity of their produce. This helps reduce price uncertainty and revenue volatility which eventually leads to more productive farming. Commodity derivative exchanges are platforms where commodity futures contracts trade.

Kenya, a largely agriculture dominated country, is affected by the extreme volatility of commodity spot price trading. It relies heavily on its agricultural sector for overall growth as historically, on average, this sector has provided approximately 25% of the national GDP each year. A way forward, would be to ask the question: ''Commodity futures trading in Kenya - Are we ready for the future?''.

Under our null hypothesis, we propose that there is a positive link between commodity futures market development and economic growth in the agricultural sector. A statistical study is undertaken in the attempt to establish a link between commodity futures market development and economic growth. The dynamic panel model – GMM is used. It is viewed as an appropriate technique as it allows us to study the time-series nature of the relationship between the variables with pooled cross-section and time-series data. Further we are able to control for country specific and year specific effects, removing any biases created by country specific unobserved effects. Also, the independent variable and all additional variables in the conditioning set may undergo an endogeneity problem, which is controlled by the GMM technique.

The study incorporates 8 developed and 5 emerging economies. The empirical results prove that there exists a strong positive relationship between commodity futures market development and economic growth in the agricultural sector. This is an important first step.

For a country dominated by small scale farming, this study's empirical results show that, commodity futures markets, having the various known benefits of price discovery and risk management, would lead to agricultural sector growth and government policy encouraging the development of a commodity futures market should be formulated.

However, further analysis is needed on this relationship. The choice of the proxy representing commodity future market development and all the other financial development measures of the conditioning set and the econometric technique of GMM panel estimation used are subjective. Further advancements in different fields of research will shed more light on the underlying relationship between commodity futures markets and economic growth.

6. References

Abbott, P.C., Hurt, C. and Tyner, W.E. (2011). What's Driving Food Prices in 2011?. Food Foundation Issue Report. URL: http://www.farmfoundation.org/news/articlefiles/105-FoodPrices_web.pdf

Acemoglu, D. and Zilibotti, F. (1997). Was prometheus unbound by chance? Risk, diversification, and growth. Journal of Political Economy, 105, 709-751.

Agricultural Society of Kenya. (2012). Vision and Mission: Objectives. URL: http://www.ask.co.ke/

Alonso-Borrego, C. and Arellano, M. (1999). Symmetrically normalized instrumental variable estimation using panel data. Journal of Business and economic Statistics, 17, 36–49.

Angeletos, G. and Calvet, L.E. (2006). Idiosyncratic production risk, growth and the business cycle. Journal of Monetary Economics, 53, 1095-1115.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies, 58, 277–297.

Baffes, J. and Haniotis, T. (2010). Placing the 2006/08 Commodity Price Boom into Perspective. The World Bank, Development Prospects Group. Policy Research Working Paper 5371. URL: http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2010/07/21/000158349_20100721110120/Rendered/PDF/WPS5371.pdf

Bank for International Settlements. (2012). About BIS statistics. URL: http://www.bis.org/statistics/index.htm
Chicago Board Options Exchange. (2012). CBOE history. URL: http://www.cboe.com/AboutCBOE/History.aspx

Bartram, S.M., Brown, G. W. and Fehle, F. R. (2006). International Evidence on Financial Derivatives Usage. Financial Management, 38, 185-206.

Basu, P. and Gavin, W.T. (2011). What Explains the Growth in Commodity Derivatives?. Federal Reserve Bank of St. Louis Review, 93, 37-48. URL: http://research.stlouisfed.org/publications/review/11/01/37-48Basu.pdf

Beck, T., Levine, R. and Loayza, N. (2000). Finance and the sources of growth. Journal of Financial Economics, 58, 261-300.

Beck, T. and Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. Journal of Banking and Finance, 28, 423-442.

Beckwith, C.I. (2011). Empires of the Silk Road: A History of Central Eurasia from the Bronze Age to the Present. Princeton University Press, New Jersey.

Beelders, O. and Massey, J. (2003). The Relationship Between Spot and Futures Index Contracts After the Introduction of Electronic Trading on the Johannesburg Stock Exchange. Department of

Economics, Working Paper, Emory University, Atlanta. URL: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=304324

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87, 115–143.

Buttonwood. (2010). Clearing the usual suspects. The economist. 2010-06-24. URL: http://www.economist.com/node/16432870?subjectid=2512631&story_id=16432870

Capital Markets Authority. (2012). Plans to set up Futures Exchange. URL: http://www.cma.or.ke/

Cashin, P. and Mcdermott, C.J. (2002). The Long-Run Behaviour of Commodity Prices: Small Trends and Big Variability. Staff Papers, 49, IMF. URL: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.187.1513&rep=rep1&type=pdf

Claessens, S. and Coleman, J. (1991). Hedging Commodity Price Risks in Papua New Guinea. Policy Research Working Paper, 749, World Bank. URL: http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/1991/08/01/000009265_3961001212413/Rendered/PDF/multi0page.pdf

Dodd, R. (2012). Markets: Exchange or Over-the-Counter. The International Monetary Fund. Finance & Development. 2012-03-28. URL: http://www.imf.org/external/pubs/ft/fandd/basics/markets.htm

Dybvig, P.H. and Marshall, W.J. (1997). The New Risk Management: The Good, the Bad, and the Ugly. Federal Reserve Bank of St. Louis Review, 79, 9-22. URL: http://research.stlouisfed.org/publications/review/97/11/9711pd.pdf

Fernandez, V. (2003). What determines market development?:Lessons from Latin American derivatives markets with an emphasis on Chile. Journal of finance intermediation, 12, 390-421.

