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A CGE model analysis of reducing obstacles to trade in Kenya: a focus on the agro-food sector

Summary

This paper evaluates compliance cost with regulations as obstacles to trade and its effects in exports to the EU in the avocado market. An exporter interview conducted in several African countries provides the structure of compliance costs as obstacles to trade. The questionnaires collected in Kenya contain information on the main products exported by Kenya: tea, flowers, coffee and fresh beans. These products give the structure of compliance costs of firms which have already successfully modify their export facilities to comply with international regulations. Their costs incurred are adopted for the avocado market and the implications for the Kenyan avocado exporters and international trade are evaluated. Trade between the EU and African countries has increased through different agreements such as the program "Everything But Arms" (EBA). Within EBA, the main exports of the least developed countries (LDCs) have been able to enter the EU market without any duties since 2001. The ACP countries' trade agreements, favouring ACP access to the EU market. Being Kenya one ACP Member State, trade to the EU has been intensified since then.

In a first step higher compliance with private standards for avocados is modelled in a multi-country CGE model as a change in technology enhancing EU imports from Kenya. The changes in export and import quantities obtained from GTAP are transmitted to the single country model to analyse changes in the Kenya economy.

The main scenario takes into consideration an increase in the Kenyan export due to the higher compliance with international standards by increasing technological change in EU imports from Kenya. Results evaluate the main implications of this in international trade (GTAP model) and in Kenyan households (single country model).

1. Introduction

Trade between the EU and African countries has increased through different agreements such as the program "Everything But Arms" (EBA). Within EBA, the main exports of the least developed countries (LDCs) enter into the EU market without any duties since 2001. Another important agreement is the ACP countries' trade agreements, favouring ACP access to the EU market. Being Kenya one ACP Member State, trade to the EU has been intensified since then.

The European Union is an important destination for Kenyan exports, capturing approximately 70 percent of total agricultural commodities. Exports from Kenya's to the EU are mainly primary agricultural commodities. The major trade flows are represented by fresh cut flowers, green beans, tea and coffee and to a lesser extent other agricultural commodities like avocado. The country exports a substantial amount of fruit, especially avocadoes and mangoes, and is the fifth largest avocado exporter to the EU after Peru, Israel, Mexico and

South Africa (EUROSTAT, 2011). Tea and coffee have been privileged African exports to the EU due to the high market value and no associated consumer health issues; while other horticultural products are subject to compliance with standards and regulations concerning consumer health and environmental requirements.

In the last three decades the exports of agricultural commodities have increased with the rest of the Kenyan economy. Particularly, Kenya's has stand out for her horticulture and floriculture industries. The floriculture industry has been regarded as very competitive, flexible to the adoption of new inputs (seeds, fertilizers and agrochemicals), and operating on the 'cutting edge' through the implementation of stringent environmental and social practices to comply with the standards required in export destinations -such as the EU market- (Jaffee, 2004). Green beans have been a representative export product of Kenya's fresh produce trade for many years, mainly to the European Union. Kenya accounts for about 30 percent of the EU market for green beans (COMTRADE, 2011). Kenya beans have a number of food safety and standards to comply with sanitary and phytosanitary regulations required to enter in the EU markets. This compliance is part of the successful expansion of green beans from Kenya in the EU market.

Other markets with high potential in international markets such as the avocados from Kenya have not prospered in the same way as green beans and cut flowers had. Therefore, in this paper we analyse the possible effects of a higher investment in the export infrastructure to overcome obstacles to trade related to the compliance with private standards. The main hypothesis of our research is that higher compliance with private standards leads to an increase in exports to the EU.

In this paper we study the implications for avocado exporters of a higher compliance with certification of agricultural production processes. We assume that avocado exporters follow the structure established for the export of green beans to Europe, in which exporters pay in most of the cases the costs involved with product certification.

The paper is organized as follows. Section 2 lays out the background of Kenyan production and trade, particularly as it relates to trade with the EU and presents the structure of the exporter survey used in this study. Section 3 presents the econometric analysis of the exporter survey and discusses the conceptual framework that determines the structure of exports for selected exporters of green beans, cut flowers, tea and coffee from Kenya based on the information obtained by interviewing agricultural exporters in Kenya of competitive products. Section 4, the structure found for leading Kenyan exporters is adapted to avocado exporters Section 5 analyses the effects on the international markets and the implications for Kenya derived from a higher compliance of avocado production by adopting trends observed in interviewed exporters. Section 6 shows the effects of the exercise at national level with particular focus on rural and urban households in Kenya. Finally, Section 7 discusses the results and provides some conclusions of this exercise.

2. Kenyan Horticultural and Floriculture Production and Exports

2.1 Production

Agriculture represents the most important economic activity in Kenya, although less than 8% of the land is used for agricultural activities. From the total surface Kenya's, only approximately 20% corresponds to arable land, of which 12% is classified as high potential (rainfall) agricultural land and about 8% is medium potential land. Remaining land is considered as arid or semiarid. Agricultural activities in Kenya are represented by small producers who usually cultivate no more than two hectares using low technology systems (Jaffee, 2004).

In comparison to other African countries, over the past two decades attention of researchers, government, and donors has been focused in Kenya's horticultural and floriculture sectors due to their capacity to grow rapidly and yet sustainably meeting international standards (Jaffee, 2004).

The production highly oriented to export markets can be track back at the farm level. While over 90% of smallholder farmers in all but the arid regions of Kenya produce horticultural products, less than 8% cultivate other kind of crops (Tschirley, et al, 2004).

In Table 1 information on the production of different horticultural commodities and flowers is shown. The general pictures show increases in horticultural and floriculture production in the regarded years. This trend has been already observed since the last three decades (Wiersinga and de Jager, 2007). In terms of quantities, vegetables dominate the agricultural production in Kenya, representing more than 50% of the total in 2007. In terms of values, flowers possess the highest value per unit in comparison with other products displayed in Table 1.

Table 1: Overall agricultural production volumes ('000' MTs) and values (Million EUR)

Product	Quantity '000' MTs			Million EUR		
	2005	*2006*	*2007*	*2005*	*2006*	*2007*
Vegetables	4,533,352	4,327,375	4,337,883	390,647	385,626	407,299
Fruits	2,463,984	2,478,570	2,547,339	288,913	315,668	332,474
Nuts	97,582	116,571	102,035	37,247	44,154	38,879
Flowers	102,348	113,461	114,878	138,402	191,787	233,017
Total	7,197,266	7,035,977	7,102,135	855,226	937,252	1,011,686

Source: (HCDA; 2008)

The floriculture industry historically has been growing as well since the early 90's recording higher growth in both volume and value in comparison to horticulture. Kenya is currently one major exporter of cut flowers to the EU showing increasing export volumes every year.

2.2 Exports

Kenya has become a predominant exporter in recent years. Kenya is an important world supplier of horticultural exports, flowers, tea and coffee. The main flowers exported from Kenya include roses, carnations, and a variety of summer flowers. Under the vegetables category, French beans, peas, Asian vegetables such as karella, chillies, aubergines and okra are main exports. With regards to fruits, mangoes, avocadoes and passion fruit are the most representative Kenyan exports (voor den Dag, 2003).

There are now some 500 commercial flower growers in Kenya. However, approximately 75 % of Kenya's cut flower exports are grown by about 30 large and medium scale producers. The remaining export share is grown and supplied by smallholders in open plots of less than half a hectare (Collinson, 2001). For fresh flowers, Kenya supplies 32 % of the EU imports. The main market for Kenyan cut flowers and cuttings are the Netherlands, United Kingdom, Germany, France, Switzerland, Italy, Scandinavian Countries and the Russian Federation.

Exports to the EU

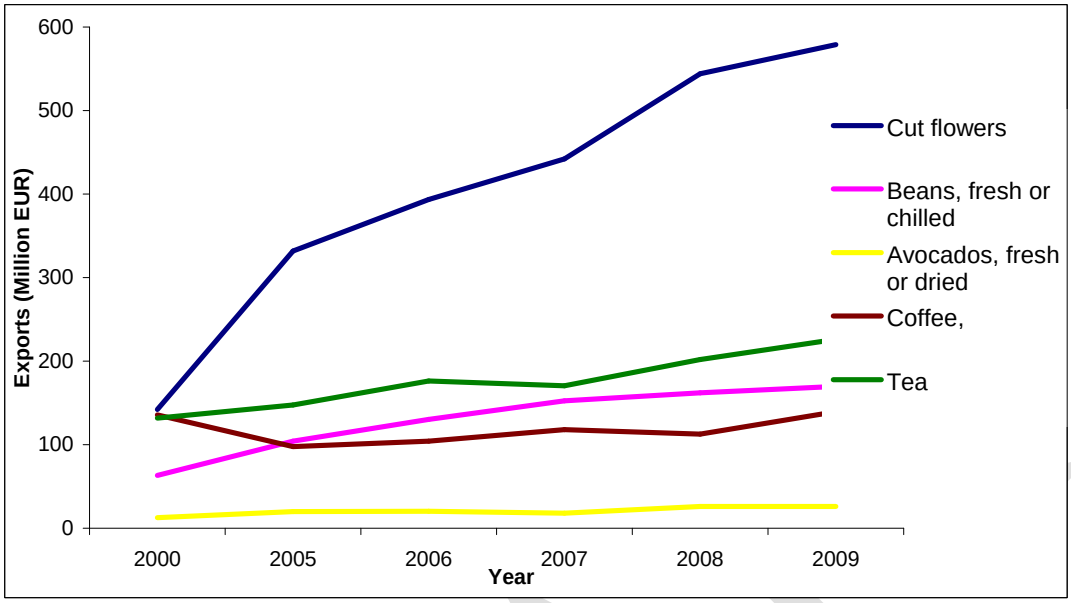
Exports to EU, by importance, are cut flowers, tea, leguminous vegetables, coffee and fruits which account for over 70 % of the value of exports to the EU. In 2009, EU imports of green beans represented approximately 50% of the total, with major import destinations being the UK (30 %), France (26%) and Belgium (7%). The country exports a substantial amount of fruits, especially avocadoes and mangoes, and is the fourth largest avocado exporter to the EU after Israel, Mexico and South Africa (EUROSTAT, 2011).

