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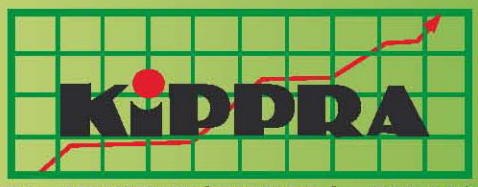

The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

Effect of Trade Facilitation on Kenya's Exports to the European Union: Case of Fruits and Vegetables

Boniface Owino

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

YOUNG PROFESSIONALS (YPs) TRAINING PROGRAMME

Effect of Trade Facilitation on Kenya's Exports to the European Union: Case of Fruits and Vegetables

Boniface Owino

Trade and Foreign Policy Division

Kenya Institute for Public Policy
Research and Analysis

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Abstract

The objective of this study was to estimate the effects of trade facilitation on Kenya's fruits and vegetables exports to the European Union using an augmented gravity model. The trade effect of improving trade facilitation in Kenya to the level of its major competitors in the EU was also estimated. The study found a positive and statistically significant relationship between exports of fruits and vegetables and customs efficiency, importer regulatory efficiency, exporter regulatory efficiency, ICT use, and quality of air transport infrastructure index. This means that trade facilitation with respect to these variables has a positive effect on exports. Additionally, production volume and lagged importer GDP per capita have a positive effect on exports of fruits and vegetables. However, a depreciation of the Kenya shilling against the US dollar and an increase in Kenya's GDP per capita reduce exports. Improving Kenya's ICT use and customs efficiency index to the level of Costa Rica would positively affect exports of fruits and vegetables. Similarly, improving Kenya's regulatory efficiency and quality of air transport infrastructure index to the level of Morocco would have a positive effect on exports. In light of these findings, the study recommends implementation of trade facilitation measures geared towards improving customs efficiency, regulatory efficiency, air transport infrastructure, and ICT use to reduce trade costs and improve exports.

Abbreviations and Acronyms

ASEAN	Association of Southeast Asian Nations
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
ECOWAS	Economic Community of West African States
EPAs	Economic Partnership Agreements
EU	European Union
FDI	Foreign Direct Investment
FEM	Fixed Effect Model
FTA	Free Trade Agreements
FT	Trade Facilitation
GCR	Global Competitiveness Report
GMM	Generalized Method of Moments
HCD	Horticultural Crop Directorate
HTM	Hausman Taylor Model
ICT	Information and Communication Technology
JKIA	Jomo Kenyatta International Airport
MFAIT	Ministry of Foreign Affairs and International Trade
NBT	Non-tariff Barriers to Trade
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
REM	Random Effect Model
SMEs	Small and Medium Enterprises
SSA	Sub-Saharan Africa
WEF	World Economic Forum
WTO	World Trade Organization

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1. Introduction

1.1 Background

Reducing trade costs is an integral aspect of measures taken to improve a country's competitiveness in international trade. There are two aspects of trade costs, namely, trader-specific costs and trading environment specific costs (De, 2009). Trade costs that are specific to the trader are mainly determined by operational efficiency at firm level. Thus, they can be reduced by individual traders through better management and improved efficiency (Melitz, 2003). Trade costs that are specific to the trading environment are external to the trader. They are attributed to, among other factors, in-built inefficiencies in public institutions, regulation, and customs management; lack of adequate transport and communication infrastructure; trade tariffs and information asymmetry; and administrative loopholes that encourage rent-seeking behaviour at various stages of international trade.

Although international trade costs cannot be eliminated entirely, they can be reduced. Globally, measures geared towards reducing costs that are specific to the trading environment focus on reducing or eliminating tariffs through Free Trade Agreements (FTAs) and improving efficiency at every stage of the international trade chain through trade facilitation (Liapis, 2015). In the last three decades, the importance of tariff barriers to trade has reduced significantly as countries joined the World Trade Organization (WTO) and various FTAs. Thus, eliminating non-tariff barriers through trade facilitation (TF) has become one of the most important strategies for overcoming competition in international markets.

Trade facilitation refers to "simplification and harmonization of trade procedures that include activities, practices, and formalities involved in collecting, presenting, communicating, and processing data required for the movement of goods in international trade" (WTO, 2011). In a broad sense, TF also addresses behind-the-border trade costs. This includes costs associated with corruption, regulation, trade finance, and quality of infrastructure (Moise and Sorescu, 2013). Thus, TF aims at reducing the costs associated with all types of non-tariff barriers (NTBs) to trade. The resulting increase in exports improves economic growth. TF has both soft and hard dimensions (Perez and Wilson, 2012). The hard dimension is associated with tangible aspects such as roads, ports, and ICT infrastructure among others. The soft dimension includes intangible aspects such as transparency, quality of institutions, regulation, and customs management.

The importance of TF was emphasized during the 2013 Bali Ministerial Conference when WTO members reached an agreement to facilitate trade. The objectives of the agreement included enhancing transparency and efficiency in customs procedures; providing clarity to improve information flow; eliminating

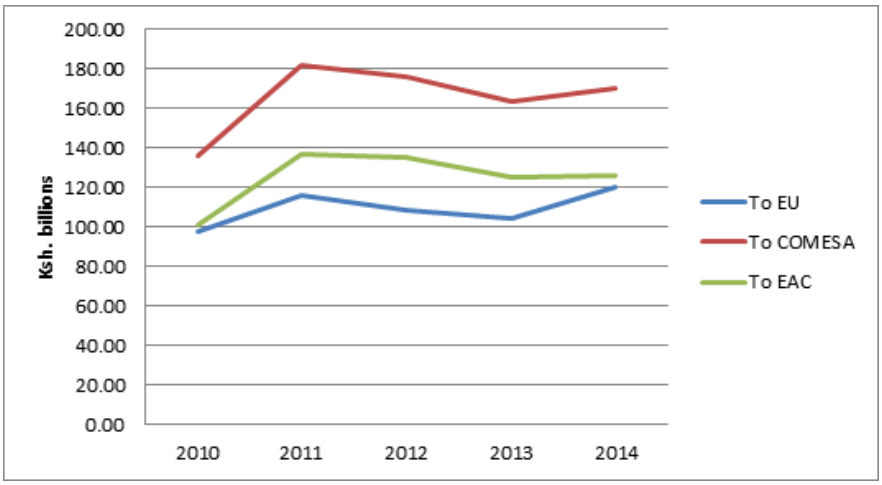
discrimination and partiality; and improving the use of technology in coordinating international trade.

Kenya has made tremendous efforts to reduce trade costs associated with the trading environment. This includes joining regional and international free trade agreements such as EAC, COMESA, and EU-EAC-EPAs, among others. The country has also made efforts to facilitate trade through expansion of physical infrastructure such as roads and ports, and automating customs management (MFAIT, 2015). However, there is no TF policy to guide the process. According to OECD (2014), Kenya's performance in harmonization and simplification of customs management in terms of automation, streamlining of procedures, documents, and external border agency cooperation is better than the average for Sub-Saharan Africa. Nonetheless, the country's performance in areas such as involvement of trade community, internal border agency cooperation, and reduction of fees and charges imposed on imports and exports is below the average for Sub-Saharan Africa.

Kenya's commodity export is composed of three major product categories, namely: food, beverages, and tobacco; basic materials, mineral fuels, and lubricants; and manufactures. Fruits and vegetables, on average, accounted for 21.25 per cent of food and beverages exports between 2007 and 2014. Overall, fruits and vegetables on average accounted for 8.49 per cent of Kenya's total exports over the same period (KNBS, 2015).

Despite the efforts made to improve international trade, Kenya's export performance has been declining. Figure 1.1 shows that Kenya's exports to key destinations such as the EU, COMESA, and the EAC declined between 2011 and 2013. Specifically, exports to the EU, COMESA, and the EAC declined by 9.68 per cent, 9.83 per cent, and 8.89 per cent, respectively, between 2011 and 2013. In 2014, exports to COMESA and the EAC increased by only 3.86 per cent and 0.67 per cent, respectively. Overall, the value of principal commodity exports grew by only 1.07 per cent in 2014 (KNBS, 2015). It is against this background that this study sought to determine the effects of trade facilitation on Kenya's exports to the EU, with a focus on the fruits and vegetables industry. The industry was selected because of its heavy reliance on trade facilitation measures with respect to transportation, production, and regulation (Zaki, 2010). The industry is also an important source of employment and income, especially among smallscale farmers in rural areas. The EU was selected because it is the main external market for Kenya's fruits and vegetables, accounting for nearly 75 per cent of exports.

