Wheat Import Demand and Welfare Effects of Import Controls in Kenya

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Abstract

Wheat is the second most important cereal in Kenya after maize and it plays an important role in enhancing food security. Despite this importance, the industry has been facing competition from import of cheap wheat. To protect wheat producers, Kenya imposes an import tariff of 35 per cent, a safeguard mechanism granted by Common Market for Eastern and Southern Africa (COMESA) protocol as from 2001, on wheat grain imports. However, even after the imposition of import tariffs, wheat production has not improved and competitiveness is still low with increasing wheat imports, while consumer prices for wheat and wheat products are on the increase. Thus, the tariff burden is being passed to the consumers. There has been inadequate evidence to guide decision making on whether to continue with the safeguard mechanism depending on the effect to producers, consumers and importing firms. This study estimates import demand function for wheat to provide a bearing on the decision making regarding wheat import tariffs. Further, welfare effects under import tariffs are estimated. The study uses time series data from 1980-2007 and employs Instrumental Variable Two Stage Least Squares (IV2SLS).

Results indicate that wheat import demand is significantly responsive to import prices and real income but exhibits an inelastic behaviour. The signs of the co-efficient of relative import prices and income follow economic theory expectations. Increased domestic wheat production reduces import demand, while the quota barrier reduces the quantity imported. Imposition of import tariff is found to be insignificant in reducing wheat imports while the value of exported wheat products positively impact on demand for wheat imports. Importing firms are largely favoured by the import tariff unlike producers and consumers. The losses by consumers cannot be compensated by the producer gains under import tariffs and there is high efficiency losses and loss of consumer choices resulting from price increase. The need to remove tariffs is imperative in order to allow free trade in the increasing interregional integration. Value addition in wheat is recommended to enhance the profitability of wheat enterprise and consequently the welfare. At the same time, it is important to import to the level of the deficit so as to avoid market glut that would dampen producer prices.

Abbreviations and Acronyms

ADF	Augmented Dickey Fuller
CGE	Computable General Equilibrium
COMESA	Common Market for Eastern and Southern Africa
CS	Consumer Surplus
EAC	East African Community
ECM	Error Correction Model
EPA	Economic Partnership Agreement
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IE	Income Elasticity
IV2SLS	Instrumental Variable Two Stage Least Squares
KIPPRA	Kenya Institute for Public Policy Research and Analysis
NTBs	Non-Tariff Barriers
PE	Price Elasticity
PP	Phillips-Perron
PS	Producer Surplus
QR	Quota Rents
SSA	Sub- Saharan Africa
UK	United Kingdom
USA	United States of America

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1. Introduction

Wheat attracts special attention in Kenya because it is the second nost important cereal grain in Kenya after maize in terms of area cultivated. While wheat occupies an area of 150,000 hectares, maize occupies 1.6 million hectares. Wheat production in Kenya has remained below the consumption levels, prompting importation to satisfy the ever increasing demand. Kenya imports over 50 per cent of its wheat requirements (Gamba *et al.,* 2002 and Njau *et al.,* 2006). Wheat demand has increased over time as a result of a growing economy and population against dwindling domestic production. Since 1980, wheat imports increased from 64 thousand tonnes to 1.1 million tonnes in 2007, with Argentina and Australia being the dominant origins. Kenya imports hard wheat consisting of unmilled (grain) durum wheat and meslin. The imported wheat is of high quality and is used in baking. The increasing demand for imported wheat has attracted import tariffs in a bid to control the inflow. Theoretically, import controls are imposed to protect an infant or less competitive industry from external competition, prevent employment losses prompted by undue competitive advantage of the competing industries, and also as a source of revenue to the government.

The increasing wheat imports threaten the growth of the domestic wheat industry. Wheat imports lead to decline in domestic wheat production, wheat acreage, yields and wheat prices received by farmers, but increases the level of wheat consumption (Nabangi, 2004). Imported wheat is cheaper than the domestic wheat, hence dampens the prices offered to wheat producers in Kenya. The dampened prices negatively impact on production, since farmers cannot recoup substantial gains from the enterprise. Consequently, employment and the livelihoods supported by the sub-sector are put under threat. In 2001, the Common Market for Eastern and Southern Africa (COMESA) allowed Kenya to maintain a safeguard mechanism[1] to protect the domestic wheat industry by imposing a tariff of 35 per cent for grain wheat and 60 per cent for wheat flour until the end of 2008. From 2009, wheat imports from COMESA member countries were expected to be zero-rated, but the tariff rates were to be maintained for non-COMESA countries. Simultaneously, Kenya was to embark on strengthening the domestic

[1] These are contingency restrictions on imports taken temporarily to deal with special circumstances such as a surge in imports. They can be in form of restrictive tariff rates or quotas. Kenya applies 35% tariff rate on imported wheat as a safeguard mechanism.

wheat industry to compete effectively with imports. The import controls protect the small-scale dominated wheat industry in Kenya by reducing the influx of cheap wheat imports from other countries and enabling producers to maintain their market share as imports are barred or their prices increased. However, even with the imposed tariff, wheat imports have been increasing, with production remaining relatively constant. Under the government controls, production has not shown significant increase while the prices of the wheat-related consumer products have significantly increased.

While wheat import restrictions are beneficial to the producers, the consumers are disadvantaged by the increase in prices that result from the safeguard mechanism. Despite the increase in cheap wheat imports, consumers have been faced with increasing domestic prices of wheat and wheat products such as bread, biscuits, animal feeds and other wheat related products. The increase in domestic prices of wheat products is also pushed by increase in global wheat prices, which are reported to have been 83 per cent higher in 2008 (Quevenco, 2008). The increase in prices is attributed to the import tariff, which has raised the price of imported wheat. Increase in imported wheat prices is often passed on to the consumers.

Under the safeguard mechanism, the gains accrued to producers should be commensurate to the losses incurred by the consumer. This implies that the safeguard mechanism should set all the stakeholders well off. The low response in domestic wheat production, increasing wheat grain importation, and increasing consumer prices for wheat products at the background of imposed safeguard mechanism point to unbalanced benefits between producers, consumers and the intermediary agents. Analysis of the effects of the wheat safeguard mechanism and the resulting welfare are sensitive to the estimates of import demand elasticities (there is little research conducted on this area). The magnitude of the benefits to producers and the importing firms/government and losses to consumers are not well known, raising questions as to whether the wheat safeguard mechanism should continue being applied. This stems from lack of sufficient, exhaustive and elaborate empirical examination of wheat import demand and the implied impacts of wheat import tariffs on wheat producers, consumers, importing and wheat processing firms and the resultant resource reallocation under poor enterprise competitiveness. Consequently, the result has been ad hoc imposition of import tariffs and inconclusive decisions on whether to continue with the safeguard measures or not.

The few studies such as Elliot *et al.* (1986); Mwega (1993); and Geda *et al.* (2001), that have ventured into import demand analysis, have taken an overall agricultural sector analysis but have fallen short of analyzing specific agricultural enterprises. Further, they fall short of analyzing the welfare component of import controls. This void in the existing empirical literature motivates this study into estimating an import demand function for wheat in Kenya under import tariffs and welfare implication for producers, consumers and wheat firms.

1.1 Objectives of the Study

The overall objective of this study is to provide sufficient evidence on the impact of wheat import tariffs in Kenya. In order to address the overall objective, the study revolves around two specific objectives:

(i) Estimation of wheat import demand function to elicit the determinants of wheat import demand in Kenya.

(ii) Estimation of welfare effects of wheat import tariffs to elicit the consumer and producer surplus changes due to import tariffs imposed on wheat.

The information generated finds use in decision making concerning wheat import tariffs to the stakeholders in the sub-sector. These include the government, wheat millers, producers and consumers. From this study, the gains or losses due to the import tariff will be estimated as changes in welfare measures: consumer and producer surplus, quota rents and deadweights. Based on these measures, it will be possible to deduce whether to continue with the safeguards or not. The estimated responses (elasticities) are inputs in most trade policy simulation models and have found increasing and invaluable use in Computable General Equilibrium (CGE), determining pattern of protection where those industries with high import demand elasticities are given less protection due to the high deadweight loss resulting from trade diversion, and effects of and terms of trade. Wheat import elasticities, therefore, find important use in evaluating the effects of changes in domestic agricultural production and trade policies on consumers and producers (Brester, 1996).

1.2 Study Organization

The study is organized as follows: the first section gives a background of the wheat sub-sector in Kenya. Section two highlights the literature of

import demand with a focus on trade and production approaches besides reviewing import demand studies in Sub-Saharan Africa, in Kenya and welfare estimations. The theoretical underpinnings of import demand analysis as they relate to the classical demand theory are expounded, besides the conceptual framework. Section three highlights the data sources and estimation procedure of the import demand function, while section four presents the results and discussions. The conclusion and policy recommendations are discussed in Section five.

1.3 Global Wheat Production and Demand

World wheat production has been increasing, reaching 683 million metric tonnes in 2008, from 436 in 1980 (Table 1.1). Over the same period, feed use increased from 91 million metric tonnes to 123 million metric tonnes, a 35 per cent increase (USDA, 2009). An increase in domestic use from 444 million metric tonnes in 1980 to 652 million metric tonnes in 2008 was also realized. This 32 per cent increase in wheat consumption has been pushing world demand upwards.

The increases in the different uses of wheat indicate the growing importance and therefore demand for wheat. Over the period, significant increases in wheat production were realized in major producing countries that include Argentina, Australia, Canada, China, European Union and United States of America (USA). This increase stems from the increasing acreage devoted to wheat production, driven by the relatively high prices (Food and Agriculture Organization, 2008).

Table 1.1: World wheat production and utilization

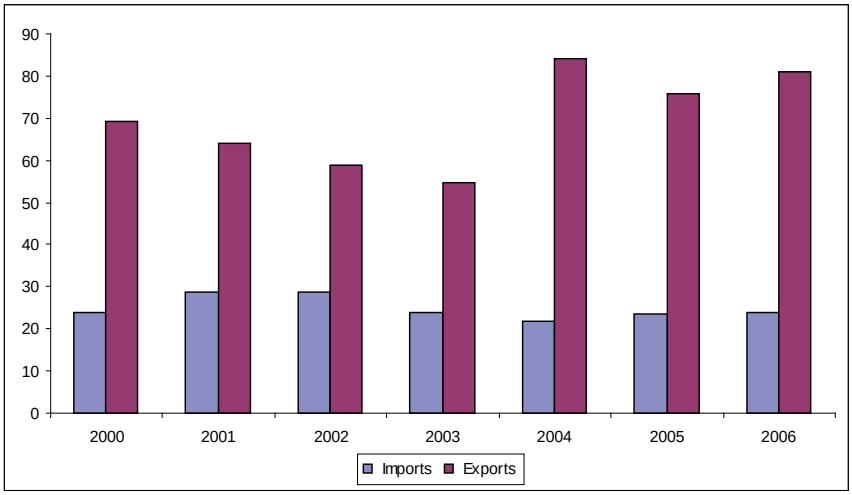
Year	Production	Feed use	Domestic use	Exports	Ending stocks
1980	436	91	444	90	113
1985	495	97	484	82	178
1990	589	130	554	104	171
1995	537	92	545	99	156
2000	583	104	585	101	207
2001	583	108	587	106	203
2002	569	112	605	106	167
2003	554	96	589	109	132
2004	626	106	607	111	151
2005	620	111	623	117	147
2006	596	106	617	112	127
2007	611	94	618	117	120
2008	683	123	652	123	150

*Source: USDA (2009),*All units in million metric tonnes*

Corresponding to the increasing world wheat demand, wheat export volumes reached 123 million metric tonnes in 2008, from 90 million metric tonnes in 1980. The difference between exports and imports in the world market have generally increased due to the increasing production against declining importation by the major wheat importers such as Brazil, EU, Iran and Japan (Figure 1.1). Although larger supplies may not necessarily boost exports since domestic demand in several major exporting countries is also expected to increase, the increasing difference between the major importing and exporting countries will lead to a decline in world wheat prices. With the increasing world wheat supply and trade, the availability of relatively cheap wheat in the world market against high domestic prices in other importing countries, especially in Africa, has been the reason for increased imports and has resulted to declining domestic wheat production.