Figure 1 illustrates how the levels of Kenya's main agro-food commodities exported to the EU varied between 2000 and 2009. The first fact observed in Figure 1 is the remarkable growth that exports of Kenyan fresh cut flowers to the EU have experienced. The other commodity that presents a noticeable growth as well , even if is much more moderate, is green beans.

On the other hand, coffee and tea, two typical cash crops leveraged by African countries to tap into the EU market have remained almost unchanged in their exports from 2000 to 2009. Fresh avocados exports have also remained roughly stable throughout the analysed period.

Despite Kenya's rapid and sustained growth in production, horticultural exports to the EU remain a small fraction of Kenya's overall production. From 1990 to 2005, over 90% of all fruit and vegetable production is imputed to domestic consumption either on-farm or through domestic markets (Tschirley, et al, 2004; HCDA, 2008).

Figure 1. Historic values of Kenya's main exports to the EU



Source: COMTRADE (2011)

The rapid growth of the flower and green bean export horticulture can be attributed to several factors. First, preferential treatment under the Cotonou Convention between APC countries and the EU provides concessionary access for Kenyan flowers and vegetables to the European market. Second, the sustained demand for horticultural products from EU provides a stable and growing market for Kenyan producers. Third, the location of Kenya as a centre of air transport between Europe and the East and Southern Africa region ensures that there is sufficient northbound air cargo to transport rapidly exports. Finally, the presence of ample local and international investors willing to invest in compliance with international standards and regulations provides Kenya with an added advantage (voor den Dag, 2003).

Other potential competitive export oriented sectors such as avocado have not experienced same increasing trends in exports (Figure 1). Therefore, since 2002 different programs have been implemented to improve Kenyan avocado exports to the EU (Jones and Webber, 2010). Although avocado production has increased with the implementation of these programs (Figure 4.63; Jones and Webber, 2010), EU avocado imports from Kenya have been steady (Figure 1). Some possible reasons for the steady trends of Kenyan exports to the EU are: the low infrastructure and logistic organization of micro- and small farmers as well as the low exports shares complying with EU regulations and standards. Some implemented programs have targeted the improvement of the value chain of avocado production, however, compliance with European certification remains as an important goal to be achieved (Nyagah R., 2007). Furthermore, several larger avocado exporters are not aware of the costs and benefits associated with the certification compliance of their export commodities (Nyagah R., 2007).

2.3 Importance of avocado for Kenya

Avocado production is important for domestic consumption, processing industry of avocado oil and for export markets. The main varieties grown in Kenya are Hass and Fuerte with the latter being the main variety grown for export. In late years international market demand has shifted to Hass. Hence since 2002 Hass variety is being established more than Fuerte. In Table 2

main avocado producers worldwide are shown. Since the 60's, Kenya has been in the top ten avocado producers. In 2008 Kenya had 7,500 ha under avocado production yielding about 93 thousand tons (Table 2), however about one third is lost due to poor pre- and postharvest handling practices; poor tree crop management practices; low infrastructure, poor market information, pests (thrips, scales, fruit fly, etc.) and diseases (root rot, anthracnose and Cercospora leaf spot) (Wasilwa et al., 2007).

Table 2. World production of avocado (thousand tons)

	1961-64	**1971-74**	**1981-84**	**1991-94**	**2001-04**	**2007-08**
Mexico	120.7	254.6	453.2	753.5	980.5	1133.7
Chile	9.4	13.1	28.5	46.8	127.5	250.0
Indonesia	31.3	39.9	56.9	95.2	226.5	213.4
Colombia	12.2	13.2	19.9	73.5	149.6	189.0
Dominican	109.8	125.8	134.7	141.7	137.1	185.4
United	47.0	67.1	209.3	180.4	195.2	154.6
Brazil	94.2	151.0	141.9	107.9	168.5	150.7
Peru	21.7	102.4	80.9	81.9	94.4	129.0
Kenya	***n.a.***	***n.a.***	***21.0***	***23.3***	***64.4***	***93.6***
China,	n.a.	n.a.	n.a.	17.0	78.6	93.5
Spain	0.4	1.6	17.4	47.8	113.1	82.1
Venezuela	53.9	42.6	45.6	49.3	49.6	77.5
South Africa	4.7	10.9	23.0	44.4	67.3	74.4
Ethiopia	n.a.	n.a.	n.a.	n.a.	80.4	55.0
Israel	1.3	11.7	40.6	56.1	75.5	69.5
Congo,	13.0	20.3	38.5	41.3	60.9	64.8
Haiti	40.8	51.0	61.8	48.0	45.0	58.0
Cameroon	13.0	17.0	26.5	41.0	51.8	55.0

Source: FAO report and FAOSTAT (2011)

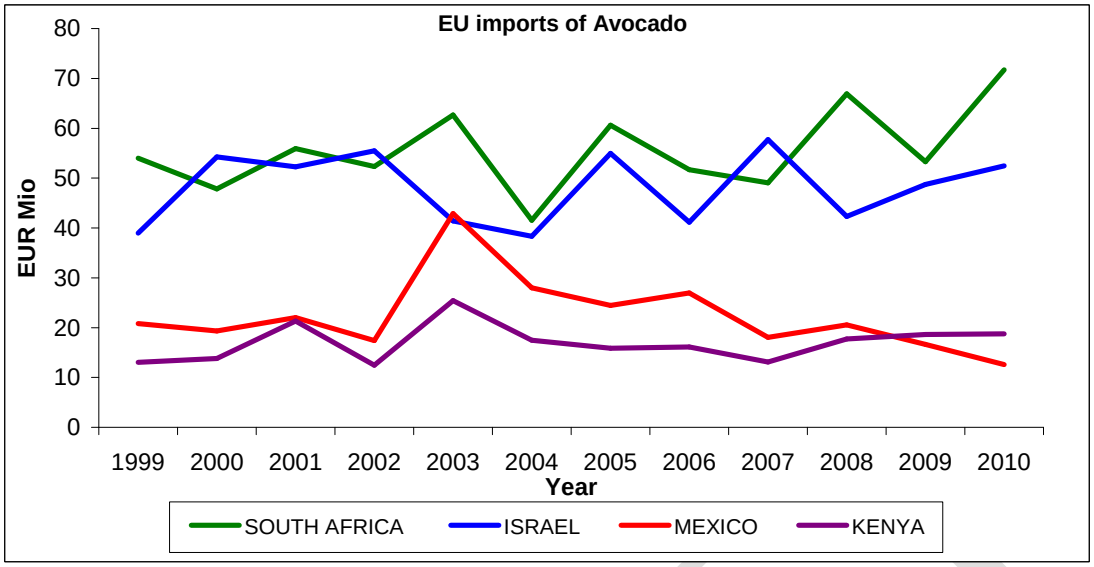
Kenya exports a substantial amount of fruit, especially avocadoes and mangoes. Kenya is the fourth largest avocado exporter to the EU after Israel, Mexico and South Africa. Main export markets for avocado are Europe and the Middle East.

Figure 2 highlights Europe's more important avocado suppliers. South Africa accounted for about 25 % of imports in 2010, followed by Mexico, Israel and Kenya. The EU maintains a seasonal import tariff of 4 % from 1 December to 31 May and in the remaining months the unit price value is used to determine the custom value, regularly higher than 4 % (TARIC 2011, Commission Regulation (EC) No 215/2006).

This seasonal variation appears to be small enough so as not to affect imports significantly. However, the Cotonou agreement allows free entry of Kenyan avocados in the EU giving with this a special treatment for Kenyan avocado exporters over other suppliers, yet this special treatment has not been reflected in increased avocado export flows to the EU (Figure 2).

In the EU, about 15 % of EU consumption is supplied by Spain, the largest EU avocado producer, followed by Greece.

Figure 2. EU imports of avocado from different countries (1999-2010)



Source: EUROSTAT (2011)

2.3 Data

Export commodities from Kenya complying at a high extent with EU regulation and their investment costs associated, are used in this study as role model for avocado exports. This approach evaluates the determinants for investment costs associated with EU standard and regulation compliance for selected commodities. Further, exporter value chain structures are compared to determine possible investment costs required for avocado exporters to increase the share of production compliance with private standards and thus to increase avocado exports to the EU.