Figure 1.1: Value of Kenya's exports to the EU, COMESA, and EAC



Source: KNBS (2015)

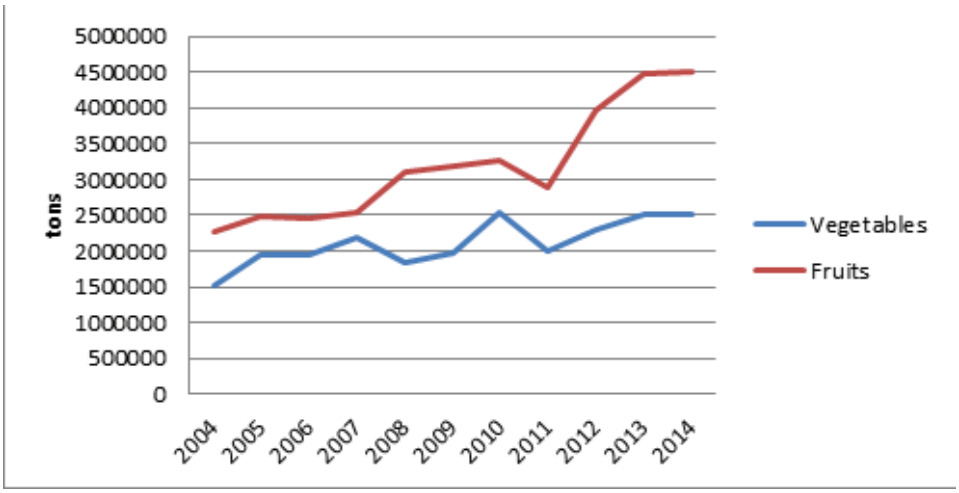
1.2 Fruits and Vegetables Industry

Fruits and vegetables are among the key horticultural products that Kenya exports to the EU. According to HCD (2015), fruits and vegetables account for approximately 15.9 per cent and 32.0 per cent of the total value of output in the horticulture industry. Smallscale farmers produce approximately 80 per cent of output in the industry (HCDA, 2013). However, they are linked to export markets by intermediaries. The EU is the main market for Kenya's fruits and vegetables, accounting for over 70 per cent of exports (HCDA, 2013). The top five major importers include the UK, France, German, Belgium, and the Netherlands.

Nearly 90 per cent of fresh vegetables are transported by air to export markets. However, some fresh fruits such as mangos, pineapples, and avocados are transported to the export market by sea using controlled atmosphere containers. Additionally, processed fruits and vegetables with long shelf life are transported by sea, which is relatively cheaper than air transportation.

Production of fruits and vegetables measured in tonnes increased albeit with fluctuations between 2004 and 2014 as indicated in Figure 1.2. The fluctuations in production are mainly explained by adverse climatic conditions such as unexpected droughts. For instance, in 2011, production of fruits and vegetables decreased by 15.12 per cent and 20.83 per cent, respectively, due to the 2010/2011 drought.

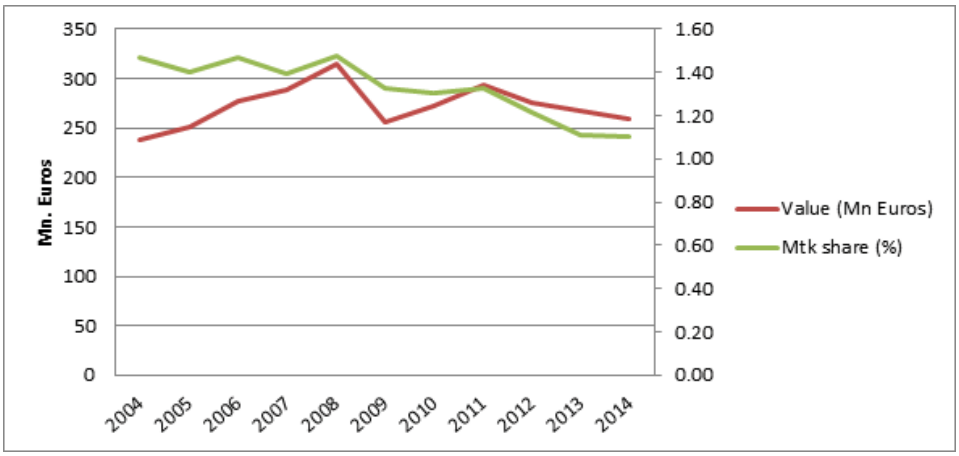
Figure 1.2: Fruits and vegetables production in Kenya (in tons)



Source: FAO Statistics (2015)

Despite the increased production, Figure 1.3 shows that the market share of Kenya's exports of fruits and vegetables has been declining since 2008. Additionally, the value of exports to the EU has been declining since 2011. The sharp decline in value and market share between 2008 and 2009 can be explained in part by the Global Financial Crisis, which reduced aggregate demand in Europe. The 2007/08 post-election violence in Kenya also had a negative effect on exports since it interfered with production in the agricultural sector (KNBS, 2009). Despite economic recovery in Europe and Kenya after 2010, Kenya's market share and value of exports failed to rebound.

Figure 1.3: Market share and value of Kenya's fruits and vegetables exports to the EU



Source: EU-ASI (2015)

1.3 Problem Statement

Kenya's share of exports of fruits and vegetables to the EU market declined from 1.48 per cent in 2006 to 1.12 per cent in 2014 (EU-ASI, 2015). Moreover, the value of fruits and vegetables exports to the EU declined by 2.90 per cent and 3.36 per cent in 2013 and 2014 respectively (EU-ASI, 2015). The decline in export performance is a threat to economic growth and development since the industry contributes approximately 27 per cent of agriculture GDP, accounts for nearly 8.49 per cent of total export value and supports nearly one million jobs directly and indirectly (HCD, 2015). Thus, the socio-economic impacts of the decline include increased poverty, dependency, and unemployment, among others.

Kenya's fruits and vegetables enjoy tariff and quota free entry to the EU under the EU-EAC EPAs. However, Kenya still faces high competition that limits exports to the market since the EU has also negotiated FTAs with other countries that export fruits and vegetables to the region (Muluvi et al., 2015). The competition is exacerbated by the continued decline in tariffs in the EU due to multilateral trade liberalization under WTO and harmonization of Phyto-sanitary measures (Ong'onge, 2015). In a world of declining tariff rates, trade facilitation is increasingly becoming an important source of competitiveness through the cost channel (Lee and Kim, 2012). Conceptually, efficient customs management systems, high quality transport and communication infrastructure, and effective regulation are expected to reduce production and transportation costs (Spence and Karingi, 2011). Producers with relatively low cost structures can overcome competition in the export market by adopting competitive pricing without significantly compromising their earnings.

In Kenya, the government has focused on facilitating trade in the last decade by expanding transport and communication infrastructure; harmonizing and automating customs procedures; and improving regulation in various industries. However, the expected significant increase in exports as a result of trade facilitation has not been realized. Thus, it is important to empirically study the effects of TF on exports of fruits and vegetables from Kenya to facilitate evidence-based policy interventions. Specifically, the knowledge obtained from this study is expected to inform trade policies with the aim of increasing exports of fruits and vegetables to spur economic growth and employment as expected under the Vision 2030.

1.4 Objectives of the Study

The broad objective of the study is to estimate the extent to which hard and soft dimensions of trade facilitation affect fruits and vegetables exports to the European Union market. Specifically, the study sought to:

1. Estimate the effects of trade facilitation on fruits and vegetables exports to the EU
2. Estimate the trade effect of increasing the level of Kenya's trade facilitation to that of its competitors in the EU market

1.5 Research Questions

1. What are the effects of trade facilitation on Kenya's exports of fruits and vegetables?
2. What would be the trade effect of increasing the level of Kenya's trade facilitation to that of its competitors in the EU?