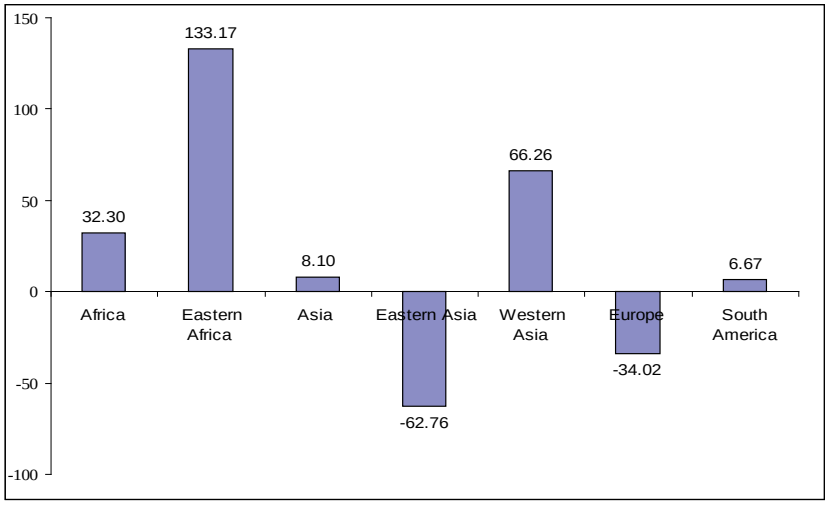
Wheat imports in Africa were estimated at 29 million tonnes in 2006, up from 15 million tonnes in 1980. Africa's percentage share of world wheat imports increased by 32 per cent due to demand increase in Northern Africa, especially in Algeria, Egypt, Libya and Tunisia (Food and Agriculture Organization, 2008). Eastern Africa's share of imports increased by 133 per cent, indicating increasing wheat importation in Eastern Africa within the African region (Figure 1.2). The increase in the share is an indicator that wheat imports are on the increase and could imply increasing demand. The increase in wheat imports demand

Figure 1.1: Global wheat trade (million tonnes)



Source: UNComtrade (2009)

Figure 1.2: Percentage change in the share of world's imports, 1980 and 2006



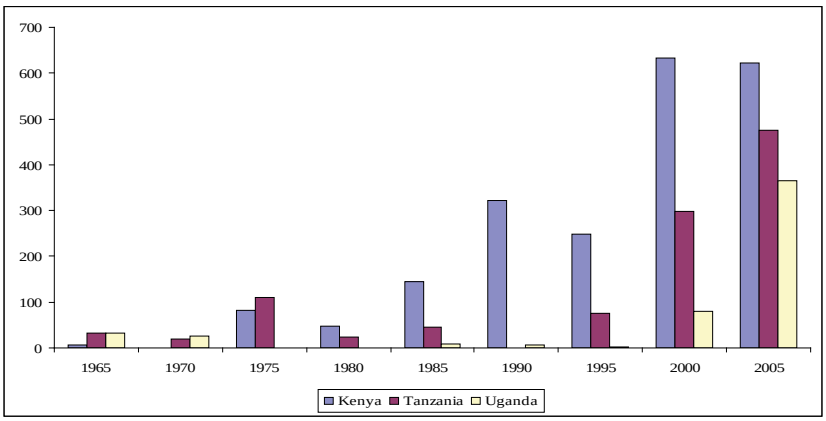
Source: FAOSTAT (2009)

can be attributed to increasing demand for wheat in the country, due to increasing population, rapid urbanization, rising income levels and changing tastes and preferences (Gamba *et al.,* 2002).

The least growth in wheat imports over the period was realized in the South America and Asian regions. This is attributed to increased production, especially in Brazil and Argentina. Eastern Asia and Europe's negative share growth indicate that the two regions have been net exporters of wheat rather than importers. However, the growth in imports in Western Asia outweighed the export growth in the Eastern region resulting in 8 per cent growth in import share in the Asian region.

Wheat imports within East Africa (Kenya, Tanzania and Uganda) amounted to 1 million tonnes in 1980 and 4 million tonnes in 2006. Kenya had the highest level of wheat imports among the three East African countries followed by Tanzania and then Uganda (Figure 1.3). The level of wheat imports increased as from early 1990 when liberalization started taking effect. While USDA (2009) forecasts an increase in demand for wheat and wheat products in the world, the stability of wheat markets expected under increasing production and exports is undermined by the unstable conditions of maize and rice, and more by the increasing domestic demand for wheat and wheat products (Food and Agriculture Organization, 2008). Maize and rice production have declined, resulting to increased world prices. The increase in maize prices is propped by

Figure 1.3: Evolution of wheat imports in East Africa (000' tonnes)



Source: UNComtrade, 2009

tight supply in the world markets resulting from decline in production in United States of America, which is the major producer and exporter. Similarly, the price increases in rice are as a result of export restraints in some major producing countries. This puts the world cereal markets into uncertainty and unpredictability. The unpredictable conditions of the alternative cereals to wheat may lead to long unstable markets for wheat, even under the predicted record for wheat production (Food and Agriculture Organization, 2008).

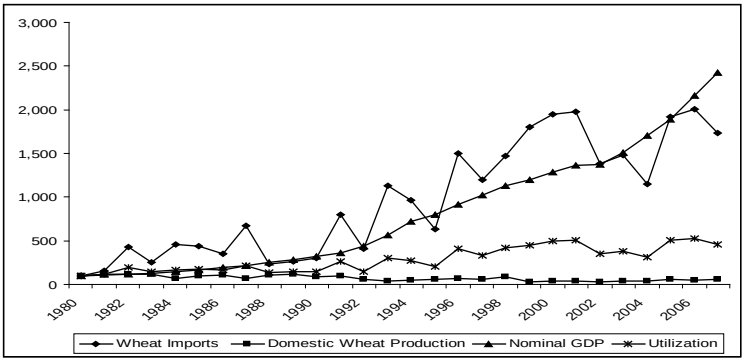
1.4 Review of Wheat Sub-Sector in Kenya

This section reviews the wheat sub-sector in Kenya, taking into consideration of wheat production, consumption imports and the overall trend in policies that have influenced wheat importation.

1.4.1 Domestic wheat production, consumption and economic trends

From 1963 when the import substitution policies were in place and even after liberalization in 1990s, Kenya has not been self-sufficient in wheat. Figure 1.4 shows the evolution of wheat imports, production, consumption and nominal GDP. Wheat imports, consumption and GDP show increasing trends, while the patterns are relatively constant for production and income per capita. Wheat imports exhibit an erratic but

Figure 1.4: Evolution of domestic wheat production, imports, utilization and GDP in Kenya (1980=100)



Source: Government of Kenya (variou); FAOSTAT (2009); and UNComtrade (2009)

increasing pattern over the whole period.

While production was over 200 thousand tonnes in 1980, it went below 80 thousand tonnes by 2001. Total wheat production in 2007 was estimated at 112.9 thousand tonnes (Government of Kenya, 2008). These trends map two distinct economic periods; the pre- liberalization period before 1992, and the liberalization period after 1992. During the pre-liberalization era, import substitution policies guided economic growth and development. The liberalization era was marked by withdrawal of the government from controlling the market to letting the forces of demand and supply operate.

1.4.2 Imports and import policies in Kenya

Kenya imports mainly hard wheat, which is blended with soft wheat produced domestically. The soft wheat imported is of high quality, with a high extraction ratio than the domestically produced soft wheat. Kenya domestic production only meets around 40 per cent of its requirements. Soft wheat comprises 75 per cent of the domestically produced wheat, with the rest being hard wheat (Nyangito *et al.,* 2002). Hard wheat attracts a tariff rate of 35 per cent as specified in the EAC Common External Tariff (version 2007). In 2007, Kenya's domestic wheat demand was estimated at 677 thousand tonnes against the production of 113 thousand tonnes prompting imports amounting to 1,129 thousand tonnes (UNComtrade, 2009). However, this is twice the total quantity imported (Government of Kenya, 2008), and could be pointing to over importation and/or statistical discrepancy.

An Economic Partnership Agreement (EPA) report by KIPPRA (2005), forecasts that by 2015, Kenya's wheat consumption will be about 2,400 thousand tonnes against a production level of 1,900 thousand tonnes. By 2025, wheat is projected to overtake maize as the leading staple food in Kenya.

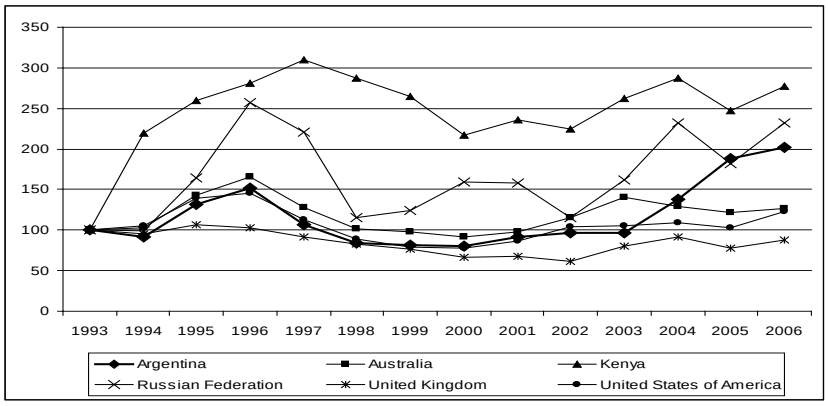
The share of imports in Kenya relative to the world imports increased from 0.07 per cent to 0.44 per cent between 1980 and 2006, while within Africa, Kenya's share of imports increased from 0.4 per cent to 2 per cent over the same period. Since 1980, wheat imports have increased from 65 thousand tonnes to 1,129 thousand tonnes in 2007. This means that Kenya has been relying on imports to satisfy the ever increasing domestic and regional demand for wheat and wheat products (Nyangito *et al.,* 2002). Based on the deficit in production as projected, imports will still be needed to cater for the rising demand. Wheat imports dampen domestic prices, are disincentives to domestic production and they erode the producer benefits. However, the decline in prices for wheat, unlike the producers, is a reprieve to the consumers who could enjoy increasing welfare. As a result, farmers are shifting to other lucrative enterprises such as dairy and horticultural production.

The major exporters of wheat to Kenya are Argentina, the Russian Federation, United Kingdom (UK), United States of America (USA) and Australia (Table 1.2). However, Argentina has been the consistent exporter in the recent past. Other sources include Egypt, Pakistan, Canada, Ukraine, Tanzania and Mauritius. Some sources such as Egypt and Mauritius are cases of trans-shipment.