For these purposes, a survey of African agricultural exporters has been lunched in 2009 in five different African countries, one of them Kenya. Exporters were randomly selected and consulted about their willingness to participate in the survey. In Kenya exporters participating are exporting green beans, cut flowers, tea and tobacco. Only private companies -no-cooperatives- have been chosen to participate in the survey. A total of 21 Kenyan export products are considered in the survey. Thus, the outcome is not representative but it provides an insight into the export chain, product characteristics, opinions and perceptions of exporters, and can provide some indicators for other agricultural exporters on the potential structure required to overcome obstacles to trade. Some exporters do business with different agricultural products simultaneously; therefore for the exporter survey they were requested to focus on one product when answering the interview. In this sense, each observation in the survey corresponds to one product and one exporter.

Unfortunately, the export survey provided few variables in comparison to other available survey data e.g., the enterprise survey (which however only covers manufactures). Particularly following variables are available from our data set:

- % of production complying with EU standards
- Exporting to non-EU markets (dummy 1=yes)
- Investment in the last 3 years (EUR)
- Investments as % of total revenues associated with the product
- % increase in earning resulting from compliance
- Total exporters' revenue (EUR)

- Revenues coming from EU market (EUR)
- Share of EU total expenditures (%)
- Perishable comm. (dummy 1=yes)
- Package used (1=pre-packed & final consumer; 0= bulk)
- Years in Business

The data set contains 21 observations of different export products provided by 15 Kenyan agricultural exporters. Due to the low number in observations, it is hard to believe in the representativeness of the survey. However, it covers one quarter of the total Kenyan agricultural exporters registered in the Fresh Produce Exporters Association of Kenya (25 flower exporters and 36 fruits and vegetable exporters registered) including small-, medium- and large Kenyan exporters (FPEAK, 2011).

The descriptive statistics of our work data set are presented in Table 3. As a first outline of the distribution of exporters characteristics, and compliance costs associated to EU regulations and standards, Table 3 summarizes the main variables consider in the study. Table 3 gives the mean and the standard deviation of each variable. Notice that nearly half of the exporters interviewed (42%) in the survey have invested in the last 3 years to comply with EU regulations.

Table 3. Export chain survey' characteristics

Variable	Observations	Mean	Std. Dev.	Min	Max
Flowers' exporters	8				
Green beans exporters	7				
Coffee and/or tea exporters	6				
% of production complying EU standards	21	0.90	0.11	0.60	1.00
Exporting to non-EU markets	12	0.57	0.51	0.00	1.00
Investment in the last 3 years (EUR)	9	112975.90	297722.40	12500	1000000.00
Investments in % of revenues	9	0.04	0.04	0.002	0.1
% increase in earning resulting from compliance	9	0.17	30.15	0	0.70
Total exporters' revenue (EUR)	21	2,855,952.00	4,578,352.00	200,000.00	12,000,000.00
Revenues coming from EU market (EUR)	21	1,870,387.00	3,142,454.00	125,000.00	10,800,000.00
Share of EU total expenditures (%)	21	0.78	0.17	0.38	0.88
Perishable comm.	21	0.38	0.50	0.00	1.00
Package used	21	0.19	0.40	0.00	1.00
Years in Business	21	14.19	7.79	3.00	25.00

Source: own calculations

3. Exporters determinants to invest in EU standard compliance

The analysis assesses the contribution of individual exporter characteristics in determining the amount of investment required to comply with EU standards and regulations in the last three years. A high compliance with regulations and standards[1] will be related to the exporter's success. The existing empirical literature (e.g., Bernard and Jensen (1997, 2001); Roberts and Tybout (1997)) provide information on the structure of successful exporters: their businesses are considerably larger, have higher productivity and have recent machinery.

The data set contains variables which might explain the investments to comply with EU regulations and standards. These variables are associated with exporters' characteristics, such as firms' success, total revenues, etc. Firm's success can be covered by several variables indicating different characteristics. Successful exporters have been improving their export chains and infrastructure over the time (experience) and in this manner increased their export shares[2]. This is grasped by the variable 'years of experience' in the survey. Other variable covers firms' size by associating it with the total revenues of the exporter due to lower average costs (economies of scale). Firms' specialization in one market could be also the key of the successful large exports to the EU. A variable representing the share of the EU imports is included to capture the importance of the EU market in needed investments done by Kenyan exporters. The importance of the EU market is also captured by the variable representing the total revenues accrued from exports to the EU27. A dummy variable for perishable commodities is as well included in the model. Finally, the current compliance with EU standards determines the investments required to increase the percentage of exports complying with EU regulations and thus increasing the exports to the EU.

An econometric impact model is specified, which statistically investigate the determinants obtained from the exporter survey that can be relevant, so that the costs of adoption can be easily extrapolated for avocado exporters. Regression analyses assesses the contribution of each individual factor mentioned above (Table 3) in conditioning the amount of investment required to comply with the EU standards and regulations. All data were analysed with an STATA version 9.0 software package. The equation defining was compliance costs is:

$$cc = \alpha + \sum \beta X \qquad \text{[Eq. 1]}$$

Where:

CC= compliance costs

α = intercept

X= explanatory variables (see Table 3)

In the following section we adapt this structure for avocado exporters to calculate the related amount of compliance costs needed to increase the extent of the compliance with European standards.

The first log regression equation included all variables as dependent variable Investment in the last 3 years to comply with standards and regulations (Table 4) and explanatory variables were all those remaining listed in the Table 3 except the dummy for exporters of fresh flowers. Non-significant variables and variables with probabilities higher than 1 were removed. Exporting to non-EU countries and product type were not significant and removed from subsequent models. Table 4 presents the final model obtained. Variables '% of production complying EU standards' and 'years in business' were not significant predictors. The final model contains three significant variables: Exporters' revenue, revenues coming from EU market; and share of EU total expenditures.

[1] High compliance is understood as a high share of production complying with EU standards, in the current case, private ones.
[2] Firms improve export chains and therefore investment costs required to comply with EU regulations are lower in comparison with other firms.

Table 4. Influence of selected determinants on exporters investments to comply with EU standards and regulations

Explanatory variable	Coefficient	Std. error	Pr > Chi-square
Log Total exporters' revenue (EUR)	-3071698.0	243107.4	0.000
Log Revenues coming from EU market (EUR)	3175919.0	239137.2	0.000
Share of EU total exports (%)	-4718113.0	415744.1	0.000
Constant	3182438.0	466914.8	0

Source: own calculations

Results from the regression analysis indicate that the single most important predictor of how much exporters invest in regulation compliance is the log of total exporters' revenue (coefficient: -30.7×10^5, p≥ 0.00).

Thus, the expenditure incurred by the interviewed exporters to implement processing systems in order to comply with standards and regulations (compliance costs) is determined by:

$$CC=31.8 \times 10^5 * - 30.7 \times 10^5 * \log (R) + 31.7 \times 10^5 * \log (EU) - 47.1 \times 10^5 * S \quad \text{[Eq. 2]}$$

Where:

CC= investment needed or 'compliance costs'

R= Total exporters' revenue (EUR)

EU= Revenues coming from EU market (EUR)

S= Share of EU total exports (%)

In the following section we adapt this structure for avocado exporters to calculate the related amount of compliance costs needed to increase the extent of the compliance with European standards.

4. Estimating costs of compliance for avocado exporters in Kenya

4.1. Current situation

In the 90's a new framework for food safety was implemented in the EU leaded by a new pesticide regulation. Simultaneously, the EU initiated the Pesticides Initiative Programme (PIP), to support ACP countries in the adaptation to the new pesticide regulations in the EU. With the help of PIP, several leading Kenyan companies expanded their smallholder activities with increased grower management and product traceability. However, there are still standards and regulations related to packaging, quality, sanitary and phyto-sanitary measures, private standards etc. that have to be met, such as GlobalGAP[3] or other private certifications (Bear, 2007; Nyagah, 2007). Since the early 2000s, several aid programs have been implemented in Kenya to consolidate the growth of micro-, small and medium enterprises including avocado producers. One of these programs is performed by the USAID and called Kenya BDS program. The Kenya BDS program has as major goal to target the sustainability of supply for fresh fruits and vegetables through the linkage of farmers and producer groups with exporters (Nyagah, 2007). The decision of which party covers the cost of compliance can be agreed on different ways. In some schemes, exporters and producers undertake the costs jointly. In other arrangements, non-governmental organizations support producers to pay for the compliance costs. To have an idea of the structure of possible compliance costs, we describe the

[3] Starting as a private standards initiative of European retailers and supermarket chains, GlobalGAP has formerly been known as GlobalGAP. The change of name indicates that GlobalGAP is now established in the global marketplace, serving as a key reference for retailers/supermarket chains worldwide. For detailed information about GlobalGAP see http//www.globalgap.org

requirements to comply with voluntary standards for the certification of production processes described by GlobalGAP for the avocado market:

- Investment in staff training to set up formal arrangements such as documentation and the implementation of new methodologies. According to Jaffee (2004) and Nyagah (2007), the salaries for trained personal engaged with quality assurance and food safety systems increase by 25-40%.

- Access to private laboratories to audit farms (water analysis, soil analysis, pesticide residue analysis, etc). The analyses (pesticide, water quality, and soil) in an external laboratory have a total annual cost of approximately 200 EUR (Nyagah, 2007). For a large exporter or group of producers it would be feasible to consider the construction of a new packing house, or a new building to run the quality analysis in-house. The cost of establishing one of either facilities would represent an investment of 30 000 EUR (Jaffee, 2004).