1.6 Justification of the Study

Agriculture was identified as one of the key sectors that will enable Kenya to achieve and maintain an annual economic growth rate of 10 per cent to realize Vision 2030. The full potential of the agricultural sector can be achieved through appropriate trade facilitation measures that are geared towards increasing exports of key products such as fruits and vegetables. An increase in exports of fruits and vegetables is expected to increase foreign exchange earnings, thereby increasing job opportunities. As a result, economic growth and development will improve as poverty and dependency levels decline. Although TF has been suggested as one of the possible solutions to declining export performance, the role of the hard and soft dimensions of TF in improving exports is not well documented, especially in Sub-Saharan Africa (Djemmo, 2013; Beverelli, Neumueller, and Teh, 2015; Hillberry and Zhang, 2015; and Moise and Sorescu, 2013). Indeed, lack of empirical evidence on how TF improves exports, especially, fruits and vegetables, limits formulation of appropriate policies. Apart from filling this knowledge gap, this study sought to provide empirical evidence to inform trade facilitation policies with the aim of boosting economic growth and development through increased earnings from exports of fruits and vegetables.

1.7 Organization of the Study

The rest of the paper is organized as follows. Section two presents the theoretical and empirical literature. Section three covers the methodology used in the study. The results of the study are presented in section four. Section five presents the conclusion and policy recommendations of the study.

2. Literature Review

2.1 Theoretical Literature

There is no single theory that explains trade facilitation per se. However, both classical and new international trade theories provide a framework for explaining the theoretical foundations of trade facilitation. In the Ricardian trade theory, a country has a comparative advantage, and thus can gain from international trade if it produces a particular good or service at a lower opportunity cost than its competitors. In this context, trade facilitation plays an important role as a determinant of comparative advantage. Indeed, Gamberoni et. al (2010) acknowledged that TF measures that improve the quality of institutions and reduce the time required to export are important sources of comparative advantage. This underscores the importance of improving transport and communication infrastructure, and institutions such as the judiciary and regulatory agencies to enhance export performance.

The Heckscher-Ohlin theory shows that countries gain from trade by exporting goods whose production involves intensive use of factors that are abundant locally. For instance, Kenya would have a comparative advantage if it produced and exported goods that intensively use its abundant labour. Improving on the classical trade theories, Krugman (1979), Lancaster (1980), and Helpman (1981) developed the 'new trade theory'. In the new trade theory, countries gain from trade through an increase in efficiency in production. Countries also benefit from welfare gains since international trade allows their citizens to access a variety of goods and services at low costs. The new trade theory was further developed by Melitz (2003) who shifted analysis of international trade from industry to firm-level and developed the new-new trade theory. The central tenet of this theory is that gains from trade result from increased productivity, which enables highly efficient firms to export as the least efficient firms (least productive) are forced out of business due to increased competition.

In the context of the Heckscher-Ohlin theory and new trade theory, the key role of trade facilitation is enhancing factor productivity. For instance, De (2009) and later Brooks and Stone (2010) have showed that trade facilitation with respect to transport and ICT infrastructure not only increases comparative advantage but also raises total factor productivity. Low costs lead to production of more output per unit of input. This encourages existing firms to increase their exports and allow new firms to enter export markets (Spence and Karingi, 2011). Trade facilitation also improves productivity through its positive effect on imports. Specifically, it facilitates access to cheap intermediate goods, increased FDI inflows, and access to advanced technologies, which developing countries such as Kenya need to

increase their productivity and export competitiveness. This study was guided by the new trade theory since it is based on the premise that TF reduces transaction costs, thereby making Kenya's fruits and vegetables cheaper/ more competitive in the EU.

2.2 Empirical Literature

2.2.1 Effect of hard dimensions of TF on exports

Trade facilitation measures that focus on development of physical infrastructure are vital in boosting domestic exports. Adequate and efficient transport and communication infrastructure are expected to reduce the costs associated with production, transportation, marketing, and distribution of goods, thereby increasing exports. Indeed, De (2009) demonstrated that trade facilitation mainly influenced exports through transportation costs in seven Asian countries including China, Thailand, and Japan, among others. A 10 per cent increase in domestic transport cost was found to reduce exports by 2 per cent. This means that TF measures that improve transport infrastructure with the aim of reducing transportation costs would increase exports in the seven countries. The findings underscore the importance of improving logistics performance through effective TF.

Perez and Wilson (2012) concur with De (2009) by concluding that improvement in physical infrastructure is the most important determinant of exports in 101 developing countries. In their study which used the gravity model, the researchers found that transport and ICT infrastructure had a positive effect on export performance. In Cameroon, Djemmo (2013) used the gravity model to show that an improvement in port efficiency and quality of roads by one per cent would increase manufactures export volume by 2.9 per cent and 2.3 per cent, respectively. Iwanow and Kirkpartrick (2009), however, found a relatively less impact of transport infrastructure on exports. In their study, a one per cent increase in transport infrastructure index improved manufactures exports by only 0.6 per cent in African countries.

Djemmo (2013) also found that ICT use had a positive and statistically significant effect on manufactures exports. Using data for 16 Arab countries, Mostafa and Mohamed (2015) further demonstrated that information and communication technology reduced time and cost to export. This led to an increase in the value of exports and imports. Given that the effect of TF varies by product category or industry (Gamberoni et al., 2010), the results of Djemmo (2013), which are based on manufactures exports data only might not hold in the case of fruits and vegetables exports.

In Turkey, Cosar and Demir (2015) concluded that investments in domestic transport infrastructure positively affected trade at both intensive and extensive margin. The positive effect resulted from the fact that expanding roads from single to high capacity expressways reduced transportation costs by nearly 70 per cent, especially in transport-intensive industries. This result is consistent with Hoekman and Nicita (2011) who found that exporter logistics performance index had a positive relationship with export volume in developing countries. This means that TF measures taken by exporters to improve transport infrastructure, transport services, border procedures, and supply chain reliability increase exports. Nonetheless, the results of Hoekman and Nicita (2011) are based on cross-sectional data that does not facilitate making unambiguous conclusions concerning the sign and magnitude of the coefficients of TF variables.

At the firm level, Li and Wilson (2009) found that increased availability of ICT services increased SMEs' propensity to export in 10 East, Southeast, and Central Asian countries. However, improvement in transport infrastructure had no statistically significant effect on SMEs' export propensity.

2.2.2 Effect of soft dimensions of TF on exports

An efficient customs management system is expected to reduce delays in cargo clearance and the cost of complying with customs formalities. According to Ueki (2015), customs inefficiencies that delay cargo clearance negatively affect export intensity at firm level. As a result, the overall export performance of a country reduces. This perspective is supported by Asgarkhani and Amini (2014) who found that a one per cent increase in the number of days to export reduced non-oil exports by 0.77 per cent in select South West Asian countries. This is consistent with Hoekman and Shepherd (2015) who established a negative relationship between export time and firm sales in developing countries.

Asgarkhani and Amini (2014) also found that a one per cent increase in the number of documents needed to export reduced non-oil exports by 0.71 per cent. Their study used the gravity model and panel data for 16 countries in South West Asia to determine the role of trade facilitation in developing non-oil exports. The study, however, fails to shed light on the effects of behind-the-border TF measures such as regulatory efficiency on exports.

Using the gravity model and data for a panel of 107 countries consisting of low income, lower middle income, and upper middle income countries, Moise and Sorescu (2013) underscored the importance of customs efficiency in improving export performance. In low-income countries, harmonization and simplification of customs documents led to the most significant increase in trade flows.

Streamlining customs procedures had the greatest positive effect on trade flows in middle-income countries. In terms of trade cost reduction, automation and simplification of customs processes reduced costs by 2.3 per cent and 3 per cent, respectively, in low-income countries. Harmonization and simplification of procedures reduced costs by 2.7 per cent in lower-middle income countries, whereas streamlining procedures and automated processes reduced costs by 2.8 per cent and 2.4 per cent, respectively, in upper middle-income countries. Overall, trade facilitation reduced trade costs by approximately 14.5 per cent (Moise and Sorescu, 2013). These savings boosted export performance.

Hillberry and Zhang (2015) concurred with Moise and Sorescu (2013) on the positive effect of customs efficiency on trade costs. Their gravity model results showed that improvement in governance and automation of customs procedures reduced the number of days required to export. A one day reduction in days in customs was equivalent to approximately 0.6 per cent ad valorem tariff reduction. However, Hillberry and Zhang (2015) failed to estimate the direct effect of TF on export value or volume.