Kenya has had the highest producer prices compared to those of major exporters (Figure 1.5). Although most of the imports have originated from Argentina, producer prices in the major wheat exporting countries have been lowest in the United Kingdom. Nyangito *et al.* (2002), highlight the fact that freight charges and quality have mostly dictated the origin of wheat imports rather than price. Wheat from Argentina is regarded to be of high quality, and freight charges are comparably lower.

Evolution in prices over the period of analysis is shown in Figure 6. The period prior to 1995 shows that the domestic and imported wheat moved in step. Since liberalization of the wheat industry in 1993, the trends in prices are indicative of changes in economic policy regimes. Imported wheat prices have been lower than domestic wheat prices. The need to protect the domestic wheat industry against external competition emanating from liberalization, and also revenue objective, has created incentive for imposition of wheat imports controls.

Figure 1.5: Evolution of producer prices (1993=100) US$ per tonne



Source: FAOSTAT (2009)

Table 1.2: Major wheat exporters to Kenya

	2000		2002		2004		2005		2006	
Country	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Argentina	453	61	102	13	451	98	34	5	305	288
Australia	275	42	103	20	0	0	0	0	0	0
UK	159	23	65	9	25	5	0.00	0.0	4.00	1.1
USA	23	3	50	7	49	11	195	42	127	46
Russian Fed.	0	0	0	0	0	0	341.51	57.0	358.73	89.6
Others	213	32	535	71	221	53	730	118	334	1038.4
World	1124	160	855	120	746	168	1301	223	1129	1464

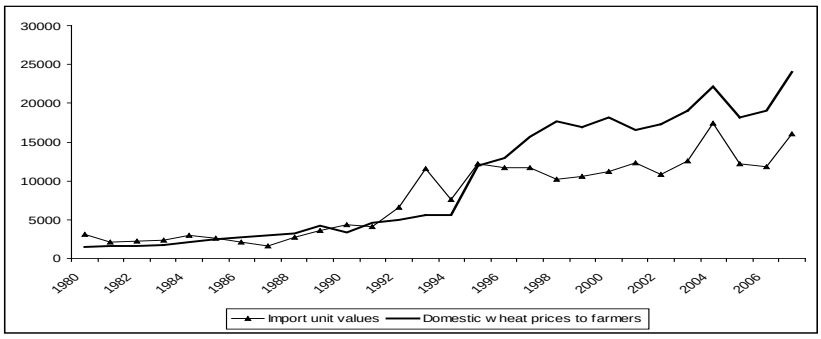
Source: UNComtrade (2009) (Quantity '000 tonnes, value in Ksh million)

The imposed import tariffs have ranged from 25 per cent in 1997 to 35 per cent (plus 50% suspended duty) in 2000. These duties are reviewed after every three months to offer producers protection depending on the level of production and domestic demand (Nyangito *et al.,* 2002). Since 2001, through a safeguard mechanism granted by COMESA, a tariff rate of 35 per cent has been applied on imported wheat from all countries. The tariff on wheat was to be zero-rated by early 2009 for imports from COMESA country states to allow for regional integration. While the tariff makes imported wheat more expensive than the locally produced wheat, and has far reaching effects to both producers and consumers, the domestic pricing mechanism is based on the prices of imported wheat, hence giving the imported wheat an edge in the market. The tariff, applied in an ad hoc manner, has served as a barrier to imports of wheat,

with an expectation of improved welfare to the wheat farmers and also benefiting the government through increased revenue. However, even with the imposition of the 35 per cent tariff, the domestic prices set are higher above the import unit value inclusive of the tariff. This is because there is a tendency to set domestic prices on the basis of import prices (Nyangito *et al.,* 2002), which automatically sets the domestic prices higher, conferring undue competition to the imports.

In future, while Kenya risks exposing the wheat sub-sector to external competition if it reduces the tariff, the imposition of import tariffs in the growing regional integration under East African Community (EAC) and COMESA frameworks and at the background of liberalization could have far reaching implications in the exports of other agricultural commodities considering that the imported wheat originates from countries that are major importers of some Kenya's important cash crops. For instance, barring wheat imports from Pakistan and Egypt could have negative implications on the export of tea and trade in general to these countries.

Figure 1.6: Evolution of imports unit values and domestic prices for wheat (Ksh per tonne)



Source: KIPPRA-Ministry of Agriculture data compendium; Economic Surveys (various) and UNComtrade (2009)

2. Literature Review

Import demand has been studied widely in both developed and developing countries (Anaman and Buffong, 2001). Despite the valuable importance of elasticities of import demand, there are few studies of the kind in Africa as compared to the other continents. Even the few studies have focused on the aggregate rather than at the disaggregated sector level. This section reviews the literature on the approaches to import demand, and some relevant existing studies outside and within Sub-Saharan Africa (SSA) and specifically in Kenya. The survey of literature extends to the literature on welfare of imports under control.

2.1 Approaches to Import Demand Analysis

Trade and production theory approaches have been widely applied in analyzing demand for import. The basis of production theory approach has been on the argument that most imported commodities are inputs rather than finished products, and enter the production chain even when there is no transformation, thus impacting on the substitutability of other inputs of the production process. For instance, Davis and Jensen (1994) argue that most of the imported agricultural commodities/goods are inputs and not final goods. Specifying the second stage aggregates is more intuitive when using production theory approach and that to estimate unconditional elasticities using production approach is more intuitive and easier. Import demand can be derived from the production theory, and thus there is no need to model the final demand (Kohli, 1991). This approach helps in overcoming the aggregation difficulties that arise when aggregate is done over industries and consumers. While the use of the production theory approach could be justifiable, its application in this case is limited due to the inputs data requirement at a disaggregated level. Several recent studies have alluded to the appreciation of treating imports as inputs entering the value chain at different levels. Examples of studies that have used production theory approach include Burgess (1974a and 1974b), Kohli (1978), Brester (1996), Washington and Kilmer (2002) and Halit (2004).

The studies that have treated agricultural imports as unfinished commodities have tended to embrace the production theory approach, with most studies using production function or the Rotterdam[2] model as

[2] The Rotterdam model is compensated demand expressed in log changes.

the analytical framework. The Rotterdam model is based on consumer demand theory. Brester (1996) uses the Rotterdam model approach to analyze import demand. The estimation of import demand through the Rotterdam model is accomplished in two procedures. In the first stage, budgetary allocation is done on product groups imported and in the second stage, allocation is done for products within the product groups. The second stage demand systems present the conditional demand system. By substituting the first stage demand systems into the conditional system, the unconditional demands are derived. The estimation assumes separability in the stepwise budgeting procedure as in consumer demand theory.

A production function framework that treats imports as inputs entering the production process as a substitute to the domestic inputs is used by Halit (2004). In such frameworks, it is possible to assess the substitution possibilities, and that international trade policies may directly affect the level of domestic factor income and its distribution within a country. Washington and Kilmer (2002) argue that in the Rotterdam model, imported goods enter directly into the consumer's utility function, and the resulting demand equations for imports are derived from utility maximization. However, given the nature of international trade, where traded goods are either used in other production process or go through domestic channels before reaching the consumer, it is more appropriate to treat imported goods as intermediate than as final consumption goods, even if no transformation takes place. That is, activities such as handling, insurance, transportation, storing, repackaging and retailing occur resulting into some significant domestic value addition.

In the trade approach, import demand is modeled as final goods or intermediate goods rather than inputs in the production process (Halit, 2004). This is the traditional approach to import demand modeling. Such framework entail modeling demand of imports as a function of national income, and the ratio of the price of imports relative to the price of domestic value added. This approach forms the basis for the traditional import imperfect substitutes model. They provide trade elasticities for crucial economic forecasting and international trade policy and welfare analysis. The studies that have treated imports as finished commodities,have entrenched their arguments in the neoclassical utility/ demand theory and have assumed that import demand functions are derived from maximizing utility subject to price and income constraints. Such studies have fallen within the imperfect substitute or the gravity

model[3] analytical frameworks (Hong, 1999). The imperfect substitute model was proposed by Goldstein and Khan (1985) and dwells on the assumption that imports cannot be perfect substitutes to the domestic commodities or goods. The imperfect imports substitutes framework focus on the determinants of aggregate international trade with emphasis on structural parameters and their economic policy implications. Hong (1999) observes that the neoclassical demand theory is the theoretical framework behind most studies that use the imperfect substitute model. A significant number of studies such as Houthakker and Magee (1969), Leamer and Stern (1970), Goldstein and Khan (1985), Knetter (1992), Senhadji (1998), Tambi (1998), Hooper and Marquez (1995) and Sinha (1997) have used this demand theory. Others include Jones (2003), Dutta and Ahmed (2006), Agbola and Damoense (2005), Aziz and Horsewood (2008) and Hauk (2008) who delve into import demand, taking the trade approach.

Different functional forms and specification of import demand have also been used. Thursby and Thursby (1984) examined the appropriateness of alternative specifications using five countries (Canada, Germany, Japan, United Kingdom and the United States) as case studies. They explored nine different models of aggregate imports demand from which 324 alternative specifications were derived. The general conclusion from this detailed research was that there is no single functional form that is universally appropriate across countries over time. The logarithmic functional form was found to be more appropriate by Thursby and Thursby (1984). Hong (1999) also ascertains that the log form has been applied widely in import demand studies. Log-linear functional forms have been widely applied as the analytical functional form due to their flexibility, and that the estimates are elasticities.

2.2 Determinants of Import Demand

Most of the studies have focused on the import behaviour in developed countries (Sinha, 1997), with a few focusing on the developing countries. Within the developing countries, focus has also been given to the traditional determinants of import demand, and the trade approach has

[3] The gravity modeling framework focuses on the determinants of bilateral trade flows, with an emphasis on location factors and their geo-political and geo-economic policy implications. However, the gravity model, which has its origin from physics discipline, has been criticized for its lack of theoretical basis (Hong, 1999).

widely been applied. In the trade approach, traditional variables included in the import demand function are income and price. The theoretical *apriori* expectations for these variables have been in line with demand theory. The trade approach has also given room for inclusion of other variables such as the exchange rate, foreign direct investment or the quality of the traded commodity (Camarero and Tamarit, 2004) and policy shift variables. Quality and preferences have been analyzed in several studies. Quality of wheat differ across countries due to different climatic conditions, varieties, soils, cultural practices and this also impact on the end uses (Wilson, 1994). Focus is given to developing countries, since they share some similarities such as common policy shifts, protection of domestic economies, and relatively similar economic growth trends.

Wilson (1994) estimates the demand for various classes of wheat in the Pacific Rim countries and tests preference shifts over time. The results confirmed the existence of differences in demand parameters for wheat in different classes and across countries. Further, expenditure played an important role in distribution of different classes of wheat, with preference shift over time towards high protein wheats.

In the study by Halit (2004), duality principle is applied to production to arrive at the cost or profit function for analysis. Using a translog form to model imports as inputs, Halit concludes that inputs in the production process exhibit inelastic response, with labour being the most inelastic, then imports and capital. The inputs exhibit substitutability relationship, with the partial substitution between capital and imports being higher than the partial elasticity of substitution between labour and imports. Washington and Kilmer (2002) analyze import demand comparing two models: the Rotterdam model and the differential production model. From the analysis, it is clear that the use of Rotterdam model when a production function approach should be used can lead to over-estimation of elasticities, under-estimation and incorrect signs in deriving unconditional price effects. Brester (1996) used a Rotterdam model to estimate the import demand elasticity in the United States beef industry, and concluded that imports of beef are influenced by income and prices.