- Certification fees GlobalGAP, British Retail Consortium (BRC) etc. The fees per day and related costs for 16 certificates included have a total cost for the GlobalGAP of about 347 EUR (Nyagah, 2007).

Currently, some group of farmers have paid this through donor funds and others have paid this through arrangements with exporters. However, to assure a continuous avocado supply chain, it is required to comply with some of these private regulations. The costs associated with compliance are considered 'compliance costs'. As mentioned above, there are ongoing programs such as Kenya BDS dealing with the identification of strategies to support smallholders for obtaining the GlobalGAP certification (Nyagah, 2007). Therefore, this study complements in-field programs providing information on the possible effects that standard compliance will have on national and international markets.

The design and implementation of these quality assurance and production standard systems can be expensive for small and medium farmers. Therefore in this study we suppose that these costs are mainly covered by exporters.

The exporter's experiences obtained from the exporter survey are taken as reference to estimate the cost of compliance for avocado exporters. Considering the investment structure obtained from the econometric model obtained in section 3, specific information on the avocado exporters is required. According to the results from Section 3, determinants in the amount of money needed to comply with the standards are: total exporters' revenue (EUR), revenues coming from EU market (EUR), share of EU total exports (%). In the coming section we analyse each of these parameters of avocado exporters.

4.2. *Determinants of compliance costs*

Once the we determined the production and export characteristics determining the compliance costs, we require information from the avocado market on the same characteristics in order to calculate the amount required to comply with basic regulations. To calculate the compliance costs following the structure developed in section 3, we first analyse available information on the avocado market existing literature. This data is substituted in Eq 2 to obtain the compliance costs required by avocado exporters and/or producers.

Total exporters' revenue

The major avocado export firms in Kenya are East African Growers Ltd, Kenya Horticultural Exporters Ltd (KHE), Kakuzi Ltd, Indu Farms Ltd, Sunripe Ltd, and Vegpro Ltd (Wasilwa, et al., 2007). Since most of these firms are dedicated to the export of two or more products, total exporters revenues rely on several commodities.

We take as basis for this analysis the yearly business report by a representative avocado exporter firm. In the period from 2006-09, this firm reported total revenues from the avocado

marketing of approximately *7 084 777* EUR. We have taken into account this value to estimate the compliance costs in Equation 2.

Revenues coming from EU market (EUR)

From the exporters interview performed is observed that most of the firms concentrate strongly their exports to the EU market, according to the interviews most of them focused at the beginning only on the EU market. After this market has been established and private standards are fulfilled (even partially), this opens other international markets. Therefore, we assume that in a pre-compliance phase companies concentrate highly their exports to the EU. Therefore, we adopt the average revenue coming from the EU observed from the exporters' interview which in average accounts for 95.8% of horticultural exports going to the EU. In this case of the firm taken as example, revenues from EU market would reach *6 801 387* EUR.

Share of exports to EU market

According to previous exporter interviews launched (CIRAD, 2005), avocado exporters focus mainly on European market, with a few batches shipped to the Middle East and South Africa. French importers are the European leaders for the origin, with the avocados being imported in Marseilles (CIRAD, 2005).

From 2006-09 Kenyan avocado exports have turned more diversified. In 2009 new destinations such as Canada, Malaysia, Oman, India and Sudan were reached (COMTRADE, 2011). The main competitors for Kenya are Mexico the largest worldwide producer in 2010 (Table 2) and South Africa the major supplier of avocado into the EU in 2010 (Figure 2). Thus, we focus mainly on the development of avocado exports from 2006 to 2009[4] (COMTRADE, 2011). According to export *quantities*, exports to the EU have represented 87-56% of the export quantities, with a decreasing trend over time due to gradual increase in the diversification of the market. From 2006-09, the share of exports to the EU in quantities averaged 71.8 %, this number was taken as the share of exports to EU market.

4.2. *Calculating compliance costs*

According to our econometric study presented in section 3, compliance costs will be determined as in Eq 2. Substituting the values presented in section 4.1: total exporters' revenue from avocado exports (*7 084 778 EUR*), Revenues coming from EU market (*637 6300.1* EUR), Share of exports to EU market (*0.718*) in Eq 2 gives the compliance costs in the implementation phase, representing fix and variable costs. Compliance costs according to these assumptions reach *363,459 EUR.* This amount represents approximately 5.1% of the annual turn over of the example company. In percent terms, other studies evaluating compliance costs for Kenyan horticultural exporters have reached higher compliance costs in a range from 2 to 5% of the firms' turnover (Jaffee, 2004; own exporters interview).

According to section 4.1, four different areas have been identified where compliance with quality standards is needed. These areas are: staff training, acquisition of new facilities, access to private laboratories and certification fees. Table 5 presents the distribution of total costs allocated for each of the categories in which exporters invest to comply with European regulations. As part of financial planning by some firms, compliance costs are divided into 3 yearly periods to amortize costs and thus implementing gradually the compliance procedures.

[4] This data is not reported in this study but available under request.

Table 5. Compliance costs for a Kenyan avocado exporter

Implementation		%[a]	Investment required (EUR)
Laboratory (sample analysis)		45.8	166464.05
Staff training and external consultancy (skilled labour)		41.8	9449.92
Internal auditor training		3.9	14174.89
Certification fee		5.9	21444.06
Other trainings (unskilled labour)		41.8	9449.92
Total		*100*	*363 458.63*

Source: Own calculations
[a] structure of compliance costs based on Jaffee (2004) and Nyagah (2007)

5. Global effects on Kenya: higher compliance of avocado exporters

The trade implications of a higher compliance of avocado exporters on the EU market and the Kenyan economy such as the implications for different other agricultural products and household types and the wider macroeconomic effects suggest the use of a general equilibrium approach. To analyse the global effects, we have used the multi-regional, multi-sectoral standard comparative computable general equilibrium (CGE) GTAP model. The model distinguishes 37 product categories across the whole economy and 11 different world regions (see Appendix A, Table A1 and A2). All product categories are disaggregated in such a way that sectors might be compatible with those sectors presented in the country SAM analysed with the single country CGE model (see section 6).

5.1 Scenario's Description

Global scenario: One general experiment is considered to evaluate the effects of adoption of practices that respond to the GlobalGap protocols. These practices are mainly an initial phyto-sanitary training for staff and tracking systems of inputs in agricultural production (water, fertilizer, etc).

As mentioned in section 2.3 diverse factors contribute to high produce losses in the avocado marketing chain. These factors were mainly poor infrastructure and lack of technical knowledge on crop husbandry. In our global scenario, the implementation of standards will lead to a reduction of avocado losses caused by these factors. Thus, increase in the avocado quality will thus have an impact in the quantities exported mainly to the EU.

We represent this situation in the model by shocking technological change through the *ams* variable; *ams* would have an import enhancing impact in imports into the EU coming from Kenya. The shock applied to technological parameter is calibrated in such a way that the increase in vegetable and fruits exports from Rest of Eastern Africa (including Kenya) to the EU27 is equal to +5%. This increase in exports by 5% comes from assuming that production losses will decrease due to the implementation of standards in the production side. This does not necessarily increase the quantities produced, but the quantity of product fulfilling export requirements.

This empirical experiment pursues to reproduce what it has been pointed out by exporters in field interview, namely that quantities produced may not increase considerably, yet export quantities do have an important increase due to compliance with European regulations (Jaffee, 2003; Solomon A, 2007).

5.2. Results

In this section we present results of the scenario described in section 5.1 and modelled applying the GTAP model. Results are discussed for changes in international trade of: the vegetable and fruits sectors in GTAP and trade of rest of East Africa. Furthermore, changes in

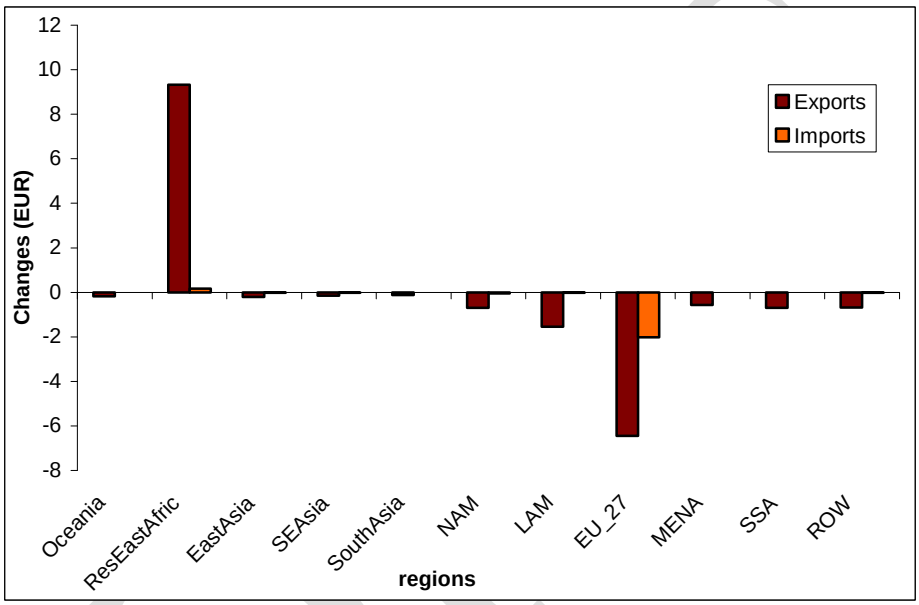
quantities which are transmitted into the single country model are presented in the last part of this section together with the description of their insertion in the single country model.