Focusing on export diversification, Beverelli, Neumueller, and Teh (2015) found that improvement in customs efficiency with respect to the number of documents, cost, and time to export increased the number of exported products and export destinations in Sub-Saharan Africa and Latin America. Their trade impact simulation results indicated that convergence to the regional and global median of the three indicators (number of documents, cost, and time to export) would increase the number of exported products by 15.7 per cent and destinations by 27.9 per cent in Sub-Saharan Africa. In Latin America, convergence would increase the number of products exported by 12.2 per cent and destinations by 21.7 per cent.

Regulatory efficiency plays an important role in boosting exports by improving the ease of doing business and reducing the transaction costs associated with complying with government regulations. Indeed, Iwanow and Kirkpartrick (2009) in their study of TF in African countries found that a 10 per cent improvement in regulatory environment index would increase manufactures exports by 5 per cent. A similar improvement in customs efficiency index would increase manufactures exports by 2.5 per cent. These findings mean that TF measures aimed at reducing the time and costs associated with settling regulation disputes and eliminating restrictions in factor movement increase export performance. Additionally, TF measures that reduce the time and cost of complying with customs formalities improve export performance.

Focusing on quality of institutions, Francois and Manchin (2013) found that trade facilitation measures that reduce taxes on international trade, regulatory trade barriers, exchange rate controls, and factor mobility constraints positively affected

exports in both developed and developing countries. The researchers concluded that trade between high-income countries is nearly 50 per cent more than the trade between high-income and low-income countries because of poor quality of institutions in the later. This implies that improving regulatory efficiency through institutional reforms is important in boosting domestic export performance.

2.2.3 Effect of trade partner's TF measures on domestic exports

Trade facilitation measures taken by importers benefit exporters by enhancing the entry and distribution of their goods in the export market. In this context, importers subsidize exporters by reducing trade costs in the export market. Shoji (2013) supports this thesis in his TF study, which showed that a one per cent increase in importers' port efficiency improved US exports by 3.7 per cent. Additionally, a one per cent increase in importers' customs environment index increased US exports by 0.39 per cent.

In the Greater Mekong Sub-region (GMS), which includes Cambodia, China, Lao, Myanmar, Thailand, and Vietnam, Stone and Strut (2009) concluded that importer trade facilitation with respect to land transport infrastructure led to trade gains (imports and exports) by approximately 40 per cent. Similarly, Hoekman and Nicita (2011) found that an improvement in importer logistics performance index (LPI) positively affected developing countries' export volume.

According to Francois and Manchin (2013), trade between developed and developing countries is mainly determined by exporter and importer trade facilitation with respect to transport and communication infrastructure. Specifically, they found that an improvement in the quality of importer's physical infrastructure improved domestic exports. By improving the quality of institutions and transport infrastructure to the level of developed countries, trade volume in developing countries would increase by 26 per cent. This finding underscores the importance of adopting international best practices in TF in the developing world.

Cali and Velde (2011) in their study of trade performance in developing countries (SSA) found that financial aid invested in economic infrastructure reduced trade costs and the time required to import or export. This improved the export performance of countries that exported to the aid recipients. Additionally, aid for trade facilitation increased recipients' exports.

However, importer trade facilitation initiatives do not always improve exporters' export performance. In fact, importer trade facilitation can make importer's products more competitive than foreign ones, thereby reducing domestic exports. For instance, Shoji (2013) found that importer's regulatory environment index had a negative relationship with US exports. Similarly, Cali and Velde (2011) found

that TF measures aimed at improving productive capacity had no effect on exports in SSA.

2.2.4 Effect of TF on agricultural exports/ sectoral trade

Different products have different trade facilitation needs. Thus, the effects of TF measures are expected to vary across industries. For instance, Masyhuri and Dermoredjo (2010) found that various dimensions of trade facilitation had different effects on food and agricultural exports from Indonesia and other ASEAN countries. Improvement in transport services increased rice exports from ASEAN countries. Nonetheless, internet use and transport services did not have statistically significant relationships with exports of other food products from Indonesia.

Surprisingly, Masyhuri and Dermoredjo (2010) established a negative and statistically significant relationship between food exports and internet use and transport services. This finding suggests that improvement in internet use and availability of transport services reduced food exports in ASEAN countries. The finding is inconsistent with Djemmo (2013), Perez and Wilson (2012), and Li and Wilson (2009) who found a positive relationship between ICT and transport infrastructure and export.

Liu and Yue (2013) in their study of the effect of TF on perishable agricultural products in 96 countries found that delays in customs clearance had a negative effect on exports fruits and vegetables. The negative effect was attributed to the fact that border delays reduced the quality and prices of fruits and vegetables, thereby exposing exporters to the risk of making losses. Biswas and Lynn (2015) support this perspective by arguing that customs delays have a negative impact on agricultural exports. In their study of TF, the researchers found that improvement in e-governance proxied by e-governance readiness index had a positive effect on agricultural exports. This suggests that automation of business-related government services, including customs management, is important in improving agricultural exports. Nonetheless, this conclusion is based on pooled and cross-sectional OLS regressions, which may not address the problem of self-selection bias in bilateral trade data with missing values.

In ECOWAS trade bloc, Olayiwola and Oluyomi (2013) found that TF measures had mixed effects on agricultural exports. An increase in internet and telephone use per 100 persons was found to have a positive effect on agricultural exports. A 100 per cent reduction in the number of days required to process export documents increased agricultural exports by nearly 7 per cent. However, quality of regulation had no effect on agricultural exports.

According to Zaki (2010), trade facilitation can improve international trade by reducing the costs associated with the average time required to export or import. His study showed that the time required to export would increase by 8.1 per cent if the number of documents needed to export increased by 10 per cent, thereby increasing overall export costs. Time to export had a negative effect on food, beverages, tobacco, and leather exports.

2.3 Overview of the Literature

The literature reviewed indicates that TF has positive effects on export performance (Perez and Wilson 2012; Moise and Sorescu 2013; Asgarkhani and Amini 2014; and Djemmo, 2013). The literature also shows that some aspects of TF have negative effects (Masyhuri and Dermoredjo, 2010; Shoji, 2013) and no effects (Olayiwola and Oluyomi, 2013; Cali and Velde, 2011). Additionally, the effect of TF on exports varies with country/region, industry, and product categories. This variation is attributed to, among other factors, the level of economic development and TF among countries, and the sensitivity of different products to various aspects of TF. The implication of this variation is that findings based on data from different countries and overall export data might not hold in the context of Kenya and fruits and vegetables industry, respectively. Thus, this study sought to contribute to existing literature and inform policy by empirically investigating the effect of TF in the context of fruits and vegetables industry using Kenya's data.

3. Methodology

3.1 Theoretical Framework

Empirical analysis of bilateral trade is often done using the gravity model, first introduced in economics by Tinbergen in 1962. Conceptually, the ability of a country to export depends on its economic size proxied by national income measures such as GDP or population. Similarly, imports are determined by the importer's purchasing power proxied by its national income. Economic size variables are essentially the supply and demand forces that determine international trade. The distance between trading partners is also considered as an important determinant of trade, since it influences transport costs (Tinbergen, 1962).

Anderson (1979) made the first attempt to provide theoretical underpinnings for the gravity model by incorporating Armington (1969) assumption that goods are differentiated according to their place of origin. Two goods of the same type, but produced in different countries, are not perfect substitutes since production costs differ from country to country. Bergstrand (1985) asserts that exchange rate should also be controlled for when analyzing international trade since it determines relative prices of goods. Summary (1989) further emphasized the need to augment the gravity model by controlling for other factors that may enhance or impede international trade. These factors can be economic, country-specific characteristics, political, or quasi-economic in nature. This means that trade facilitation variables/measures enter the gravity model as trade enhancing factors since they are expected to reduce the trade costs associated with NTBs. Thus, exports of fruits and vegetables exports were conceptualized to be a function of trade facilitation variables, demand and supply variables, transport costs, macroeconomic variables, and political factors (Table 3.1).