In India, Dutta and Ahmed (2006) study on aggregate imports behaviour through a cointegration and Error Correction Model (ECM) finds that import volumes are cointegrated with relative import price and real GDP. Their results indicate that import demand is largely explained by real GDP and is less sensitive to import price changes. Further, they find that import liberalization is found to have had little impact on import

demand. Thomakos and Uludasoglu (undated) determine the effect of trade liberalization on import demand in Turkey using disaggregated elasticities. Their results indicate that a significant effect of reform was there but varied across industries that were important to the economy. Trade reforms in Turkey in the 1980s deepened the industrial base in certain sectors by increasing the product varieties available to the consumers. This can be inferred from the changes in magnitudes of the import demand elasticities. However, their study finds an inelastic import demand response to income, implying that there is a limited amount of income increase channeled to imports.

Kotan and Saygili (1999) estimate the import function for Turkey using cointegration analysis and conclude that both the short-run and long-run dynamics are consistent in terms of negative effects of the depreciation rate of the exchange rate, and the positive effects of the income. The long- run income level, nominal depreciation rate, inflation rate and international reserves significantly affect imports. The import demand function is estimated to be income and price elastic. However, in the short-run, inflation growth and growth of the international reserves lose their significant effects on imports growth. Sinha (1997) estimates the import demand for Thailand correcting for stationarity and finds that import demand is inelastic to income, import prices and domestic prices in the short-run.

Anaman and Buffong (2001) estimate the determinants of aggregate imports demand functions in the oil rich Brunei Darussalam country using data stretching from 1964 to 1997. The study uses OLS, and estimates imports as a function of real effective exchange rate, real GDP and population. Their results reveal that real effective exchange rate, population and real GDP significantly influence aggregate import demand and, further, aggregate imports are price and income inelastic but elastic to the population. Faini *et al.* (1988) estimated an import demand function for 50 developing countries. They found that for most of the countries, imports were relatively inelastic with respect to prices, while income elasticities were higher than one, violating the neoclassical assumption of unitary income elasticities. Aziz and Horsewood (2008) use cointegration and error correction models to estimate aggregate demand for Bangladesh. Their study reveals that real GDP and relative prices are significant determinants of imports. However, the study finds no significant effect for liberalization. Hauk (2008) reveals that income and prices are important determinants of imports demand. Lagged imports quantity is also significant.

There are relatively few studies in sub-Saharan Africa that attend to import demand analysis compared to other regions of the world. Studies by López and Thomas (1990), Egwaikhide (1999), Jachia and Teljeur (1999), Gumede (2000), Jones (2003) and Edwards and Lawrence (2006) are some examples. López and Thomas (1990) extended the coverage of earlier models of import determination to account for the factors that often lead to the adoption of adjustment programmes, particularly changes in terms of trade and foreign exchange shortages, and the policy changes that are commonly included in them; reductions in the level of and shifts among the components of absorption, and devaluation of the exchange rate. They therefore modified the traditional framework of demand function by including exchange rate and disaggregate income to private consumption, government consumption and aggregate investment and used the framework to determine the demand functions for Democratic Republic of Congo, Cote d'Ivoire, Kenya, Madagascar, Nigeria, Tanzania and Zambia. Results indicate that import price elasticities are generally higher in absolute values than the exchange rate elasticities. The hypothesis of equality between the elasticities of price and exchange rates cannot be rejected for the Kenyan case, but it is rejected for Democratic Republic of Congo, Nigeria, Tanzania and Zambia.

Availability of foreign exchange earnings, relative prices, and real output (income), significantly explained the growth in total imports in Nigeria between 1953 and 1989 (Egwaikhide, 1999), concluding that the effect of foreign exchange availability is particularly remarkable. Results show that imports of raw materials responded significantly to foreign exchange earnings, relative prices and industrial output through an error correction mechanism. Other studies in Nigeria include those of Aliyu (2007) and Ajayi (1975). Aliyu (2007) finds exchange rate stability as important in determining imports and exports while Ajayi (1975) showed that real income, relative prices, and foreign exchange were the major determinants of total imports in Nigeria between the 1960s and 1970s.

Import demand elasticity was estimated by Jachia and Teljeur (1999) to be price inelastic (-0.85) in South Africa. Using the Engle-Granger technique, Gumede (2000) estimated import demand for South Africa. The results indicate that the import demand elasticity for South Africa is unitary, while the income elasticity is estimated to be elastic with a magnitude of 1.63. Basically, the South African imports are highly sensitive to an income change and less sensitive to a price change,

indicating that policies that impact on income will have the highest changes on import demand. This implies that policy interventions that influence income are likely to have highest impacts on imports, unlike those that influence prices.

Using the imperfect substitutes model, Jones (2003) estimates import demand elasticities for ten African countries: Algeria, Cameroon, Central African Republic, Ethiopia, Egypt, Gabon, Kenya, Madagascar: Tanzania and Uganda. The elasticities are estimated at three levels, aggregates for each country, using iterative dummy to create estimates for 16 sectors of African economies and the elasticity estimates for each of the 942-digit product lines defined by HS codes. Import demand appears more elastic in sectors that have relatively high levels of domestic production or where there are exports. The OLS import demand estimates are elastic, indicating that African imports are more responsive to prices. Madagascar has the largest import demand elasticity of -1.532 while Tanzania has the lowest estimate of -1.053. However, the same analysis with fixed effects estimator reveals that import demand elasticity are inelastic except for Egypt, Ethiopia and Gabon. In Ghana, Fosu and Frimpong (2006) find an inelastic import demand response to income and relative import prices using disaggregated expenditure components of the national income. Seleka (2006) finds inelastic price elasticities for three agricultural enterprises: onions, oranges and potatoes. However, the income elasticities are mixed, with oranges exhibiting inelastic income elasticity. Further, import controls are significant in influencing import demand.

From the foregoing literature, despite the different approaches, functional forms and different degrees of elasticities, import demand is evidently influenced by income, the relative prices or absolute prices, and exchange rates. As income increases, the demand for imports increases and as import price increases (relative price), the demand for imports declines. The income and relative price corresponding elasticities behave according to economic theory. Foreign exchange rates have also been found to be important in several studies. Devaluation of the domestic currency makes imports expensive, hence less importation. However there will be more importation if the currency is under-valued.

2.3 Import Demand Analysis in Kenya

Despite the importance of import elasticities in ensuring the success of trade policies, there are few studies on import demand in Kenya. Except

at aggregate sectoral level, there is no sub-sectoral import demand analysis. Several studies have attempted to analyze elasticities and import determinants in Kenya at sectoral or national level. The studies by Elliot *et al.* (1986), Faini *et al.* (1988), Tegene (1989), Mwega (1993) and Geda *et al.* (2001) are cases in point. Faini *et al.* (1988) estimated the import demand elasticity for Kenya to be -1.48, while Tegene (1989) estimates were -2.12. Elliot *et al.* (1986) attempted to construct an econometric import model for the period 1968-1980, in which imports were disaggregated as petroleum and non-petroleum imports and OLS estimation technique applied. Kenya's petroleum imports were modeled as a function of refined petroleum products exports, real GDP and the existence of EAC. Exports of refined petroleum products and real GDP were found to have positive impacts on import of petroleum, while the collapse of EAC had a negative impact. The impact of EAC is estimated through a dummy variable. Non-petroleum imports are estimated as a function of real GDP, ratio of net foreign assets to the real exchange, and the ratio of GDP price deflator to other commodity imports prices. All the variables had a positive and significant effect on the imports of non-petroleum imports.

The study by Mwega (1993) for import demand elasticities for aggregate imports over the period 1964 to 1991 used an error correction model (two-step Engle-Granger). The results from this study suggest that the short-run relative price and real income aggregate import demand elasticities are insignificant in determining aggregate imports. On the other hand, aggregate imports were strongly responsive to lagged foreign exchange reserves and foreign exchange earnings. The significance of the error correction term in Mwega's study points to some degree of endogeneity in imports. The recent study that has tried to estimate elasticities of demand in Kenya is Jones (2003). This study estimated the aggregate import demand elasticity for Kenya as -1.148 for OLS estimator and -0.817 for fixed effects estimator. Geda *et al.* (2001) in a bid to estimate aggregate import demand elasticities for the KIPPRA-Treasury Macro Model assume cointegration in order to obtain the long-run elasticities. The estimates of long-run income and price elasticities are 0.589 and -1.0953. From these studies, imports in Kenya are influenced by income, prices and exchange rates. Several methods of import demand estimation have also been used, albeit with their shortcomings. However, few have considered import demand under policy shifts such as trade liberalization and safeguard mechanism.

Table 2.1: Selected income elasticity and price elasticity of aggregate import demand

Country	Source	IE	PE	Country	Source	IE	PE
Argentina*	Khan (1974)	0.143	-0.850	Mexico *	Salas (1982)	0.510	1.140
Brazil*	Khan (1974)	0.107	-1.688	Morocco*	Sarnad (1988)	1.737	-0.072
Brunei*Ana-man and	Buffong (2001)	0.226	-0.670	Pakistan*	Khan (1974)	1.021	-0.779
Chille*	Khan (1974)	0.004	-0.633	Peru*	Sarnad (1988)	-0.472	-0.679
Columbia*	Khan (1974)	0.210	-0.758	Philippines*	Khan (1974)	0.668	-2.731
Ecuador*	Khan (1974)	0.555	-1.173	Sri Lanka*	Khan (1974)	0.218	-1.074
Ghana*	Khan (1974)	0.238	-1.057	Thailand*	Sinha (1997)	2.148	-0.768
India*	Khan (1974)	-0.187	-2.188	Trinidad and Tobago*	Gafar (1988)	3.005	-0.532
India	Dutta and Ahmed 2006	1.48	-0.47	Turkey	Kotan & Saygili 1999	LR 0.37 SR 0.78	SR 0.26
Kenya*	Sarnad (1988)	0.885	-0.848	Turkey*	Khan (1974)	0.554	-2.715
Kenya	Faini (1988)	1.37	-1.48				
Kenya	Geda, *et al.*, 2001	0.589	-1.095				

*Source:*Anaman and Buffong (2001) pp 67. Income Elasticity (IE) and Price Elasticity (PE)*

A summary of import demand elasticities in several countries over the world is presented in Table 2.1. Goldstein and Khan (1985) recommended that income elasticity ranges between 1.0 and 2.0, while the price elasticity ranges between -0.5 and 1.0.

2.4 Import Demand Analysis and Welfare

In the neoclassical texts of microeconomics, welfare analysis is undertaken within the frameworks of consumer and producer surplus. There are few studies that have transcended the import-welfare nexus. In this, we review a few studies that have purposively analyzed import demand and gone beyond to welfare analysis. The study by Kang *et al.* (2009) analyzes import demand and welfare effects for rice importing countries using the trade approach. They estimate the consumer surplus using the import price elasticities, and then determine the effect of changes in export price on the consumer surplus of the importing country. Their results indicate that an increase in the price of exports reduces the consumer surplus of the importing country. Following this conclusion, it is possible to allude the increase in import price of wheat to the decline in the welfare of the consumers. The effects of market integration in agricultural produce traders can be seen in Bandinger *et al.* (2002), who estimated the welfare

effects of European Common Organization of the market on bananas. Using the trade approach, they determined the gains by international banana traders to be EUC 937 million, with national budgets of EU member states gaining EUC 1,036 million. The resulting deadweight losses were EUC 100 and 2,073 million losses to the consumers.