Financial Web. (2012). Differences in Behaviour between Hard and Soft Commodities. URL: http://www.finweb.com/investing/differences-in-behavior-between-hard-and-soft-commodities.html

Goldsmith, R.W. (1969). Financial Structure and Development. Yale University Press, New haven.

Hull, J.C. (2006). Options, Futures and Other Derivatives, 6th Edition. Prentice Hall, New Jersey.

Jagadharini, T. S. and Putran, R. (2003). Derivatives Markets in India: Issues Before A National Multi Commodity Exchange. Invest India economic foundation. URL: http://www.iief.com/Research/CHAP7.PDF

Jiménez, G., Ongena, S., Peydró, J. and Saurina, J. (2008). Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say about the Effects of Monetary Policy on Credit Risk-Taking. Bank of Spain, Working Paper, 0833. URL: www.bde.es/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/08/Fic/dt0833e.pdf

King, R.G. and Levine, R. (1993). Finance and growth: Schumpeter might be right. Quarterly Journal of Economics, 108, 717-738.

Knutson, R., Penn, J.B. and Flinchbaugh, B. (2006). Agricultural and Food Policy, 6th Edition. Prentice Hall, New Jersey.

Krebs, T. (2002). Growth and welfare effects of business cycles in economies with idiosyncratic human capital risk. Review of Economic Dynamics, 6, 846-868.

Levine, R., Loayza, N. and Beck, T. (2000). Financial intermediation and growth: Causality and causes. Journal of Monetary Economics, 46, 31-77.

Liapis, P. (2012). Structural Change in Commodity Markets: Have Agricultural Markets Become Thinner?. OECD Food, Agriculture and Fisheries Working Papers, 54, OECD Publishing. URL: http://dx.doi.org/10.1787/5k9fp3zdc1d0-en

Lien, D. and Zhang, M. (2008). A Survey of Emerging Derivatives Markets. Emerging Markets Finance & Trade, 44.

Marx,K. (1977). A Contribution to the Critique of Political Economy. Progress Publishers, Moscow.

Masuoka, T. (1990). Asset and Liability Management in the Developing Countries, Modern Financial Techniques: A Primer. Policy, Research and External Affairs Working Paper, 454, World Bank. URL: http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/1990/06/01/000009265_3960930002512/Rendered/PDF/multi_page.pdf

Merton, R.C. (1992). Financial innovation and economic performance. Journal of applied corporate finance, 4, 12-22.

Nairobi Stock Exchange. (2012). History of organisation. URL: http://www.nse.co.ke/

Nam,S., Park,K.S. and Kim, Y.K. Korean Securities Market in transition. URL: http://aric.adb.org/pdf/external/financial_market/Republic_of_China/china_cap.pdf

Ondieki-Mwaura, F. N., Njoroge, L. M., Okello, J. J. and Bahemuka, J. M. (2012). Are there significant welfare outcomes for farmers who participate in global commodity chains? The case of export horticultural farmers in kirinyaga region of Kenya. Scientific conference proceedings. Jomo Kenyatta university URL: http://elearning.jkuat.ac.ke/journals/ojs/index.php/jscp/article/view/722

Rolfo, J. (1980). Optimal Hedging Under Price and Quantity Uncertainty: The Case of a Cocoa Producer. Journal of Political Economics, 88, 100–116.

Rousseau, P.L. and Wachtel, P. (1998). Financial intermediation and economic performance: Historical evidence from five industrial countries. Journal of Money, Credit and Banking, 30, 657-678.

Rukuižienė, R. (2012). Management theory and studies for rural business and infrastructure development: Discontinuity between entrepreneurship development and social capital in rural

areas. Research paper, 3, Aleksandras Stulginskis University. URL: http://content.ebscohost.com/pdf27_28/pdf/2012/2WOG/15Sep12/77501921.pdf?EbscoContent=dGJyMMTo50Sep7E4yOvqOLCmr0qeprFSr6%2B4TbaWxWXS&ContentCustomer=dGJyMODb8nm52%2BKL3%2BbnU%2FTr5IHs2uJ96%2BUA&T=P&P=AN&S=R&D=bth&K=77501921

Schaede, U. (1989). Forwards and futures in tokugawa-period Japan: A new perspective on the Dojima rice market. Journal of Banking & Finance, 13, 487–513.

Schofield, N.C. (2008). Commodity Derivatives: Markets and Applications. John Wiley & Sons Ltd, New Jersey.

Şendeniz-Yüncü, İ., Akdeniz, L. and Aydoğan, K. (2008). Interdependence of the banking sector and the real sector: Evidence from OECD countries. Applied Economics, 40, 749-764.

Şendeniz-Yüncü, I., Akdeniz, L. and Aydoğan, K. (2007). Futures market development and economic growth. URL: http://www.bilkent.edu.tr/~akdeniz/vita/sendeniz_akdeniz_aydogan2.pdf

Telser, L.G. (1981). Why There Are Organized Futures Markets. Journal of Law and Economics, 24, 1–22.

The World Bank. (2012). Data: Kenya. URL: http://data.worldbank.org/country/kenya

Thompson, S. (1985). Use of Futures Markets for Exports by Less Developed Countries. American Journal of Agricultural Economics, 67, 986–991.

Tsetsekos, G. and Varangis, P. (2000). The structure of derivative exchanges: Lessons from developed and emerging markets. The World Bank research observer 15, 85-99. URL: http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/1998/02/01/000009265_3980429111125/additional/105505322_20041117150511.pdf

World Trade Organisation. (2012). Agriculture: fairer markets for farmers. URL: http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm3_e.htm