3.2 Analytical Framework

This study follows previous studies (Asgarkhani and Amini, 2014; Djemmo, 2013); Perez and Wilson, 2010; and Moise and Sorescu, 2013) that used the gravity model to estimate the effect of TF on export performance because of its simplicity and ability to facilitate analysis of bilateral trade. The gravity model is based on Newton's Law of Gravitational Force, which shows that attraction between two objects increases with the masses of the objects, but reduces with the distance between them. In economics, the gravity model shows that exports are directly proportional to the economic masses (GDP, population, income per capita) of the importing and exporting country, but inversely proportional to the distance (trade costs) between the trading countries. Thus, the basic gravity model is defined as:

$$X_{ij} = (KY_i^{ai} Y_j^{bj})/(T^{v}_{ij}) \quad (1)$$

Where X_{ij} is exports from country i to j; K is a gravitational constant, Y is the economic mass of country i and j, T^{v}_{ij} represent trade costs, proxied by geographic distance between i and j. Equation 2 can be expanded by including country-specific factors that could enhance or impede trade (Segura & Vilarrubia, 2008). Thus, equation 1 can be expressed as:

$$X_{ij} = KY_i^{ai} Y_j^{bj} T_{ij}^{(-cij)} \alpha F_{ij} e^{\varepsilon} \quad (2)$$

Where αF_{ij} is a vector consisting of trade enhancing or hindering factors. These include sharing a common border, language, currency, free trade agreement, or colonial background. The model can be augmented to include trade facilitation variables among the trade enhancing or hindering factors. Thus, a linear version of equation 2 can be defined in a log-log form as:

$$LnX_{ij} = LnK + aiLnY_i + bjLnYj - cijlnT_{ij} + \alpha F_{ij} + \varepsilon \quad (3)$$

3.3 Model Specification

The gravity model (equation 3) was augmented to consider the aspects of TF that are relevant to fruits and vegetables exports in the context of Kenya. These include quality of air transport infrastructure, ICT use, customs efficiency, importer regulatory efficiency, and exporter regulatory efficiency. Thus, the estimated equation was:

$$LnX_{ijt} = \alpha_{ij} + \beta_1 lnQATinf_{it} + \beta_2 lnICTuse_{it} + \beta_3 lnCE_{it} + \beta_4 lnRE_{it} + \beta_5 lnRE_{jt} + \beta_6 lnPro_{it} + \beta 7 lnEx_{it} + \beta_8 lnGDPpc_{it} + \beta_9 lnGDPpc_{jt} + \beta_{10} lnDist_{ij} + \beta_{11} EUEACEPAs_{ijt} + \beta 12 Col_{ij} + \mu_i + \varepsilon_{ijt} \quad (4)$$

Where:

X is Kenya's exports of fruits and vegetables in US$ to select EU countries, i is exporter, j is the importer, t denotes time, and α_{ij} is a constant. $\beta = 1,2 \ldots 12$ are parameters to be estimated, Ln denotes natural logarithm, ε is a white noise error term and μ_i is an unobserved country-specific characteristic.

TF variables include: quality of air transport infrastructure index (*QATinf*), ICT use proxied by internet use per 100 persons (*ICTuse*), customs efficiency index (*CE*), and regulatory efficiency index (*RE*). ICT use and quality of air transport

infrastructure are hard dimensions of trade facilitation. Customs efficiency and regulatory efficiency are soft dimensions of trade facilitation.

The gravity model variables include: GDP per capita (*GDPpc*), geographic distance in kilometres between country *i* and *j* capital cities (*Dist*), common official language dummy, which is equal to 1 if Kenya shares an official language with an importer and 0 otherwise (*Col*). *EUEACEPAs* is a dummy variable which is equal to 0 before signing of the interim EU-EAC EPAs in 2007 and 1 after the signing.

Other variables are: *Pro* is domestic production of fruits and vegetables in tonnes. *Ex* is exchange rate of Kenya shilling against the US dollar.

3.4 Scenario Analysis

Following Lee and Kim (2012) and Beverelli, Neumueller, and Teh (2015), scenario analysis was done using the parameters obtained from the gravity model and the formula given as:

$$Y_i = C_i x_i \qquad (5)$$

Where Y_i denotes the estimated trade effect on exports and C_i is the improvement in Kenya's level of trade facilitation. It is the percentage by which a given Kenya's trade facilitation indicator/index has to be increased to reach that of the reference country. x_i is the coefficient of the relevant trade facilitation indicator obtained from the gravity model.

Equation 5 was used to determine the trade effects of improving Kenya's trade facilitation indicators/variables to the level of Costa Rica and Morocco. These countries were selected because they have higher market share than Kenya in the EU. Additionally, Costa Rica represents upper-middle income countries where Kenya aspires to be while Morocco is at the same level of development (lower middle-income) as Kenya (World Bank, 2015).

3.5 Data Sources and Expected Signs

Table 3.1: Data sources

Variable	Category	Source	Expected sign
Exports		COMTRADE	
QATinf	Trade facilitation	WEF	+
ICT use	Trade facilitation	WDI	+
Customs efficiency, CE	Trade facilitation	WEF	+
Exporter RE	Trade facilitation	WEF	+
Importer RE	Trade facilitation	WEF	+
Exporter GDP	Macroeconomic/supply factor	WDI	+/ -
Importer GDP	Macroeconomic/demand factor	WDI	+
Geographic distance	Transport cost variable	CEPII	-
Production	Supply factor	FAO Statistics	+
Exchange rate	Macroeconomic	CBK	+/ -
EU-EAC EPAs	Political/economic		+
CoL	Political	CEPII	+

Source: Author

The study used panel data for the period 2004 to 2014. This choice was mainly informed by availability of TF data. The data sources are presented in Table 3.1. The study considered 15 countries in the EU, which are the main markets (accounting for approximately 95%) of Kenya's fruits and vegetables exports. The countries include the UK, France, German, Italy, Sweden, Spain, Netherlands, Greece, Finland, Denmark, Poland, Portugal, Belgium, Cyprus, and Ireland.

The indices were constructed from the World Economic Forum (WEF) using secondary and primary data obtained from annual surveys conducted at firm level. Each index assumes a value ranging from 1 to 7, where 1 means worst and 7 means best performance in a given TF indicator. Following Shoji (2013), Djemmo (2013) and Beverelli, Neumueller and Teh (2015), indices that measure similar aspects of TF were aggregated to avoid the problem of collinearity if they were to enter the regression model as separate variables. Thus, regulatory and customs efficiency are aggregates of two sub-indices shown in Table 3.2.

Table 3.2: Definition of TF indices

Main Index	Components (sub-indices)
Regulatory efficiency	• Burden of government regulation index • Transparency in government policy making index Measures the risk that trading activities will become costly due to inefficiencies in administration of government regulation
Customs efficiency	• Burden of customs procedures index • Prevalence of trade barriers index Measures the customs-related costs associated with compliance, complicated procedures, and corruption etc
Quality of air transport infrastructure	Measures sophistication, coverage, and efficiency of air transport infrastructure

Source: World Economic Forum (2015)

3.6 Estimation Strategy

Equation 4 is likely to face an endogeneity problem because the dependent variable (exports) is either simultaneously determined or has bi-directional causal relationship with some regressors. For instance, simultaneity and hence endogeneity arises from the fact that exporter GDP per capita is a function of exports, which is the dependent variable. Additionally, the unobserved country-specific characteristic μ_i is likely to be correlated with some regressors. If μ_i is correlated with independent variables, using OLS and random effect model (REM) will produce biased and inconsistent results (Arellano and Bond, 1991). The unobserved country-specific effect can be eliminated by using the fixed effect model (FEM). However, the fixed effect model will also eliminate observed time-invariant variables such as distance and common official language dummy. Thus, estimating the effects of these variables on exports of fruits and vegetables will not be possible. It is important, therefore, to use an estimator that relies on instrument variables (IV) to eliminate endogeneity while allowing for inclusion of time-invariant variables in the model.

The main estimators for analyzing panel data in the presence of endogeneity include the two stage least squares (2SLS), Hausman-Taylor model (HTM), and the dynamic generalized method of moments (GMM). Studies such as Baum, Schaffer and Stillman (2002) have shown that the 2SLS is less efficient compared to the HTM and GMM. The choice between HTM and GMM is often based on the robustness and efficiency of the estimates. Thus, the gravity model was estimated using both HTM and GMM and the estimates compared in terms of their efficiency. The HTM was estimated as a static model, whereas the GMM was estimated as a dynamic model to check the robustness of the results. Additionally,

dynamic GMM facilitated taking into account the fact that lagged exports also affect current levels of exports (Bun and Klaassen, 2002). The presence of panel-level heteroskedasticity was tested using the likelihood ratio (LR) test before estimating the regression models.