Adriana *et al.* (2005) analyzed import demand of bananas in the European Union from Latin America, Africa Caribbean, and Pacific, and the overseas countries such as Spain, Greece, Portugal and France and others (ROW). Using import price elasticities from the Almost Ideal Demand System for an indirect utility function, estimates of consumer and producer welfare changes indicate worsening trends under the import regime where imports are limited by quotas.

There is little empirical linkage of import demand analysis in Kenya and sub-Saharan Africa in general. A study by Seleka (2006) in Botswana analyzes the impacts of import controls on horticultural commodities and reveals that import controls became burdensome as consumer losses and quota rents increased and producer gains declined over time. The general argument from this study was that import controls are not effective in promoting import substitution, and that they are a major hindrance to regional integration. Botswana's import controls can be related to Kenya, and similar conclusions can be generalized over countries partially due to the variation in stages of economic development. To this effect, linking import demand and the welfare conferred to producers and consumers in a particular country is imperative. This study follows a similar approach as Seleka's (2006) and applies the trade approach to wheat import demand analysis in Kenya under import control regime, and estimates the welfare effects under import tariffs. Although the production approach would have been a better approach, the data requirement especially for the inputs at sub-sector level is limiting.

3. Theory and Analytical Framework

3.1 Wheat Import Function

Assuming that imports are treated as finished products that enter the consumer utility maximization, then import demand and welfare analysis find anchoring in neoclassical utility theory. Within the postulates of utility theory, a i^{th} consuming country such as Kenya is postulated to maximize the utility $U(M_i,.....M_n)$ subject to constraints of opportunity set defined by pm_iM_i and choice at time t, where M_i denotes level of imports of n commodities and p_i is the import price of i^{th} imported commodity. The solution to optimal case represented by maximizing utility subject to the budget constraint results into ordinary demand functions (Marshallian) expressed as quantity demanded as a function of income measured as real Gross Domestic Prices Y_t of the country, relative import prices pm_t of the imports and country specific time variant characteristics z_t such as the domestic prices. With the theoretical restrictions of homogeneity[4] of demand theory imposed, it is intuitive to conclude that the import demand function, derived from the utility function, has both theoretical and empirical underpinnings (Miller and Fratianni, 1973). The preceding exposition, assuming one country importing one commodity, is represented by equation 1.

$$M_t=f(pm, Y, z)_t \quad \text{.....(1)}$$

The function represented by equation 1 has been widely applied in the estimation of import demand, albeit in varying functional forms. Log linear functions have been widely applied because their estimates are elasticities.

In line with the literature, wheat import demand in Kenya can be conceptualized as being influenced by the commercial and relief imports, domestic production, seasonal stock carryovers, among other macro-variables such as exchange rate and policy changes, which subsequently influence the welfare. The inclusion of the variables in the models are thus not without *apriori* theoretical consideration.

Import unit values estimated as the import value to import quantities are used as proxies for import prices. As held in the demand theory, it

[4] Absence of money illusion, such that the partial derivatives of equation 1 sum to zero.

is expected that as the import price increases, the demand for imported wheat will decline. The study by Nyangito *et al.* (2002) argues that price is not one of the determinants of imports. However, it is impossible to analyze demand without prices. Similarly, increase in domestic production, which is synonymous to import substitution policy, will result into decline in the demand for imported wheat. The issues of stock carryovers, over-importation in one period which also results into increased market supply in the subsequent period, are hypothesized to reduce the demand for imported wheat. On the contrary, increase in income resulting from economic growth is expected to result to an increase in imported wheat. However, income has been controversial in some studies, with a negative sign. The reason alluded by the researchers has been on affordability. This implies that as income increases, consumers are able to afford domestic wheat and therefore demand less of imported wheat.

One of the factors that influences prices are the import controls. The imposed import tariff increases the prices of imported wheat, making it less affordable. Similarly, the Non-Tariff Barriers (NTBs) to trade also inflate the prices and make it difficult to access imported wheat. All these factors create forward and backward linkages. Other factors such as quality and freight charges are important determinants of level and origin of imports. Currently, Kenya imports most of high quality hard wheat from Argentina, leading to relatively less freight charges compared to those of other exporting countries. This study does not attempt to estimate the effects of wheat quality on imported wheat. Quality is assumed to be subsumed in the actual prices of the wheat imports.

Most of Kenya's wheat imports consist of hard wheat, while the domestic production is soft wheat. The imported wheat is of higher quality than the domestic wheat. The two are blended for use in the baking industry. While hard wheat is used for making bread, soft wheat is used for home baking. The differences in types (hard and soft) and end usage justify the imperfect substitution between imported and domestic wheat. Since imported wheat is not a perfect substitute to the domestically produced wheat due to variations in quality and type, the imperfect substitutes model developed by Goldstein and Khan (1985) is applied in this study, considering imported wheat and the domestically produced wheat as substitutes. The imperfect substitutes model is founded on the assumption that neither imports nor exports are a perfect substitute for the domestic goods or commodities.

Assuming a power function, a log-linear homogeneous imperfect substitutes model of desired import quantity derived from theoretical equation 1 is expounded in equation 2. Equation 2 depicts a standard import demand model[5]. The desired level of import quantity is hypothesized to be a function of relative prices and incomes among other factors such as domestic production, restrictive tariffs and non-tariff barriers.

$$\ln M_t^d = \alpha_o + \beta_1 \ln Y_t + \beta_2 \ln pm_t + \sum_{j=1}^{n} \beta_j z_{jt} + u_t \quad \text{..... (2)}$$

Equation 2 represents the long-run import demand model where:

M_t^d is the desired import quantity of wheat at time t in metric tonnes. The demand theory suggests that quantity rather than value is appropriate dependent variable. Relative import prices[6] pm_t estimates as $\left[\frac{p_m}{p_d}\right]_t$ can also be interpreted as a proxy for competitiveness (Tang, 2005) with p_m being the import unit value which is a proxy for import price and p_d the domestic wheat price index. The n variables denoted by z_t are country-specific variables that are theoretically hypothesized to influence imports. These include a dummy variable to denote the tariff regimes since 2001, a proxy for quantitative barrier (ratio of import quantity to total imports), and domestic production. A good measure of Non-Tariff Barriers (NTB) is not usually available and even when formulated, interpretation of its behaviour may be difficult (Faini *et al.*, 1988). A proxy is used to capture Non-Tariff Barriers (NTBs) to trade. In this case, the proxy NTB used is related to the level of domestic production and the level of imports such that as the domestic production increases, the level of imported wheat declines. This is based on the fact that according to policy regulations, wheat imports are relative to the level of domestic wheat production. This creates a kind of implicit quantitative barrier. The last term u_t is the statistical random term assumed to be normally distributed, homoscedastic and serially uncorrelated with the right hand side variables. The quantity of wheat

[5] Hong (1999) and Tang (2005) point out that import demand can be modeled by two determinants: income and relative prices. Other factors can be subsumed within these two factors, at least theoretically. The factors behind relative prices include: relative endowments of resources and productive factors, tastes, market structure, scale, exchange rates and trade barriers. The impacts of changes in these factors on demand will take place through change in relative prices.

[6] It should be noted clearly that the unit value of imports at the border represents the world price and are denoted by p_w in the subsequent sections, while the price of imports (p_m) is inclusive of 35 per cent import tariff.

demanded is hypothesized to be a subject of domestic production. As the domestic production increases, it is hypothesized that wheat imports will decline. This is because domestic production could be a substitute to imported wheat. Similar effects are expected for the dummy and the proportionate quota importation.

The left hand side variable of equation (2) is not observable, hence the equation is not estimatable if partial adjustment mechanism is not specified. The essence of specifying the partial adjustment model emanates from the postulation that the desired, equilibrium, optimal, or the long-run wheat import demand is determined by the adjustment of the *apriori* theoretical factors such as relative prices and income. Taking the expected demand as rational, then rationalization through partial adjustment is done. This requires that the actual change (difference) in imports over subsequent periods be related to desired quantity for imports in period *t* and actual imports in period *t-1* (Khan, 1974) as follows:

$$\Delta \ln M_t = \gamma[\ln M_t^d - \ln M_{t-1}] \quad \text{.....(3)}$$

Where 0≤γ≤1 is the range of coefficient of adjustment and is the actual change. Substituting (2) into (3) and solving for imports in period *t*, results to the following import demand short-run partial adjustment model in equation 4.

$$\ln M_t = \gamma\alpha_o + \gamma\beta_1 \ln Y_t + \gamma\beta_2 \ln pm_t + (1-\gamma)\ln M_{t-1} + \sum_{j=1}^{n} \gamma\beta_j z_{jt} + \gamma u_t \quad n=1..3 \text{.....} (4)$$

Equation 4 forms the standard or the traditional import demand model, with income and relative price as the explanatory variables (Tang, 2005). The model has received wide application in literature in both developed and developing countries. The model assumes some degree of substitutability between imported and domestic commodities, and upholds the imperfect substitutes assumption and homogeneity in prices (Mann and Plück, 2005) and income. That is, the estimated coefficient on the trade price and domestic price are equal, thus allowing for a single relative price term and that the elasticities with respect to economic activity (e.g., income) and relative prices are constant over time. The coefficient (1-γ) defines the speed of adjustment between the actual and the desired levels of imports. The properties of γu_t are similar to those of u_t (homoscedasticity, no serial correlation and normal distribution). The *apriori* theoretical assumptions on the income and price estimates are $\beta 1>0$, and $\beta 2<0$, respectively.

Sometimes, income elasticity may be greater than one. This means that demand for imports increases more than proportionately to the increase in real GDP (Dutta and Ahmed, 2006). A larger than unity import demand elasticity indicates a high response to prices and more deadweight, and implies that the industry/sector/enterprise should be accorded protection from import surges if price declines are experienced. It is expected that an increase in a country's income will increase demand for imports, resulting into positive income elasticity, while an increase in relative price terms will result into decline in imports, hence negative import price elasticities. However, the sizes of the coefficients on income and relative price vary greatly by study, time period, countries analyzed, coverage of commodity groups, and as to whether different or additional explanatory variables are in the model as revealed by the literature (Mann and Plück, 2005).