Changes in international trade of vegetables and fruits

We present the outcome in value terms, exploring the changes from different perspectives. Figure 3 shows the changes of international trade for vegetables and fruits across different world regions. Considering that at global level the weight of exports from rest Eastern Africa are rather small, the few trade changes shown in terms of trade diversion and trade creation, are in line with the expectations from the economic theory.

The results show an improvement in exports from rest of Eastern Africa which substitute other vegetable and fruits exports worldwide. Trade deterioration is observed in EU and other EU major EU suppliers of vegetables and fruits such as Latin American countries (LAM), North America (NAM), Mediterranean countries (MENA). These regions experience falls in international exports.

Figure 3. Changes in imports and exports of vegetables and fruits across regions



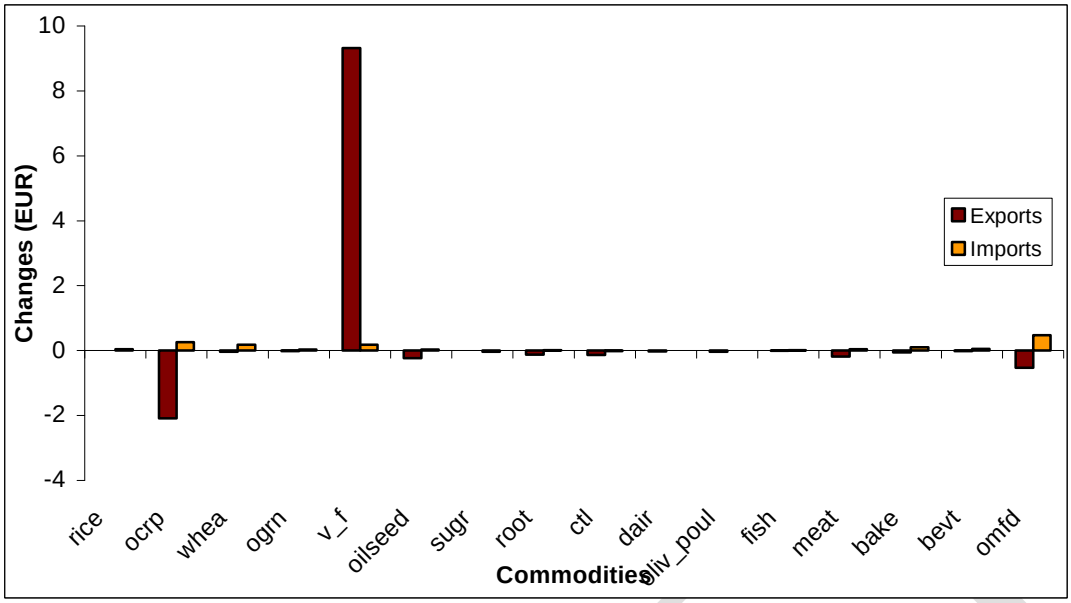
Source: Own calculations from GTAP model

Changes in trade commodities from Rest of East Africa

In Figure 4 we consider the changes in trade flows across export commodities from Rest of Eastern Africa that would result from an increase in the compliance with private regulations in Rest of Eastern Africa. In general, Rest of Eastern Africa will not modify considerably its export structure due to the implementation of quality standards in the production structure of fruits introduced in this scenario simulated.

As we have implemented in the scenario the compliance with regulations as export enhancing feature, we observe a considerable increase in exports of vegetable and fruits from the concerned region. Simultaneously, exports slightly fall in other sectors due to the reallocation of export demands towards vegetables and fruits. Sectors with declining export flows are other crops (otcrp), meats (meat) and other manufacture processed food (ompfd). The results also indicate for these sectors an increase in imports from other world regions.

Figure 4. Changes in sectoral imports and exports in rest of Eastern Africa



Source: Own calculations from GTAP model

Table 6 presents the main destinations for the rising exports from Rest of Eastern Africa shown in Figure 3. The first column points at increasing exports flows to the EU account for 9.45 Mio EUR, while exports to other trading partners decrease. Main export flows with decreasing trends are to East Asia (-20,000 EUR), North America (-30,000 EUR) and North- and West Africa (40,000 EUR), being all these regions the major export destinations for Kenyan horticultural products after the EU27. The decreasing exports to this region can be the result of trade diversion to supply the increasing export flows toward the EU27. In the second column of Table 6, the estimated contributions of the Kenyan horticultural sector are presented. Exports from Kenya to the EU represent approximately 8.46 Mio EUR[5]. These increases in horticultural exports in our study represent the increase in avocado exports due to the higher demand on avocados induced by the higher compliance with private EU regulations. Furthermore, this increase in avocado exports would represent 44% increase in the current Kenyan avocado exports to the EU (COMTRADE, 2011).

Table 6. Change in values of veg. and fruits exports from Rest Eastern Africa (Kenya) by destination

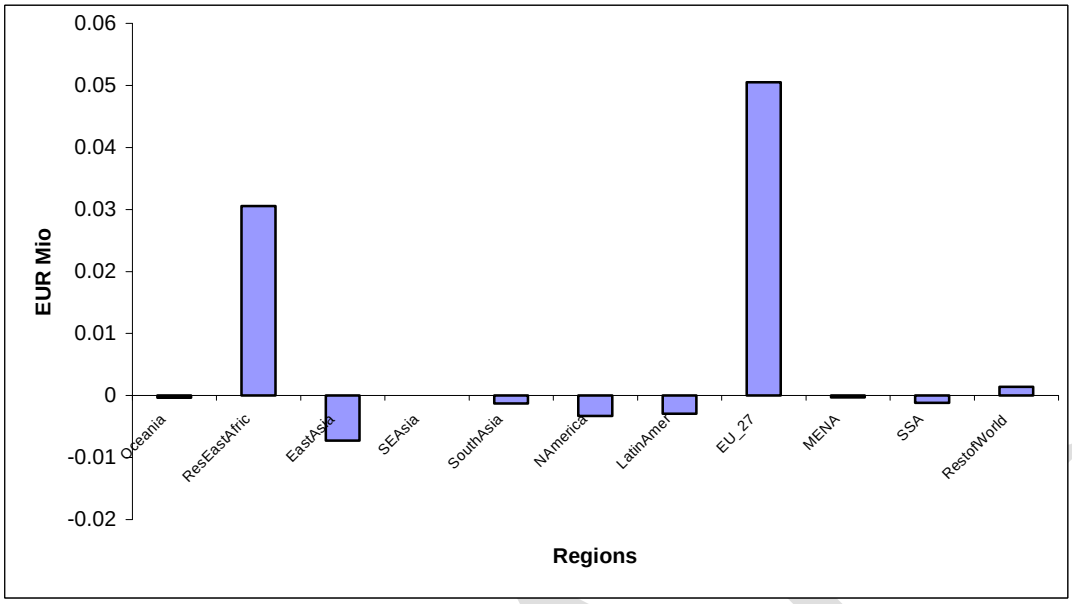
	Change in exports	**Kenya[a]**
Oceania	0.00	0.00
Rest Eastern Africa *(including Kenya)*	0.00	0.00
East Asia	-0.02	-0.02
South East Asia	0.00	0.00
South Asia	-0.01	-0.01
North America	-0.03	-0.03
Latin America	-0.01	-0.01
EU 27	9.45	8.46
MENA (*North- and West Africa*)	-0.04	-0.04
SSA	-0.01	-0.01
ROW	-0.01	-0.01
Total	0.00	0.00

Source: own calculations, [a] Estimated from historical trade flows 2006-2009 (COMTRADE, 2011)

[5] Share of Kenyan exports from the composite exports were calculated according to historical shares from the total exports in this region (Burundi, Comoros, Djibouti, Eritrea, Kenya, Mayotte, Reunion, Rwanda, Seychelles, Somalia, and Sudan).

In terms of welfare changes, Figure 5 shows the possible changes at global level changes in the Equivalent Variation[6]. In Rest of Eastern Africa an increase in welfare is expected (300 thousand EUR). These positive effects are attributed to Africa and are related to the effects on producers in Kenya and consumers in the EU which are better off from the access of imports from Kenya in the EU. Further welfare analyses are presented in Section 6 for specific household types in Kenya.

Figure 5. Changes in regional Equivalent Variation in different world regions



Source: Own calculations from GTAP model

6. Domestic Effects on Kenya: higher compliance of avocado exporters

6.1 The Kenya SAM and the single-country CGE model

A modified single-country static CGE model provided by IFPRI (Lofgren et al., 2002) has been employed for the simulations. This CGE model follows the main neoclassical assumptions, in terms of production and production functions. Trade is modelled through an Armington (1969) specification, implying imperfect substitutability between domestic and imported goods. The small country assumption holds for imported and exported goods, whose world prices are assumed exogenous, with perfectly elastic world supply and demand. The trade sector collects all margins paid for by different commodities; margins take the form of exogenous wedges affecting price formation.