3.6.1 The Hausman Taylor Model (HTM)

The HTM uses an instrument variable approach that relies only on the information within the dataset to purge the correlation between independent variables and unobserved individual effects that make REM unsuitable for estimating the gravity model. It also allows for estimation of the effects of time-invariant variables; thus, its superiority over FEM. The HTM is essentially a modified REM in which some independent variables are assumed to be correlated with the unobserved individual characteristic. Thus, before estimating the HTM, the Breusch and Pagan Lagrangian multiplier test was applied to determine the presence of random effects.

The HTM was defined as:

$$Exp_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \gamma_1 Z_{1i} + \gamma_2 Z_{2i} + \mu_i + \varepsilon_{it} \quad \text{..... (6)}$$

Where: X_{1it} is a vector of time-varying exogenous variables assumed to be uncorrelated with μ_i and ε_{it}. Importer GDP per capita was included in this vector. X_{2it} is a vector of time-varying endogenous variables assumed to be correlated with μ_i but not ε_{it}. The variables in this vector included ICT use, customs efficiency, importer regulatory efficiency, exporter regulatory efficiency, EU-EAC-EPAs, production volume, exporter GDP per capita, and exchange rate. Z_{1i} is a vector of time-invariant exogenous variables assumed to be uncorrelated with μ_i and ε_{it}. Geographic distance was included in this vector. Z_{2i} is a vector of time-invariant endogenous variables assumed to be correlated with μ_i but not ε_{it}. Common official language dummy was the only variable included in this vector. μ_i is the unobserved fixed effect, whereas ε_{it} is the idiosyncratic error term.

The variables in X_{1it} and Z_{1i} serve as their own instruments. The variables in X_{2it} are instrumented by the deviation from their individual means. The variable in Z_{2i} is instrumented by X_{1it}. In order to identify the coefficient on Z_{2i} variables, the number of variables in X_{1it} must be equal to or more than those in Z_{2i}. Moreover, there must be adequate correlation between Z_{2i} and the instruments to avoid weak instrument problem. To confirm the validity of the instruments, the correlation matrix for the instruments and Z_{2i} variables was estimated. Finally, the Hausman specification test was applied to determine the appropriateness of the HTM.

3.6.2 Dynamic GMM Model

In a dynamic linear panel-data model, lags of the dependent variable are also included as regressors. Additionally, the model includes unobserved panel-level effects (μ_i in equation 7). The correlation between the unobserved panel-level effects and the lagged value of the outcome variable renders estimators such as OLS and REM inconsistent. GMM uses the lagged levels and first differences of the dependent and independent variables as instruments to account for the simultaneity bias, reverse causality, and omitted variable bias that may cause endogeneity. There are two types of dynamic GMM, namely the difference GMM estimator developed by Arellano and Bond (1991) and the system GMM developed by Arellano and Bover (1995) and later refined by Blundell and Bond (1998). The difference GMM uses the lagged levels of the variables as instruments in the difference equation. The system GMM uses the lagged differences of the variables as instruments in the level equation and lagged levels as instruments in the difference equation. Blundell and Bond (1998) established that the difference GMM is less efficient since the lagged level instruments are often weak instruments in the difference equation. Additionally, the difference GMM is not suitable for estimating the gravity model since it will eliminate time-invariant variables such as distance and common official language dummy. Thus, this study used the system GMM. The dynamic GMM model was specified as:

$$LnX_{ijt} = \alpha_{ij} + \beta_1 LnX_{(ijt-1)} + \beta_2 lnQATinf_{it} + \beta_3 lnICTuse_{it} + \beta_4 lnCE_{it} + \beta_5 lnRE_{it} + \beta_6 lnRE_{jt} + \beta_7 lnPro_{it} + \beta_8 lnEx_{it} + \beta_9 lnGDPpc_{it} + \beta_{10} lnGDPpc_{jt} + \beta_{11} lnDist_{ij} + \beta_{12} EUEACEPAs_{ijt} + \beta_{13} Col_{ij} + \mu_i + \varepsilon_{ijt} \quad (7)$$

Where $LnX_{(ijt-1)}$ is the lagged value of exports of fruits and vegetables from Kenya to country *i* in the EU. The remaining variables are as defined in equation 4.

The moment conditions used in the GMM are valid only if there is no order 2 or higher autocorrelation in the residuals. Thus, the Arellano-Bond test for autocorrelation was used to test for the presence of autocorrelation in the residuals. Additionally, GMM estimates are consistent only if the instruments used are valid. The validity of the instruments was tested using the Sargan over-identifying restrictions test.

4. Results

4.1 Descriptive Statistics

The summary statistics for the variables considered in the study are presented in Table 4.1. The average value of exports of fruits and vegetables in the sample period was US$ 6,470,775. The quality of air transport infrastructure index (*QATinf*) and customs efficiency index had a mean of 3.84 and 3.51, respectively. The importer and exporter regulatory efficiency index had a mean of 3.92 and 3.43, respectively. The standard deviation of the quality of air transport infrastructure, customs efficiency, and exporter regulatory efficiency indices were less than 0.5. This little variation in the indices could be attributed in part to the fact that improving transport infrastructure, customs efficiency, and regulation involves heavy investment in physical capital and institutional changes that take a long time to be completed.

Table 4.1: Descriptive statistics

Variable	Mean	Std. dev.	Variance	Skewness	Kurtosis	Min. value	Max. value
Exports	6470775	7835547	6.14e+13	1.41279	4.358887	28669	3.09e+07
QATinf	3.837441	0.413480	0.170966	-0.127335	1.617335	3.217426	4.456789
ICT use	17.89182	14.21187	201.9773	0.637778	1.810041	3.02	43.4
Customs Efficiency, CE	3.511065	0.281172	0.079058	-0.409414	1.846453	3.004358	3.846721
Exporter, RE	3.434827	0.278770	0.077713	-0.114957	1.855949	2.988441	3.871775
Importer RE	3.917633	0.715255	0.511589	-0.015607	2.460631	2.579822	5.511005
Exporter GDP	932.1401	269.3368	72542.3	-0.224838	2.158788	467.3788	1358.262
Importer GDP	38521.74	13072.69	1.71e+08	-0.328303	2.456864	11247.65	64182
Geo. Distance	6240.833	866.7711	751292.1	-1.370983	3.844239	4071.189	7266.432
Production	5614243	1472525	2.17e+12	0.698673	1.909179	3788909	8002955
Exchange rate	78.88678	7.106297	50.49946	-0.111558	1.756629	67.21408	88.72775
EU-EAC EPAS	0.636364	0.482510	0.232816	-0.566947	1.321429	0	1
CoL	0.133333	0.3409694	0.1162602	2.157277	5.653846	0	1

Source: Author's estimations

ICT use had a minimum and maximum value of 3.02 and 43.4, respectively, with a standard deviation of 14.21. This significant increase in ICT use (internet) is

explained by, among other factors, an increase in mobile phone subscription, use of computers, and expansion of internet infrastructure in Kenya in the sample period. All the variables, except the dummy for common official language (CoL), had positive Kurtosis of less than 5, meaning that their distribution was relatively flat. Exports, ICT use, production volume, and common official language dummy were positively skewed. The remaining variables were negatively skewed.

4.2 Diagnostic Tests

The presence of panel-level heteroskedasticity was tested using the likelihood ratio (LR) test and the results are reported in Appendix 1. The test had a Chi^2 = 203.39 with a P-value of 0.0000. This means that heteroskedasticity was a problem that had to be addressed by using robust standard errors in the regression models (Poi and Wiggins, 2001).

For the HTM, the presence of random effects was confirmed by the Breusch and Pagan Lagrangian multiplier test which had a p-value of 0.0000 as indicated in Appendix 2. Additionally, the Hausman specification test result (p-value of 1.000) presented in Appendix 3 shows that the HTM is appropriate. The correlation matrix in Appendix 4 shows that the exogenous instruments in the HTM (importer GDP per capita and distance) are correlated with the endogenous time-invariant variable (common official language dummy). This means that there is no weak instrument variable problem. These diagnostics show that the results of the HTM are consistent and can be interpreted.