Estimation of equation 5 has previously been done through error correction models. The analysis of import demand model with error correction models has not been yielding as theoretically expected. While Mwega (1993) obtained insignificant income and price parameters, Geda *et al* (2001) assumed the existence of cointegration in order to estimate long-run elasticities. Taking Kenya to be a small country, its imports account for a small fraction of the world imports, and it is plausible to assume perfect elasticity of import supply (Dutta and Ahmed, 2006). This assumption may be realistic because the rest of the world may be able to supply exports to Kenya even with an increase in prices. By this assumption of infinite import supply elasticity, the model reduces only to an import demand model. For the imperfect substitutes model adopted in this study, wheat imports' supply is not assumed to be perfectly elastic, but tests for endogeneity are undertaken for import quantities and relative prices because the relative prices are ratios of import price and domestic price index. Estimation is therefore undertaken through Instrumental Variable Two Stage Least Squares (IV2SLS) in order to correct endogeneity. To have comparative results due to the assumption of price taking behaviour in developing countries, both OLS and IV2SLS are undertaken in the estimation. The IV2SLS solves for a simultaneous relationship (endogeneity) between prices and quantities of imports, meaning the specification and identification of the price equation to solve the problem of endogeneity. Khan (1974) proposed the specification of the price (inverse import supply) equation that identifies the import quantity equation and then simultaneous estimation of the two equations. The specified inverse imports supply equation for equilibrium purposes

and including the non-instantaneous adjustment of price, taking into consideration that prices respond to excess supply, that is:

$\Delta \ln pm_t = \gamma[\ln M_t^s - \ln M_t]$ can be expressed as follows:

$$\ln pm_t = \alpha_o + \theta_1 \ln M_t + \theta_2 \ln p_{wt} + \theta_3 \ln Y_{wt} + \theta_t \ln pm_{t-1} \quad \text{.....(5)}$$

with equilibrium of the suppliers as $M_t^d = M_t^s$.

Where M_t is the actual imported wheat quantity, p_{wt} is unit value of wheat imports (border price), Y_{wt} the World GDP (Argentina GDP as the proxy since it is the major and consistent exporter of wheat to Kenya) and θ's are parameter estimates obtained after price adjustment and substitution of the import supply equation. Equation 5 is estimated with the lagged dependent variable, world GDP and world price as instruments.

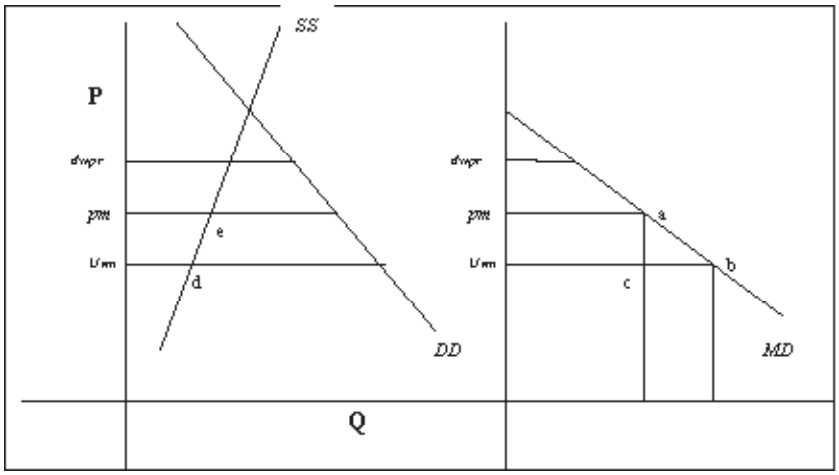
3.2 Welfare Estimation

Varian (1992) alludes that consumer surplus is the classical tool used for measuring welfare changes on the consumer side. To estimate the welfare trickling down to the wheat producers due to import restrictions, emphasis is given to the estimation of producer, consumer welfare and the quota rents. Assuming that the import demand is simplified to a power, then integration of the function over the range of import prices and domestic wheat prices is relatively simple.

Following Appleyard and Alfred (1998), a graphical estimation of welfare from 2001 to 2007 is presented in Figure 3.1. Import demand function derived from excess demand is represented by *MD* and captures the marginal benefits of imports. Figure 3.2 is a depiction of the scenario of wheat market in Kenya. The import price at the border is represented by *uvm*. This price is taken as the import unit value of the imported wheat. The domestic prices offered to wheat producers in the country is shown by *dwpr,* while the tariff inclusive import prices are represented by *pm=uvm(1+r)* , where *r* is the tariff rate. The region *pmacUvm* under the import demand curve represents the equivalence of quarter rents under DD and SS if the price ranges between the import unit value and the import unit value inclusive of tariff. The producer surplus under the tariff rate is the area *pmedUvm* while the dead weight is the area *abc*. The total of the producer surplus, quota rents and dead weights is the consumer surplus.

Using the import demand and domestic supply elasticities, the consumer and producer surplus is estimated as an integral at the range

Figure 3.1: Deriving import demand function from excess demand



Source: Appleyard and Alfred (1998)

between the world wheat price and the domestic wheat prices. Following Seleka (2006), integration to obtain the consumer and producer surplus in line with Figure 7 can be exposed as follows:

$$\Delta PS = \varphi \int_{Uvm}^{dwpr} [p_d^{e_s}] \quad \text{..... (6)}$$

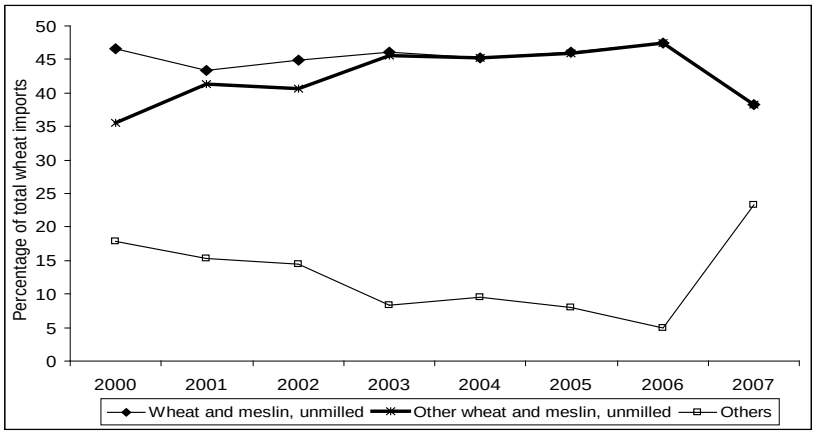
$$\Delta CS = \varphi \int_{Uvm}^{dwpr} [p_d{}^{e_s}] + \theta \int_{Uvm}^{dwpr} [pm \quad \text{..... (7)}$$

Where $\emptyset$ and θ are domestic supply and import demand shifting factors, e_m is the import price elasticity obtained from the regression as $\gamma\beta_2$, which is the short-run elasticity, e_s is assumed to be perfectly inelastic p_d and pm are as defined previously. The shifting parameters are obtained by rearranging their respective equations.

Considering that the border and domestic price of wheat differ, such that the domestic price is higher, then the accrued producer and consumer surpluses; if an import tariff is imposed to bring the price of imports to the same competitive (equilibrium) price, a decline in consumer surplus (CS) and increase in producer surplus (PS) and quota rents (QR) will be seen. Two scenarios under price are considered in estimating welfare in Figure 3.1 since the current import tariff does not bring the imported wheat prices at par with the domestic prices. One, the domestic wheat price is more than the import unit value, inclusive of the tariff.

$dwpr > uvm(1+r) = pm$ 8

Figure 3.2: SITC 2 classification category imports



Source: UNcomtrade (2009)

Two, tariff sets the import prices equal to the domestic prices making the domestic output compete effectively with imports. This is called the competitive level.

dwpr > uvm(1+r) 9

3.3 Data Sources and Empirical Model

The international trade commodity classification used in this study is the Standard International Classification revision 2 (SITC rev 2), which runs from 1980, unlike the other commodity classifications that are short. In this classification, two categories have dominated the overall wheat imports, these are wheat and meslin, unmilled-code S2-041 and other wheat and meslin, unmilled code S2-0412.[7] These two categories have accounted for over 80 per cent of the total wheat and byproducts imports (for sample years see Figure 3.2).

Data for the study was obtained from the various Economic Surveys, and Kenya Institute for Public Policy Research and Analysis and Ministry of Agriculture (KIPPRA-MoA) data compendium, FAOSTAT, UNComtrade data base, United States Department of Agriculture (USDA), and IMF database between 1980 and 2009.

The simultaneous estimation of the price equation 6 is estimated with the country GDP (Kenya), lag of domestic production, a proxy for

[7] These are international trade classification codes for traded commodities.

quantitative barrier, a dummy for the tariff, unit value of wheat products exports from Kenya and proxy for world GDP (Argentina),[8] world price (border price) and lags for the dependent variables as instruments identifying the system. Logarithm of imports quantity and import price are the endogenous variables in the system. Time series data suffers from non-stationarity problem. To identify the non-stationary variables, tests for stationarity were conducted using the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. Tests for stationarity are important to ensure that all the variables are stationary, since regressing non-stationary variables would result to spurious regressions. In the event of non-stationarity, variables were differenced until stationarity was achieved. Differencing was also important to reduce multicollinearity of the right hand side variables. The variables used in the model are defined in Table 3.1.

The empirical model drawn from the theoretical and conceptual frameworks is formulated as linear or log-linear. The empirical version of equations 4 and 5 are therefore expressed as 10 and 11, respectively.

The import demand elasticities β_2 obtained from equation 7 are used to estimate the consumer and producer surplus.

$$\ln M_t = \gamma\alpha_o + \gamma\beta_1 \ln Y_t + \gamma\beta_2 \ln pm_t + (1-\gamma)\ln M_{t-1} + \gamma\beta_3 \ln dpxn_{t-1} + \sqrt{a^2+b^2}$$
$$\gamma\beta_4 \ln tar + \gamma\beta_5 dmtar + \gamma\beta_6 \ln uvex + u_t \quad \text{..(10)}$$

$$\ln pm_t = \alpha_o + \theta_1 \ln M_t + \theta_2 \ln p_{wt} + \theta_3 \ln Y_{wt} + \theta_t \ln pm_{t-1} + \varepsilon_t$$
$$\text{..(11)}$$

[8] The choice of Argentina as the proxy income for the world income was based on the cost of production of a bushel of cereals, which was 25% below that of USA, providing a strong competitive edge internationally. The production level in US is $166 per acre ($3.97 per bushel). Use of USA's GDP did not give a significant instrument identifying the inverse supply equation. Besides, Argentina is one of the major exporters of wheat to Kenya.

Table 4: Variable definition

Variable name	Variable definition
$ln\ M_t$	Natural logarithm of quantity of imports of wheat (tonnes)
$ln\ Y_t$	Natural logarithm of domestic GDP
P_d	Domestic price index
$ln\ p_w$	Unit value of imports (border price)
lndwpxn	Natural logarithm of domestic supply of wheat (tonnes)
lntar	Natural logarithm of proxy for wheat import non-tariff barrier domestic production to import quantity
$ln\ pm_t$	Natural logarithm of relative prices. Ratio of the import to the domestic wheat prices (wheat import prices inclusive of the 35% import tariff)
$ln\ Y_{wt}$	Natural logarithm of world GDP proxy (Argentina GDP)
dmtar	Dummy for tariffs taking values of 0 for the period 1980 to 2000, and 1 for the period 2001 to 2007
lnuvex	Natural logarithm of unit value of exports of wheat flour

4. Results and Discussion

The results of the estimated wheat import demand function are presented in this section. Descriptive statistics of the data used in the analysis, diagnostic statistics for time series data, the import demand function and the welfare estimates are discussed.

4.1 Descriptive Statistics and Diagnostic Tests

The summary statistics of variables used are given in Table 4.1. Mean annual wheat imports is 629,641 tonnes at an average import price of Ksh 1,512 per tonne. Domestic production averaged 144,768 tonnes.

The Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were conducted for variables at level and at first difference with trend for the ADF and also conducted the Phillips-Perron test for first differenced variables with trend to compare the integration order levels. The non-stationarity hypothesis was tested against 1 per cent, 5 per cent and 10 per cent of the critical values, and stationarity accepted using the MacKinnon p-values.