Households and enterprises receive incomes from factors, government transfers and transfer from rest of the world. Demand is modelled separately for own-consumption and marketed consumption. Two separate LES functions are employed to model the two types of consumption.

For the simulations of this study, a Kenyan Social Accounting Matrix for 2003 (Kiringai, et al., 2006) developed at IFPRI, has been employed. The SAM is disaggregated in 50 activities and commodities. Out of these 50, twenty-eight are related to agricultural, primary and food sectors, namely fifteen are crops, five related to livestock, fishing, forestry and a mining sector, and five sectors related to processed agricultural goods and food. The rest of the economy is subdivided between manufacturing and service sectors. Households are split into twenty different types according to their location (urban or rural) and their expenditure deciles (ten deciles for both rural and urban households). Households consume both marketed commodities and self-produced commodities whose price formation is not affected by taxes

[6] EV is measured at base prices and incomes. It shows the minimum payment that the consumer would require for foregoing a change (i.e., if the consumer receives this payment, then he/she is as well off under base prices and income as he/she would have been if the change had taken place.) For positive (negative) welfare change, EV > 0 (< 0).

and trade and transportation margins. The institutional framework is completed by the enterprise sector to which the whole capital income accrues and by the government which collects money from sales taxes, direct taxes and import tariffs. The SAM provides five production factors: skilled, semi-skilled and unskilled labour, capital and land (utilized only in the fifteen crop sectors).
Three marketing margin coefficients for domestic, export and import transaction costs are represented into the SAM. They are modelled as a wedge representing costs associated with domestic sales, exports and imports. The margins are paid by the commodities account in exchange for the purchase of trade and transport services, income from these accounts accrues to a single trade sector.

6.2. Scenario's Description

The results coming from the GTAP model are now used as input for the single-country model. Single-country single trade partner CGE models are not able to catch the impacts of a unilateral reform or trade distorting policies, as the one simulated above with the global GTAP model. Thus, the linkage between these two models follows the approach developed by Horridge and Zhai (2005) and Horridge and Ferreira Filho (2003). The GTAP model provides the changes in export quantities and in world import price to be implemented in the single-country.

Table 7. Changes in import prices and export quantities

Sector	Import Price	Export quantities		Sector	Import Price	Export quantities
rice	0.05	0.00		foot	0.02	-0.61
whea	0.04	-0.05		wood	0.02	-0.06
ogrn	0.04	-0.03		prnt	0.02	-0.10
v_f	0.08	11.22		petr	0	-0.44
oilseed	0.05	-0.38		chem	0.02	-0.51
sugr	0.05	0.00		mach	0.02	-0.90
root	0.04	-0.19		nmet	0.02	-0.06
ocrp	0.05	-3.16		man	0.02	-0.74
ctl	0.05	-0.28		watr	0.02	-0.28
dair	0.02	-0.03		elec	0.01	0.00
oliv_poul	0.04	-0.08		cons	0.02	-0.02
fish	0	0.00		trad	0.03	-0.27
fore	0.03	-0.17		tran	0.02	-1.02
mine	0.01	-0.03		comm	0.03	-0.16
meat	0.04	-0.27		fsrv	0.03	-0.04
bake	0.03	-0.08		rest	0.02	0.00
bevt	0.03	-0.05		hostl_osrv	0.03	-0.16
omfd	0.03	-0.88		heal_educ_ad	0.03	-0.48
text	0.02	-0.21				

Source: Own calculations from GTAP model

The Kenyan model tries to depict as close as possible the reality of the country through the adoption of reasonable macroeconomic and factors closure rules. For the factor markets we assume that land, skilled labour and two types of capital are fully engaged and mobile among sectors. Land is engaged only in the agricultural sectors. Capital is subdivided between agricultural and non-agricultural capital and the two markets are segmented, while capital is fully mobile within the markets. On the other hand, the two unskilled types of labour described in Section 6.1 are assumed to be mobile among sectors but flexible to allow unemployment, given the high rate of unemployment recorded in Kenya (check in the literature). In terms of macroeconomic closure rule, the current account is assumed as fixed in order to avoid change of the foreign debt and consequentially the exchange rate is flexible. In order to elude bias on

the household utility coming from factors different from changes in production factors returns, prices of commodities and taxes (namely transfers), we maintain the government savings fixed, leaving a uniform tax to shift (in this case the direct income tax) in order to keep the government savings in equilibrium. Finally, we assume the economy as saving driven.

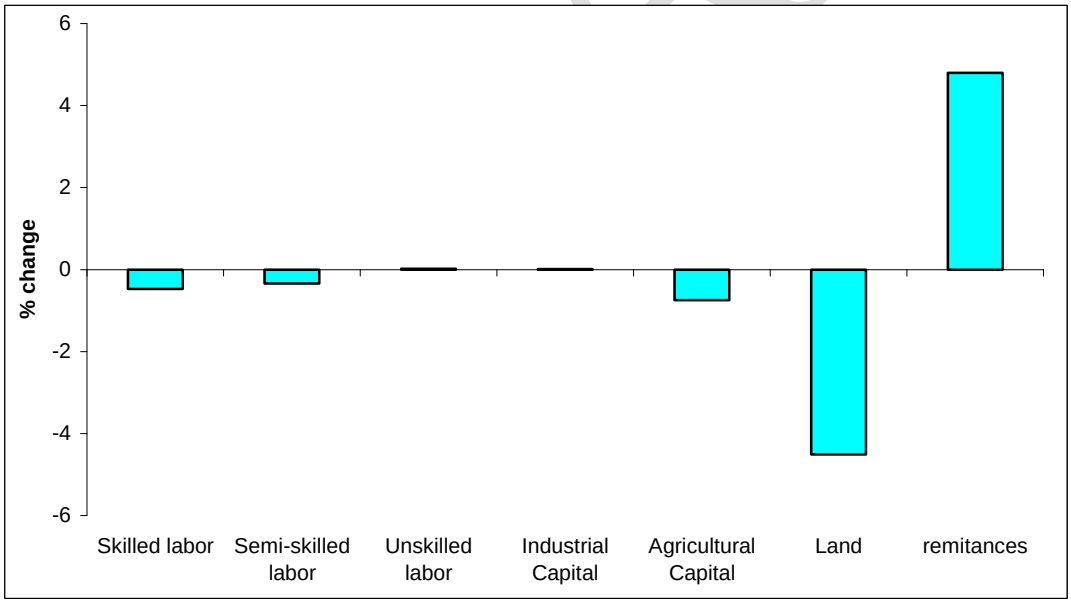
6.3 Simulation results

Presenting the results of the simulations, we will concentrate on the set of results that the global CGE model is not able to provide, particularly the implications for the different types of Kenyan households.

In order to analyze the effects of the simulation on households' income, consumption and welfare, we start from the study of the main source of households' income. In figure 6, the changes in income patterns are presented. The first driver is the income from production factors. The results show that income coming from all production factors is shrinking, apart from income from capital, which is the factor that mainly accrues to urban households. Land is the most hit factor with an income fall of 4.5% and a high impact on all rural households.

The second driver of income is the effect of the exchange rate on the households' income. For many of them, resources from the rest of the world represent a significant share of the income (Kiringai et al., 2006). This is particularly true for the first deciles of urban households, where on average income from rest of the world (remittances) is a quarter of the income (for hurb1 it reaches 42% of its income). As a result of the simulation performed, the exchange rate in Kenya appreciates by 4.8%. This revaluates the income coming from abroad, causing an income increase for all households depending heavily on remittances, which in this case are mainly urban households.

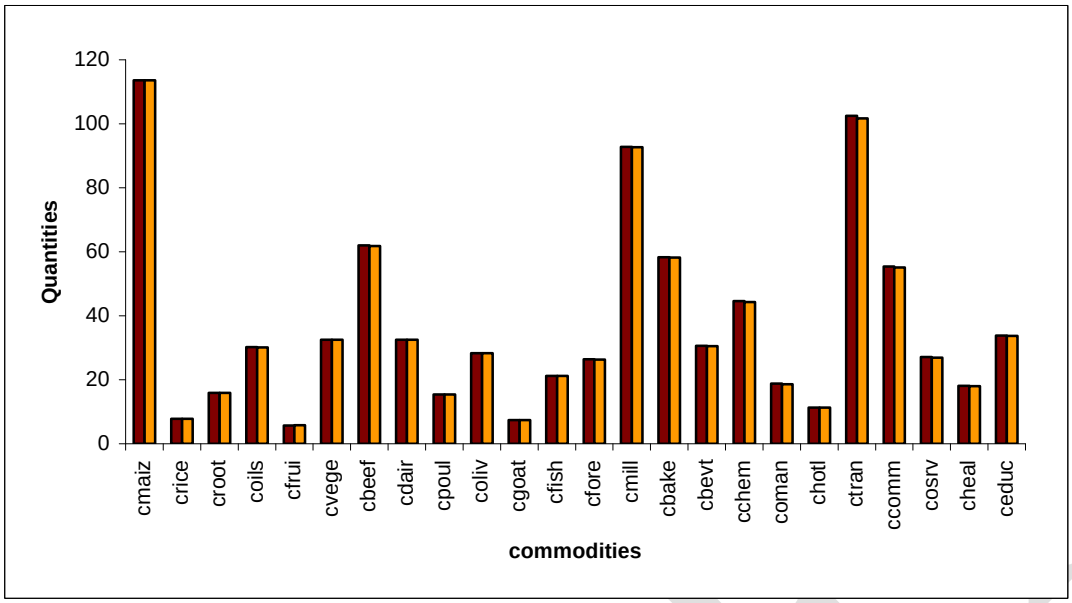
Figure 6 – Changes in household income



Source: Own calculations from single-country CGE model.