For the GMM, the presence of autocorrelation in the residuals was tested using the Arellano-Bond test for autocorrelation and the results are presented in Appendix 5. The p-value of 0.7982 shows that there is no order 2 autocorrelation in the residuals. The validity of the instruments was tested using the Sargan over-identifying restrictions test whose results are presented in Appendix 6. The Chi^2=93.65824 and p-value of 0.6327 mean that the instruments are valid. These diagnostics show that there is no model miss-specification problem and the results are consistent. Thus, the GMM results can be interpreted.

The TF variables were introduced in the HTM and GMM model sequentially to determine the changes in the sign, size, and statistical significance of the independent variables. Quality of air transport infrastructure index diminished the statistical significance of most variables in the HTM. In the GMM, the size of the coefficients became relatively larger than what is reported in the literature when customs efficiency index was included as a TF variable. Thus, quality of air transport infrastructure index and customs efficiency index were dropped from

the HTM and GMM, respectively. Since the HTM is a static model, it does not include the lagged variables.

4.3. HTM and GMM Estimation Results

The results of regression analysis based on the HTM and GMM are presented in Table 4.2.

Table 4.2: GMM and HTM results

Variable	HTM			GMM		
	Coefficient	**Std. error**	**P-value**	**Coefficient**	**Std. error**	**P-value**
$LnX_{(ijt-1)}$				0.3715959***	0.0703865	0.000
LnICT use	2.0593***	0.7817	0.008	2.83853***	0.7084784	0.000
LnCE	15.9988***	5.4114	0.003			
LnQATinf				18.62504***	3.597345	0.000
LnRE exporter	16.3163***	4.1421	0.000	11.10443***	2.402815	0.000
LnRE importer	4.3924***	1.0379	0.000	0.8559508	0.8343567	0.305
LnGDP per cap. exporter	-12.0121***	3.8781	0.002	-15.21959***	3.176886	0.000
LnGDP per cap. importer	-1.1713	0.8542	0.170	-2.41593*	1.289949	0.061
$lnGDPpc_{(jt-1)}$ importer				2.870029**	1.183137	0.015
LnGeo. distance	-2.9674	8.6052	0.730	-3.726793***	0.9380964	0.000
Lnproduction	1.8096**	0.8717	0.038	1.156991**	0.454898	0.011
Lnexchange rate	-8.9212**	3.6449	0.014	-15.323***	3.632024	0.000
EU-EAC-EPAS	0.0016	0.3762	0.997	0.3455711	0.2627214	0.188
CoL	7.3792	15.7836	0.640	-1.588138	1.237355	0.199
Constant	92.9183	80.8132	0.250	142.3805***	27.83025	0.000
Sigma_u Sigma_e Rho	2.9666598 0.70785503 0.94613505					

*Where *, ** and *** means statistically significant at10%, 5% and 1%, respectively*

Source: Estimations by author

4.3.1 Effects of TF on exports of fruits and vegetables

Effects of the hard dimensions of TF

The coefficient of ICT use is positive and significantly different from zero at 1 per cent significance level in both models. The results mean that a 1 per cent increase in ICT use would increase fruits and vegetables exports by approximately 2.06 per cent in the HTM and by 2.84 per cent in the GMM, holding other factors constant. The results are consistent with theory and *a priori* expectation. Moreover, they support the findings of Perez and Wilson (2010) and Djemmo (2013) who found that ICT use had a positive and statistically significant influence on exports. However, the findings are at variance with Masyhuri and Dermoredjo (2010) who concluded that ICT proxied by internet use had no statistically significant relationship with agricultural crops exports. The positive effect of ICT (internet) use on exports of fruits and vegetables is to be expected. Exporters depend on the internet to coordinate the supply chain from the farm gate to the end consumer. This includes marketing, exchanging transaction documents, completing customs procedures, product tracking and tracing, and processing payments, among others. The resulting improvement in efficiency along the supply and value chain boosts the exports of fruits and vegetables.

Quality of air transport infrastructure index has a positive and statistically significant relationship with exports at 1 per cent significance level in the GMM. Holding other factors constant, a 1 per cent increase in the quality of air transport infrastructure index would increase exports by 18.63 per cent. The result is consistent with a priori expectation and supports De (2009), Perez and Wilson (2010) and Iwanow and Kirkpartrick (2009) who found similar results. The positive effect of quality of air transport infrastructure on exports is understandable. Fresh vegetables and most fruits from Kenya are mainly exported through Jomo Kenyatta International Airport (JKIA). An increase in the value of the quality of air transport infrastructure index means that a country is improving the coverage, facilities, and efficiency of its airports. Therefore, exports of fruits and vegetables are expected to increase as the index increases.

Effects of the soft dimensions of TF

The coefficient of exporter regulatory efficiency is positive and significantly different from zero at 1 per cent significance level in both the HTM and GMM. Holding other factors constant, a 1 per cent increase in exporter regulatory efficiency index would increase exports by approximately 16.32 per cent in the HTM and 11.1 per cent in the GMM. The results are consistent with theory and Iwanow and Kirkpartrick (2009) who found a positive and statistically significant relationship between regulatory efficiency and exports. Improvement in exporter

regulatory efficiency is expected to positively affect exports because complying with government regulation can be a major barrier to trade if producers and exporters lack the required technical capacity and financial resources. An increase in regulatory efficiency index implies a reduction in the burden of government regulation. This explains the positive relationship between exports of fruits and vegetables and exporter regulatory efficiency index.

Importer regulatory efficiency index is positive and statistically significant at 1 per cent significance level in the HTM. The result means that a 1 per cent increase in importer regulatory efficiency would increase exports by 4.39 per cent, holding other factors constant. The result is consistent with *a priori* expectation. However, it is at variance with Shoji (2013) who found a negative and statistically significant relationship between importer regulatory efficiency and US exports. Improvement in importer regulatory efficiency reduces the regulation-related costs and barriers in the export market. Thus, an increase in importer regulatory efficiency index is expected to positively affect Kenya's exports to the EU market.

The coefficient of customs efficiency index is positive and statistically significant at 1 per cent significance level in the HTM. The results mean that holding other factors constant, an increase in customs efficiency by 1 per cent would increase fruits and vegetables exports by approximately 16 per cent. The result supports Moise and Sorescu (2013) and Asgarkhani and Amani (2014) who established a positive and statistically significant relationship between customs efficiency and exports. An efficient customs system is characterized by few and easy to comply with procedures. This eases the burden of customs procedures by reducing the number of days, documents, labour, and financial resources required to comply with customs formalities. An improvement in customs efficiency index reflects a reduction in the burden of customs procedures and prevalence of on-the-border trade barriers. Therefore, an improvement in the index leads to an increase in exports.

4.3.2 Effects of control variables

The coefficient of production volume is positive and significantly different from zero at 5 per cent significance level as expected *a priori* in both the HTM and GMM. This means that a 1 per cent increase in production of fruits and vegetables would increase exports by 1.81 per cent and 1.16 per cent in the HTM and GMM, respectively. The result supports Zaki (2010) who concluded that production volume improved food exports in select developed and developing countries. The positive effect of production volume on exports is to be expected. Increased production creates surplus, which increases the propensity to export fruits and vegetables.

The coefficient of exchange rate is negative and significantly different from zero at 5 per cent in the HTM and 1 per cent in the GMM as expected *a priori*. This means that a depreciation of the Kenya shilling against the US dollar by 1 per cent would decrease exports by approximately 8.92 per cent in the HTM and 15.32 per cent in the GMM. However, the result is at variance with Karamuriro and Karukuza (2015) who found a positive relationship between exchange rate and exports in Uganda. One of the possible explanations to the negative relationship between exchange rate and fruits and vegetables exports is that a depreciation of the shilling increases the cost of exporting, which in turn reduces the competitiveness of Kenya's fruits and vegetables. Thus, exports reduce as the shilling depreciates.

Exporter GDP per capita has a negative and statistically significant relationship with exports at 1 per cent significance level in both models. The result means that a 1 per cent increase in Kenya's GDP per capita would decrease exports by approximately 12.01 per cent and 15.23 per cent in the HTM and GMM, respectively. This result is consistent with Djemmo (2013), Hatab Romstad and Huo (2010), and Felipe and Kumar (2010) who showed that exporter GDP per capita has a negative and statistically significant relationship with exports. The income effect on normal goods explains in part the negative relationship between Kenya's GDP per capita and exports of fruits and vegetables. A rise in income is likely to increase the demand for fruits and vegetables in the domestic market. Consequently, *ceteris paribus*, producers are likely to shift supply to the local market to increase their earnings, thereby reducing exports.