The results of Augmented Dickey Fuller test for unit root (ADF) and Phillips-Perron test for unit root (PP) tests, together with MacKinnon p-values and critical values are presented in Table 4.2. At level, the hypothesis of non-stationarity could not be rejected, unlike at first difference. Several diagnostics tests are important when using Instrumental Variable Two Stage Least Squares (IV2SLS). They include the *Sargan*, *Bassman* and Wooldridge's 1995 robust score test, which

Table 4.1: Summary statistics

Variable	Obs	Mean	Std. Dev	Min	Max
M_t	28	629,641	422,985	64,925	1,300,890
pm_t	28	1,512	565	773	3,146
Y_t	28	613,018	515,585	74,940	1,814,243
dwpxn	28	144,768	60,937	52,900	242,300
dmtar	28			0	1
tar	28	1,169	2,095	0	6,082
uvex	28	404	125	219	727
pw	28	7,879	4,870	1,612	17,376
ywt	28	9,468,746	7,326,958	1,095,861	2.22e+07

Table 4.2: Augmented Dick Fuller and Phillips Perron Tests

	ADF tests at level with trend			PP tests at first difference		
	ADF Z(t)	MacKinnon approximate p-value for Z(t)	ADF Z(t)	MacKinnon approximate p-value for Z(t)	PP Test Statistic Z(t)	MacKinnon approximate p-value for Z(t)
	-3.053	0.1178	-5.674	0.0000	-9.1070	0.0000
	-2.215	0.4816	-4.208	0.0044	-7.003	0.0000
lndwpxn	-2.669	0.2491	-5.088	0.0001	-6.8660	0.0000
lntar	-2.393	0.3832	-5.281	0.0001	-7.889	0.0000
	-2.365	0.3984	-3.628	0.0276	-5.873	0.0000
lnuvex	-3.002	0.1316	-4.056	0.0073	-3.157	0.0933
ln	-1.927	0.6407	-4.404	0.0022	-6.010	0.0000
	-1.089	0.9309	-3.886	0.0127	-5.920	0.0000
	1% Critical Value (-4.371) 5% Critical Value (-3.596) 10% Critical Value (-3.24)		1% Critical Value (-4.380) 5% Critical Value (-3.600) 10% Critical Value (-3.240		1% Critical Value (-4.371) 5% Critical Value (-3.596) 10% Critical Value (-3.238)	

Source: Estimations data

validate the instruments used. A statistically significant test statistic always indicates that the instruments may not be valid.

The insignificance indicated by *p*-values of the Sargan, Basmann and Wooldridge score tests rejected the problem of instrumental invalidity (Table 4.3). The Durbin Watson statistic indicated no serial correlation.

The anticipated problem of endogeneity between import prices and imported quantities was tested. Endogeneity can be caused by omitted variables, mis-specification and simultaneity. Simultaneity and exogeneity were tested using the Hausman Specification error test. Simultaneity was confirmed using robust standard errors. If robust standard errors were not used, then simultaneity could not be statistically detected. The significance of simultaneity when tested through robust errors is an indicator of the price-taking behaviour of

Table 4.3: Tests of over identifying restrictions

Sargan $chi^2(3)$	0.338868	p = 0.8441
Bassmann $chi^2(3)$	0.211288	p = 0.8997
Score $chi^2(3)$	0.283501	p = 0.8678
Durbin Watson	1.852512	

developing countries. However, this also shows that the assumption of no simultaneity should not be generalized but tested.

4.2 Wheat Import Demand Function

Results of the Instrumental Variable Two Stage Least Squares (IV2SLS) estimation are reported in Table 4.4. The OLS estimates are reported in Table 4.5 for comparison purposes. These short-run elasticities and long-run elasticities can be recovered by dividing the estimated short-run coefficients by the coefficient of adjustment. Estimates from both estimators are realistic in terms of *apriori* theoretical underpinnings of demand theory, that the price elasticity of demand should be less than zero, while the income elasticity should be greater than zero. Lack of related studies in Kenya limit comparison of the results obtained in this study. The following discussion is focused on the IV2SLS estimates due to the lower values of standard errors of the estimates compared to the OLS estimates.

The estimated coefficients of the IV2SLS are short-run impact multipliers and in this study estimation is done by incorporating import restrictions and dynamic equilibrium. The estimated price and income

Table 4.4: Dynamic instrumental variable 2sls regression of wheat import demand

			Number of obs	26
			Wald $chi^2(7)$	696.8
			Prob > chi^2	0.0000
			R-squared	0.8515
			Root MSE	0.20104
	Coef.	**Std. Err.**	**z**	**P>|z|**
ln pm_t	-0.3715***	0.1284	-2.8900	0.0040
ln Y_t	0.3768**	0.1624	2.3200	0.0200
Lagged lndwpxn	-0.2909***	0.0687	-4.2300	0.0000
dmtar	0.0296	0.0899	0.3300	0.7420
dlntar	-0.5850***	0.0943	6.2000	0.0000
Lagged	-0.1965**	0.0997	-1.9700	0.0490
Lagged lnuvex	0.2704***	0.0959	2.8200	0.0050
Constant	0.0242	0.0321	0.7500	0.4510

*** Significant at 1%; **Significant at 5%; and *Significant at 10%.
All the lagged variables take one period lags

Source: Estimations from data

Table 4.5: OLS regression of wheat import demand

			Number of obs	26
			F(7, 18)	72.46
			Prob > F	0.0000
			R-squared	0.8524
			Root MSE	0.24088
	Coef.	**Std. Err.**	**t**	**P>|t|**
	-0.30469*	0.17066	-1.79	0.0910
	0.35154*	0.19149	1.84	0.0830
lndwpxn L1	-0.29236***	0.08250	-3.54	0.0020
dmtar	0.02464	0.10608	0.23	0.8190
dlntar	0.58633***	0.11417	5.14	0.0000
L1	-0.19088	0.12093	-1.58	0.1320
lnuvex L1	0.29234**	0.12050	2.43	0.0260
Constant	0.02614	0.04055	0.64	0.5270

*** Significant at 1%, **Significant at 5% and *Significant at 10%. All the lagged variables take one period lags

Source: Estimations from data

elasticities of import demand are significant with the price (-0.371) and income (0.377) revealing inelastic relationship. The price elasticity of imports is favourably comparable to the hypothesis of Goldstein and Khan (1985) on the range for typical import price elasticity (-0.5 to -0.1) for the imperfect substitute model in absolute values.

The signs on the relative wheat import price and income are according to the economic theory of demand. The sign for relative import price is negative, while that for income is positive as previously hypothesized confirming price and income inelasticity of demand for wheat imports under a tariff. This is similar to the typical hypothesis of demand theory, as when prices increase, the demand for a normal commodity declines. When income increases, demand also increases.

The price elasticity of import demand is significant, implying that price is an important determinant of imports, although it is less than one. This elasticity compares favourably with the views held in previous studies by Khan (1974), Bahmani-Oskooee (1986), and Faini *et al* (1988) that import price elasticity for developing countries is inelastic. The import price elasticity is less than negative one and is inelastic, implying that although import price is an important determinant of the quantity of wheat imports, the response is less than one (less than 100%).

Similarly to the import price elasticity, the income price elasticity is inelastic and significant. This compares with Sarnad (1988) on the inelastic nature, although Sarnad's income elasticity is higher (0.885) and tends towards unity. However, this deviates from the results of previous studies, which acknowledge that income elasticities are greater than one in most developing countries. From the income elasticity, it is possible to figure out that wheat in Kenya is a necessity, and this confirms why it is an important cereal crop in the country that attracts government intervention.

Acknowledging that there is no adequate NTB measure, a proxy measure of NTB used in the study is the ratio of imports to domestic production. Kenya imports wheat relative to the domestic production. The wheat imports are thus restricted by the level of domestic production. The proxy NTB (ratio of domestic production to imports) is negative and highly significant. This indicates that the significant effectiveness of quantitative restriction based on domestic production directly shows the increasing importation against the near constant domestic production. The sign of the dummy for import tariffs is opposite of the expected. However, the coefficient is insignificant and further indicates the ineffectiveness of the tariff impositions as a way of controlling imports. This finding differs with Faini *et al* (1988), who established that import controls (tariffs and non-tariff trade barriers) had significant effects in reducing imports. The difference between the results of this study and that of Faini *et al* (1988) is because of policy shifts since, before 1992, import controls were effective policy tools to control imports. However, afterwards, imports liberalization made them ineffective, and even when applied, the supply of imports to a small country can be perfectly inelastic. This supports the existence of price differences between wheat imports and domestic wheat prices to farmers. Even with the tariff on wheat import prices, domestic prices are still high, and this gives imports undue market advantage. The ineffectiveness of the import tariff also implies that there is little benefit trickling to the producers. The implication of the insignificant and significant effects of the import tariffs and non-tariff barriers, respectively, point that it may be plausible to promote domestic industry competitiveness through support of the domestic wheat industry without restricting trade.

The estimate for lagged domestic wheat production is negative and highly significant. This means that domestic wheat production reduces import demand in the subsequent period, implying there is possibility of

substitution between imports and domestically produced wheat. During the import substitution era, which lasted until 1992, imported wheat was low compared to the post-1992 period. The government supported wheat farming through provision of inputs such as fertilizers, credit, and extension and marketing services, hence reducing production costs and giving domestically produced wheat a competitive edge over imported wheat. The producer prices for domestically produced wheat were lower than the imported wheat prices, which were controlled through imposition of import tariffs. The liberalization of the wheat industry in 1993 brought changes, and the government divested from support and service provision. Currently, the industry suffers from high production costs emanating from high capital costs, diseases and pests, lack of credit and financial services, and low adoption of technology (Nyangito *et al.,* 2002). Low adoption of high yielding wheat technologies is attributed to low literacy and inadequate wheat farming experience (Gamba *et al.,* 2002). In the recent past, there have been some signs of improvement in production growth, but this has not been sufficient to satisfy the ever increasing demand, and the deficit has persisted, forcing importation. However, the slight increase in domestic wheat production has made wheat imports erratic, and there has been a slight decline in the trend. Such increase in domestic production could have emanated from the re-emerging support of government to the wheat farmers under the Economic Recovery Strategy, and strict monitoring of imports to avoid over-importation.

The lagged imports coefficient captures the dynamics of wheat import demand. The coefficient is negative and significant and implies the non-instantaneous adjustment of imports in subsequent period. This implies that previous year's imports are carried forward to the current import period, consequently reducing the amount imported. The coefficient of adjustment γ is positive and greater than one (1.2), implying that more than the discrepancy between the desired and actual is eliminated over the period, a rather fast adjustment. This could be pointing to over-importation in the previous period due to poor monitoring of the amount of wheat imported. The over-imported wheat is stored and released into the market in the subsequent period, hence dampening domestic prices by creating market glut even when there is relatively low importation of wheat. The possibility of over-importation points to the poor administration of import control measures, or over-estimation of the deficit in the country.

The variable increase in unit value of exported wheat flour is positive and significant. Increased exportation, which results from increasing the price of exported wheat products, results to an increase in the quantities of wheat imported, because domestic production cannot satisfy both domestic and regional demand. The increasing exportation is attributed to the increasing regional integration within Africa. The EAC and COMESA are increasingly becoming regional market destinations for Kenyan wheat products, despite the asymmetric imports and exports tax structures. There is need to assess whether the country can benefit more by importing and processing wheat and taking advantage of the increasing regional demand.