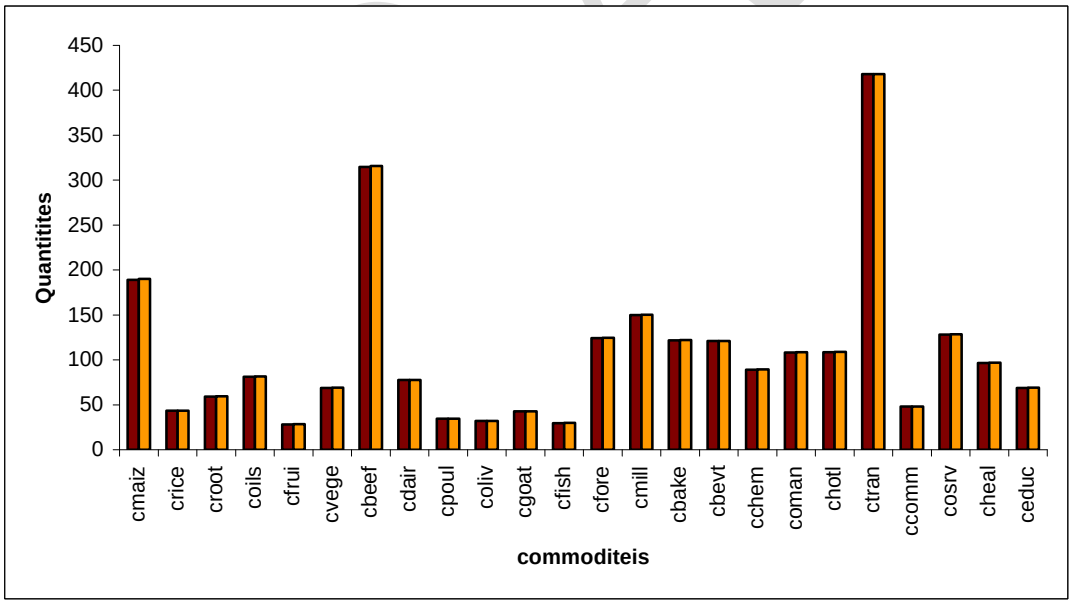
Figures 7, 8, 9 show the changes in quantity consumed by selected households. The impact in terms of consumption value is even more negative for the rural households than for urban households. These figures show that changes of selected products are very small and in the case of urban households even slightly positive. This is due to a general decrease in their relative price index, both of marketed and own –consumption commodities, which allows then to buy with a smaller income the same or higher quantity of goods.

Figure 7. Consumption in quantities of rural household decile 2 for selected commodities



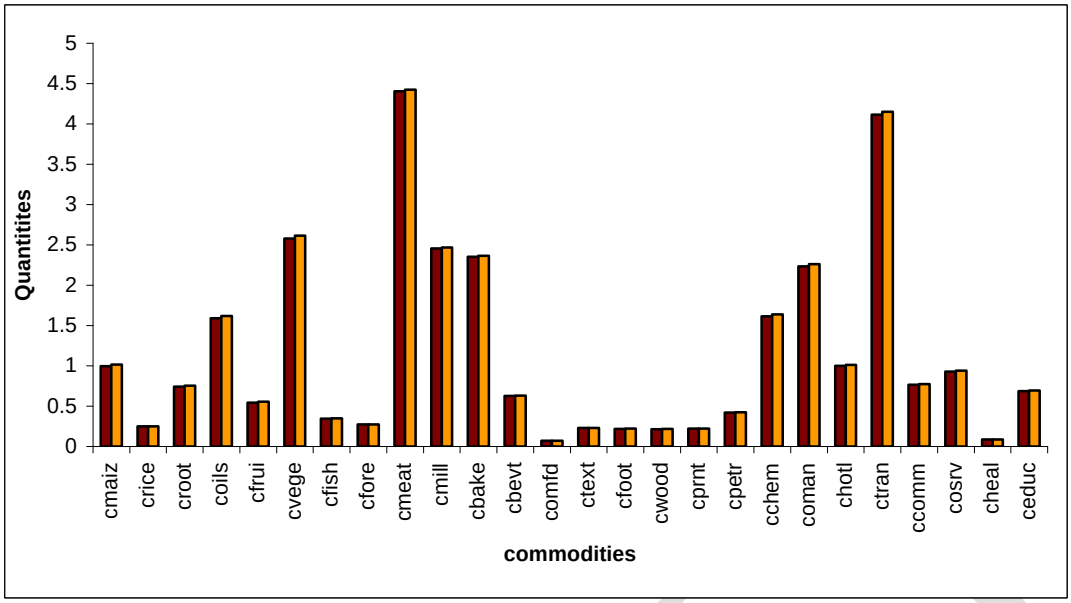
Source: Own calculations from single-country CGE model

Figure 8. Consumption in quantities of rural household decile 7 for selected commodities



Source: Own calculations from single-country CGE model

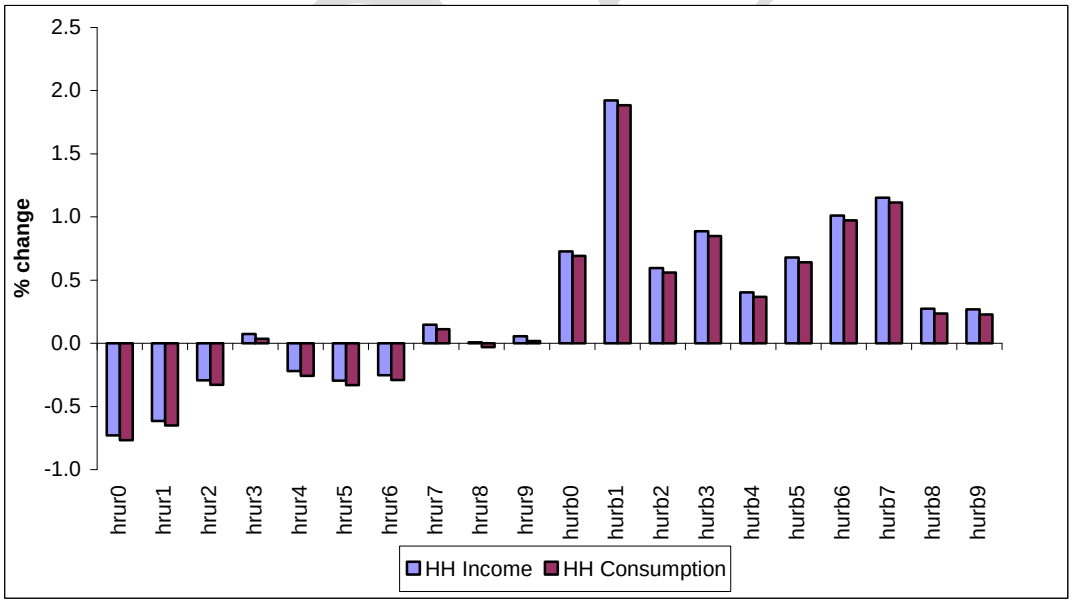
Figure 9. Consumption in quantities of urban household decile 3 for selected commodities



Source: Own calculations from single-country CGE model

In Figure 10 the percentage changes in income and consumption for the 20 different household types in Kenya are presented. In general rural households will face a decrease in both income and consumption values (except in the case of household types hrur3 and hrur7 and hrur9), while urban households will have positive changes in both income and consumption pattern. Thus, the impacts of the enhanced exportation of avocado (fruits in the single-country model) for Kenyan households are mixed in terms of income (consumption patterns are highly correlated to the income results).

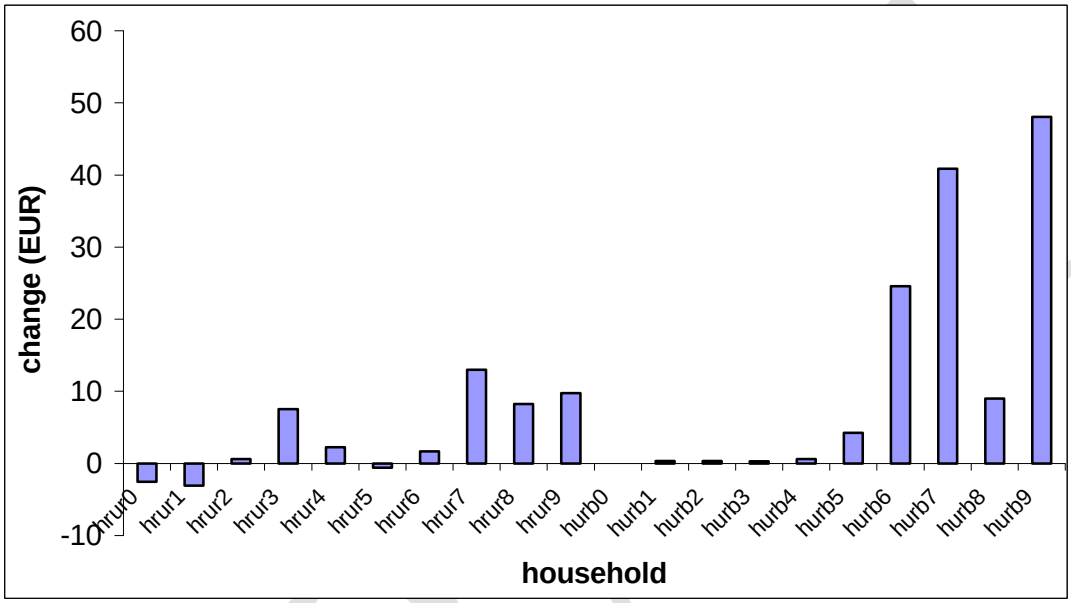
Figure 10. Households' income and consumption values



Source: Own calculations from single-country CGE model.