The lagged value of importer GDP per capita in the GMM has a positive sign and is statistically significant at 5 per cent significance level as expected *a priori*. The implication of this result is that exports of fruits and vegetables would increase by 2.87 per cent if the lagged value of importer GDP per capita increased by 1 per cent, holding other factors constant. An increase in income in the importing country is likely to increase demand for imports. This explains the positive relationship between lagged importer GDP per capita and exports.

The coefficient of geographic distance is negative, but statistically significant at 1 per cent in the GMM only. The result supports Karamuriro and Karukuza (2015) who also found the negative effect in Uganda. The results mean that geographic distance has a negative effect on exports.

Export value lagged by 1 period has a positive coefficient that is statistically significant at 1 per cent significance level in the GMM as expected a priori and in line with theory. The results are consistent with Caporale et al. (2009) who found that the lagged value of exports had a positive and statistically significant relationship with exports in the current period. Exports in the previous period

are expected to influence exports in the current period by enhancing access to financial capital (revenue from previous sales). This explains in part the positive effect of the lagged value of exports of the same in the current period.

Overall, the standard errors of all variables in the GMM save for importer GDP per capita are less than those in the HTM. This means that the GMM parameters are more efficient than their HTM counterparts. Therefore, the GMM results were used for scenario analysis. However, the coefficient of customs efficiency from HTM was used since it was not included in the GMM model.

4.4 Trade Effects of Increasing the Level of Kenya's TF to that of its Competitors

The trade effects of increasing the level of TF in Kenya to that of select competitors in the EU was done using scenario analysis. The results are presented in Table 4.3. ICT use and customs efficiency (CE) index in Kenya have to be improved by 5.98 and 1.27 per cent, respectively, to reach the level of Costa Rica. Kenya's quality of air transport infrastructure index and regulatory efficiency index have to be improved by 0.72 and 1.95 per cent to reach the level of Morocco.

Table 4.3: Scenario analysis results

Variable	Xi (coefficient from GMM)	Current Kenyan indicator	Reference country indicator		Ci (% change)	Y (Trade effect) in %
ICT use	2.83853	43.43	Costa Rica	49.41	5.98	16.97
Quality of Air Trans. Infr. Index	18.62504	4.7876795	Morocco	4.822309	0.72	13.41
CE index	15.9988	3.817438	Costa Rica	3.86587185	1.27	20.32
Exporter RE index	11.10443	3.871775	Morocco	3.9473088	1.95	21.65

Increasing the level of ICT use to the level of Costa Rica will increase exports of fruits and vegetables by 16.97 per cent. Improving customs efficiency to the level of Costa Rica will increase exports by 20.32 per cent. Exports will increase by 21.65 per cent if Kenya's regulatory efficiency index is improved to the level of Morocco. The results are consistent with Beverelli, Neumueller, and Teh (2015) who found that Sub-Saharan African countries with low levels of trade facilitation would realize an improvement in export performance if they improved their TF to the global and Sub-Saharan Africa median level.

Exports will increase by 13.41 per cent if Kenya's quality of air transport infrastructure index is improved to the level of Morocco. The result is consistent with Francois and Manchin (2013) whose scenario analysis results showed that improving transport infrastructure to the level of developed countries would increase trade volume in developing countries by 26 per cent. Overall, the scenario analysis results imply that Kenya's exports to the EU market would increase if its level of trade facilitation is improved to the level of its major competitors, particularly Morocco and Costa Rica.

5. Conclusion and Policy Recommendations

5.1 Conclusions

The aim of this study was to estimate the effect of trade facilitation on exports of fruits and vegetables to 15 EU countries. The study found that trade facilitation plays an integral role in promoting exports to the EU. In particular, customs efficiency had a positive effect on the exports. This means that on-the-border trade facilitation measures geared towards harmonization and simplification of customs formalities/procedures are important in improving the exports.

ICT use, quality of air transport infrastructure, and exporter regulatory efficiency also had a positive effect on exports. This implies that behind-the-border trade facilitation measures also play an important role in improving the exports. Additionally, the trade facilitation measures implemented by Kenya's trade partners improve exports. This conclusion is based on the fact that importer regulatory efficiency had a positive effect on thes exports. Apart from trade facilitation, production volume improves exports of fruits and vegetables. However, depreciation of the Kenya shilling against the US dollar negatively affects exports. Similarly, an increase in Kenya's GDP per capita reduces the exports.

Scenario analysis revealed that improving Kenya's ICT use and customs efficiency index to the level of Costa Rica would significantly increase exports. Similarly, improving Kenya's regulatory efficiency and quality of air transport infrastructure index to the level of Morocco would have a positive effect on the exports. This means that adopting international best practices with regard to these aspects of trade facilitation is important in improving exports of fruits and vegetables.

5.2 Policy Recommendations

In light of the results discussed in the foregoing paragraphs, the government should consider the following policy recommendations to improve exports of fruits and vegetables to the EU market. First, the government should prioritize improvement in the quality of air transport infrastructure to increase exports. This calls for expansion of port facilities such as runways, warehouses, cold rooms, loading slots, hungers, and security systems.

Second, customs efficiency should be improved through measures aimed at reducing the burden of customs procedures. The introduction of the single window system in 2014 automated cargo clearance at JKIA and the port of Mombasa. As a result, cargo dwell-time at Kenyan airports and the port of Mombasa reduced from 5 to 1 day and 8 to 4 days, respectively. However, there is still room for improvement since the burden of customs procedures in Kenya is still higher

than in most of its major competitors. For instance, Kenyan exporters require 26 days and 8 documents to export. In Morocco and South Africa, exporters need only 5 documents and 16 and 11 days, respectively. Thus, further simplification of customs procedures is necessary to improve customs efficiency which in turn will increase exports.

Third, improvement of ICT (internet) use is necessary to enhance exports. Policy interventions in this area should focus on increasing access to effective, adequate, and affordable internet infrastructure and services, especially among farmers and exporters of fruits and vegetables. Finally, regulatory reforms are needed in the fruits and vegetables industry, aand supportive sectors such as transport to improve exports. Regulatory reforms should aim at enhancing compliance with existing rules and eliminating the barriers to trade associated with regulation. The resulting reduction in the burden of regulation is expected to boost exports.

5.3 Recommendations for Data and Future Studies

Data on trade facilitation indicators is a global problem that needs to be addressed to enhance research. The government in collaboration with development partners and industry stakeholders should focus on collecting and storing TF data and availing it in electroni databases to ease access. In future, research on the effect of trade facilitation on exports can use more indicators, different products or industry data and methodologies to gain deeper insights.

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Appendices

Appendix 1: LR heteroskedasticity test

Likelihood-ratio test	LR chi2(14) = 203.39
Assumption: homosk nested in hetero	Prob chi² = 0.0000

Appendix 2: Random effects test

Estimated results	**Var**	**Sd = sqrt(Var)**
Lnexports	3.665263	1.914488
e	0.5330412	0.7300967
u	3.536008	1.880428
Test: Var(u) = 0 Chibar²(01) = 480.69 Prob > Chibar2 = 0.0000		

Appendix 3: Hausman specification test (HT vs. FE)

Test: H_0: differences in coefficients not systematic
$Chi^2\ (9) = (b\text{-}B)'[(V_b - V_B)^{-1}](b - B) = 0.00$
Prob > chi² =1.0000

Appendix 4: Correlation matrix for HTM instruments

	Lnimporter GDP per capita	Lngeo-distance	Col
Lnimporter GDP per capita	1.0000		
Lngeo-distance	0.4132	1.0000	
Col	0.2263	0.2112	1.0000

Appendix 5: Arellano-Bond test for autocorrelation

Order	**z**	**Prob> z**
1	-2.6833	0.0073
2	0.09626	0.9233

H_o*: No autocorrelation*

Appendix 10: Sargan over-identifying restrictions test

Chi²(62) = 64.59588
Prob> chi² = 0.3860

H_o*: Over-identifying restrictions are valid*

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