The long-run elasticities are obtained using the dynamic adjustment estimate as proposed by Khan (1974) and Sadoulet and De Janvry (1995). The long-run elasticities are therefore estimated as:

$$E_{lr} = \frac{\beta}{1-(1-\gamma)}$$

with β being respective elasticity for income and price. The estimated long-run import price and income elasticities under import controls are -0.311 and 0.315, respectively. Nzuma (2007) estimated long-run Marshallian domestic demand for wheat to be -0.345. These results also confirm Faini *et al* (1988) that the long-run import price elasticities are inelastic in developing countries. The small difference between the long-run import and domestic demand elasticities imply that, in the long-run, domestic demand and import demand could be identical.

4.3 Welfare Estimates

Welfare estimates were obtained by integration of the import demand function. The function was simplified to a power function and integral values of the two scenarios estimated over the range of difference in prices. The resulting values were the areas under the import demand curve. The estimation of equations 6 and 7, therefore resulted to the welfare estimates of changes in producer surplus (PS) and consumer surplus (CS), respectively. The results of the estimated changes in PS, CS, QR and the deadweight (DW) for the period under which import tariffs have been in place are reported in Table 4.6.

Table 4.7 presents the percentages of estimated changes in CS, PS, QR and DW to the imported wheat value. In general, the estimated changes

Table 4.6: Changes in producer and consumer surpluses and quota rents (Ksh Mn)

Year	Import value	PSr	PS	CSr	CS	QRr	QR	DWr	DW
2001	15,800	328	334	-5,390	-5,820	2010	2050	3,052	3,436
2002	9,740	367	218	-5,490	-3,600	2130	1270	2,993	2,112
2003	12,000	473	315	-6,030	-4,440	2350	1560	3,207	2,565
2004	13,000	403	511	-3,410	-4,790	1330	1690	1,677	2,589
2005	15,200	730	526	-6,930	-5,630	2750	1980	3,450	3,124
2006	15,400	761	441	-8,740	-5,700	3470	2010	4,509	3,249
2007	18,100	909	633	-8,470	-6,670	3380	2350	4,181	3,687

PSr, CSr, QSr and DWr are estimates of second scenario that the tariff equates the domestic and import prices of wheat

Source: Estimations from data

in PS, CS and QR indicate that increase in tariff leads to increase in each of these measures. The wheat tariff rate should be higher in order to equate wheat import prices and domestic prices. This implies that the current wheat import tariff should be increased, if the domestic prices are to be competitive. However, increasing the tariff would result to higher changes in consumer surplus.

The results in Tables 4.5 and4.6 indicate that changes in CS ranged between Ksh 3.4 and 8.7 billion (3,410 million and 8,740 million as in Table 4.6) or 26 per cent and 57 per cent of the imported wheat value, respectively, under competitive prices. If the import price inclusive of the tariff is less than the domestic prices, consumer surplus change ranges between Ksh 3.6 billion and 6.6 billion, or between 36 per cent and 37 per cent of the imported wheat value. This implies that the change in CS is smaller when tariffs are low. The decrease in CS results from the difference in prices between the imported and the domestic prices of wheat, which is as a result of the imposed import tariff. The domestic prices are higher than those of imported wheat.

The imported wheat and wheat products are cheap compared to the domestic wheat and wheat products. The imposed tariff pushes import prices higher, and consequently results to loss in consumer surplus. The PS increased between 0.334 billion to 0.633 billion (2-4%) between 2001 and 2007 but would have increased from 0.328 to 0.909 billion (2-5%) if the tariff was higher. Although this is a relatively small increment of PS to other measures, it indicates the theoretically hypothesized benefits of producers under import restrictions. The QR would increase between 10 and 23 per cent of the value of imported wheat under a competitive price tariff; alternatively if the tariff is less, then the QRs are low and remain at around 13 per cent. The losses incurred by consumers cannot be compensated by the gains of the producers.

Table 4.7: Percentage of changes in CS, PS and QR to imported wheat value

year	PSr	PS	CSr	CS	QRr	QR	DWr	DW
2001	2.1	2.1	34.1	36.8	12.7	13.0	19.3	21.7
2002	3.8	2.2	56.4	37.0	21.9	13.0	30.7	21.7
2003	3.9	2.6	50.3	37.0	19.6	13.0	26.7	21.4
2004	3.1	3.9	26.2	36.8	10.2	13.0	12.9	19.9
2005	4.8	3.5	45.6	37.0	18.1	13.0	22.7	20.6
2006	4.9	2.9	56.8	37.0	22.5	13.1	29.3	21.1
2007	5.0	3.5	46.8	36.9	18.7	13.0	23.1	20.4
Average	4.0	3.0	45.2	36.9	17.7	13.0	23.5	21.0

PSr, CSr, QSr and DWr are estimates of second assumption that the tariff equates the domestic and import prices of wheat

Source: Estimations from data

Import tariffs result into some losses in consumer surplus that are not transferred to anyone. These are the deadweight losses. These represent the net cost to society emanating from distortion of domestic free trade. These can be viewed as the efficiency losses resulting from high cost of production and the losses in consumer choice alternatives accompanying the tariff (Appleyard and Alfred, 1998). The deadweight losses are higher when the tariff-inclusive prices are not competitive. On average, over the period, they amount to 24 per cent when the import tariffs are higher than 35 per cent and 21 per cent when the tariff is 35 per cent. This implies that when the tariff does not serve to make domestic enterprises competitive through prices, then the implied losses in efficiencies to producers and reduction of the field of choice to consumers are high. The deadweights are estimates of the bearing of gains and losses and are also pointers to the aspects of trade creation and diversion that are not exclusively discussed in this study. The high deadweights also point to high resource flight to alternative competitive enterprises. They indicate the disincentives to consumption and inefficiencies to production caused by the import tariff. Although there is an indication of increase in level of production since 2001, the overall trend from 1980 has shown decline in production. In general, the overall gain favours non-tariff conditions as indicated by the overall average measures over the period. The averages over time indicate that less or full elimination of wheat import tariff is better.

5. Conclusions and Recommendations

5.1 Conclusions

The effectiveness of trade and how it affects domestic industries and consumers cannot be well explained without import price and income elasticities. Also, import controls especially in developing countries have been deemed important in estimation of import demand functions. This study has estimated the import demand function for wheat under import controls through an Instrumental Variable Two Stage Least Squares (IV2SLS) estimator. The IV2SLS estimates are used in the calibration of welfare measures to justify the imposition of import tariffs. Import tariffs have been used widely to protect domestic enterprises against external competition, and have been an issue of debate in policy making circles.

The empirical analysis of the short-run elasticities reveals that wheat import demand function is determined by import prices, import barrier and domestic production. Wheat import demand is found to be influenced by relative prices, income and domestic production. Exports of wheat and wheat products, and non-tariff trade barriers are also important as factors influencing import demand. Price and income elasticities exhibit inelastic behaviour of wheat import demand. The less than one price and income elasticity points to the fact that import demand is less responsive to price and income changes. However, the two significantly influence the level of wheat imports.

This is also supported by the high deadweight loss, which indicates trade diversion. Import tariffs are not significant in determining imports, and consequently this means that they are not effective tools of promoting import substitution. Import barriers (the ratio of imports to domestic production) could be more effective in protecting the domestic producers than the tariff rates. This points to the important fact that the industry requires no protection, but increased support through production cost reduction strategies. This evidence is further supported by the high deadweight losses that indicate the increased losses in efficiency due to high costs of domestic production which consequently leads to high prices of wheat and wheat products, and consequently loss in consumer alternative choices.

Welfare estimation was done through integration of the import demand function. The elasticities of import prices were used to determine the welfare of consumers, producers and the government besides the

deadweight effects of the import tariff. It has been clearly shown that import controls are detrimental to consumers, and that the benefits accrued by the producers cannot compensate the losses incurred by consumers due to increased wheat product prices. The estimates paint the picture of distribution of benefits over the value chain agents and indicate the implications of an import tariff to producers, government, consumers and a resource-shift to alternative enterprises.

Under a tariff rate of 35 per cent, producers gain about 3 per cent of the imported wheat value, consumers lose about 37 per cent while the gain in quota rent is 13 per cent. The deadweight is estimated to be 21 per cent. Welfare measures indicate increasing gains to the importing firms against decreasing consumer surplus. Although there is a slightly higher production response in the presence of import tariffs, the gains to the farmers are insignificant as exhibited by the amount of welfare in terms of Kenya Shillings that trickle down the chain. The gains by producers due to an import tariff in wheat are far less and cannot compensate the loss incurred by consumers. The deadweight or the efficiency losses in production and the losses of choice by consumers are higher under higher import tariff rates. This means that import tariffs increase inefficiency in wheat production, besides making few alternatives available to consumers, thus wheat import controls constrain the development of the wheat sector.

Due to the numerous challenges facing wheat production in Kenya, this study contributes to the debate on import tariffs as safeguard mechanisms to protect the domestic wheat industry. While there is hardly any evidence to justify the importance of import tariffs, the results from this study can serve as a basis for decision making. The study has shown that even when import tariffs are justified theoretically, the actual impact is insignificant to the producers whom they are indebted to protect.

5.2 Recommendations

This study brings into focus several points of intervention in relation to the wheat import tariffs, wheat production and consumer and producer welfare in the wheat sub-sector.

Import tariffs have no significant effect in reducing wheat import demand. Further, under import tariffs, consumer welfare loss is higher compared to the gains transferred to the wheat producers. In light of these

results, and at the background of the principles of regional integration that require free market, tariffs should be abolished.

The variable for lagged domestic production indicates that domestic production is important in reducing the level of wheat imports. It is therefore important to put in place strategies geared towards increasing domestic production of wheat, especially for the imported varieties. Kenya imports hard wheat for blending. Domestic production of wheat suffers from several setbacks, which include poor adoption of high yielding technologies and high costs of production. Efforts should be geared towards providing support for domestic production of hard wheat through research and extension linkage, targeted input subsidies and enhanced mechanization.

From the welfare analysis, the welfare accrued by producers under import tariff is very little, compared to the losses incurred by the consumers. While the gains by producers should be commensurate to the losses of consumers, evidence reveals that this is not happening, and points to the long chain between the producers and consumers. To shorten the chain and increase the benefits of the producers, value addition is imperative. This is possible if the producers can engage more in the wheat industry value chain. The government should therefore promote value addition particularly by encouraging wheat farmers to own milling factories, where they can mill and package their wheat. This will increase their profits and consequently their welfare.

The lagged dependent variable indicates that wheat imports adjust faster and more within one year, meaning there is over-importation. Thus, the over-imported wheat is released into the market in the subsequent period, hence dampening domestic wheat prices. The need to restrict the level of import to the deficit is important to avoid market gluts. The need to license credible importers is thus important. In this case, farmer-based organizations such as farmer co-operatives guarded by stringent rules and regulations can be licensed to operate in the region. It is important to take advantage of the growing inter-regional market as a stimulant for growth of the wheat sub-sector. Enhancing the domestic manufacturing capacity and encouraging more exportation of wheat products will be important. In light of regional agreements, the government should negotiate for removal of wheat product tariffs by other EAC and COMESA members in order to gain a level marketing ground.

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