Results of the equivalent variation changes (Figure 10) show potential increases of welfare. In line with the GTAP results, welfare in Kenya increase after this simulation. The disaggregation of households allows an analysis of welfare distribution within the country.
The results suggest that, a part from the two poorest rural households, all the rest realize gains which are quite small for rural households in general and increase for the urban ones. The drop for the poorest rural is due to their high share of income coming form land (40 and 30% respectively) which the factor income hardest hit by the simulation. For the rest of the households, result of welfare are driven by the income and consumption results presented where for many households an income decrease is counterbalanced by the drop of their price index and the consequent increase in quantities of goods consumed.

Figure 11. Changes in Households welfare in terms of Equivalent Variation



Source: Own calculations from single-country CGE model

7. Discussion and Conclusions

This research paper evaluates cost of compliance with private voluntary regulations specified for the production and exportation of Kenyan avocados. The practices evaluated are mainly initial phyto-sanitary training for staff and tracking systems of input materials.

This study has estimated compliance costs based on the structure applied by Kenyan agricultural exporters who have succeeded to enter in the EU market. The methodology to determine factors contributing to compliance costs allows the estimation of the amount required depend mainly on the size of the firm and the importance of the EU market for the exporter. A limitation of the approach is the difficulty obtaining good estimates of compliance costs when the relevance of EU market is less than 90%. Alternative methodologies to value compliance costs would be direct exporter interviews with avocado exporters.

The results suggest that the adoption of practices that respond to the GlobalGap protocols may have increase the quality of avocado production; thus, increasing exports to the EU. At the national level diverse effects at household level are detected. Urban households, particularly poor urban households are directly benefited by

remittances due to an appreciation of the Kenyan Shilling whereas rural households gain from decrease in prices of domestic commodities consumed.

However, these estimates are partial as they exclude additional regulations required to enhance exports and monitoring cost investment. Additionally, due to the static framework applied, it is important to bear in mind that compliance costs will be the sum of fix and variable costs, which in this study are treated as the total sum. Furthermore, standards are modified with the time, thus, additional costs may be required if new regulations were implemented. In this case, the required investment could be higher than higher revenues reached by compliance.

Moreover, the results do not contemplate information on the specific income sources of each household decile, which it would provide valuable information on the direct gains of households' benefits/losses due to changes in domestic prices and simultaneously higher salaries of trained employees in production, commercialization and exportation of avocados.

Information available on the effects of compliance costs is scarce. Thus, this study represents an first contribution to the importance of compliance costs in countries with such a low income as Kenya where higher export flows to the EU could significantly benefit the national economy.

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ANNEX A. Sectoral and regional aggregation of the GTAP database

Table A.1: Sector aggregation in GTAP (database v.7.0)

No	Code	Description of product category	No	Code	Description of product category
1	rice	Rice	20	foot	Fuel
2	whea	Wheat	21	wood	Wood & paper
3	ogrn	Other cereals	22	prnt	Printing and publishing
4	v_f	Vegetables. fruit & nuts	23	petr	Petroleum
5	oilseed	Oilseeds	24	chem	Chemicals
6	sugr	Sugar cane & sugar beet	25	mach	Metals and machines
7	root	Plant-based fibres	26	nmet	Non metallic products
8	ocrp	Other crops	27	man	Other manufactures
9	ctl	Live cattle. sheep. goats. horses	28	watr	Water
10	dair	dairy	29	elec	Electricity
11	oliv_poul	Other livestock, poultry	30	cons	Construction
12	fish	Fishing	31	trad	Trade
13	fore	Forestry	32	tran	Transport
14	mine	Mining	33	comm	Communication
15	meat	Meat pork. poultry. other	34	fsrv	Finance services
16	bake	Sugar & bakery	35	rest	Dwellings
17	bevt	Beverages & tobacco	36	hostl_osrv	Business services, recreation and other services, insurances
18	omfd	Manufactured food	37	heal_educ_ad	Health, education, administration
19	text	Textile & clothing			

Table A.2: Regional aggregation in GTAP (database v.7.0)

No.	Code	Country/Countries
Main trading partners		
1.	Oceania	Australia, New Zealand and rest of Oceania
2.	Rest of East Africa	Rest of Eastern Africa (including Kenya)
3.	East Asia	China, Hong Kong, Japan, Korea, Taiwan, rest of East Asia
4.	South East Asia	Cambodia Indonesia, Republic of Lao, Myanmar, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia
5.	South Asia	Bangladesh, India, Pakistan, Sri Lanka, rest of South Asia
6.	North America	Canada, United States of America, Mexico, rest of North America
7.	Latin America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Venezuela, rest of South America, Costa Rica, Guatemala, Nicaragua, Panama, rest of Central America, Caribbean
8.	EU_27	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
9.	MENA	Rest of Western Africa, Egypt, Morocco, Tunisia, rest of North Africa
10.	SSA	Nigeria, Senegal, Central Africa, South Central Africa, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Botswana, South Africa, rest of South African Customs
11.	ROW	Rest of the World

ANNEX B - The Social Accounting Matrix

In terms of value added and production, maize and vegetables are two most important agricultural sectors. This is partially mirrored by the share in employment where these two sectors are among the most important agricultural ones. Nevertheless, in term of employment the tea sector is the agricultural activity with the biggest share equal to 4.8% (the fifth biggest sector in the whole economy as share of employment). Tea represents the most important export sector of the country. Almost 18% of the Kenyan revenues from exports come from the tea sector, while cut flowers represent 7% of exports. Other important agricultural export sectors are Meat & dairy, Beverages & tobacco, Coffee, Pulses & oil seeds and Vegetables. In the case of tea, flowers and coffee around 90% of the domestic production is exported. In terms of imports, the share of agricultural sectors over the Kenyan imports is quite low; given the significance of the manufacture sectors and that the share of agricultural commodities is less than 5%. Wheat is the commodity with the biggest share of imports equal to 2.4%. Nevertheless, the import share of domestic production shows how for many agricultural products, Kenyan economy is still dependent from imports coming from the rest of the world. In particular, imported wheat represent 96% of domestic demand while for other commodities the share is lower but still significant, i.e. rice (57%) and sugarcane (43%).

Table B.1. The social accounting Matrix

	Activities	Commodities	Factors	Households	Government	Rest of the World	Savings	Direct Tax	Tariffs	Sales tax	TOTAL
Activities		179376.5		9248.412							188624.9
Commodities	90967.43	9762.278		75600.01	19903.38	28111.57	19655.35				244000
Factors	97657.43										97657.43
Households			97229.85	28927.98	4814.002	9899.73					140871.6
Government			427.5782			550.0684		6942.2	2078.297	11093.76	21091.9
Rest of the World		41689.24									41689.24
Savings				20152.96	-3625.48	3127.877					19655.35
Direct Tax				6942.2							6942.2
Tariffs		2078.297									2078.297
Sales tax		11093.76									11093.76
TOTAL	188624.9	244000	97657.43	140871.6	21091.9	41689.24	19655.35	6942.2	2078.297	11093.76	

Source: Kiringai et al. (2006)

Table B.2. Structure of value added and production

	Share in Value added (%)	Share in Production (%)	Share in Employment (%)	Sector share in total exports (%)	Exports as share in sector output (%)	Sector share in total imports (%)	Imports as share of domestic demand (%)
Maize	2.96	2.98	3.96	0.11	0.64	0.20	2.09
Wheat	0.04	0.03	0.03	0.03	14.59	2.42	96.19
Rice	0.11	0.15	0.12			1.18	56.79
Barley	0.07	0.04	0.04	0.03	11.00		
Cotton	0.03	0.03	0.03	0.01	7.37		
Other cereals	0.01	0.01	0.01	0.01	41.16		
Sugarcane	0.19	0.24	0.19	0.54	33.65	0.53	43.13
Coffee	0.57	0.72	0.58	4.57	86.61		
Tea	3.58	2.73	4.83	17.81	91.51	0.11	10.65
Roots & tubers	1.03	1.00	1.17				
Pulses & oil seeds	1.94	1.63	2.22	3.03	38.26	0.11	3.61
Fruits	1.38	1.15	1.55	0.77	18.16		
Vegetables	2.25	1.71	2.74	2.96	30.98	0.12	2.82
Cut flowers	1.20	1.15	1.50	7.71	98.40		
Others crops	0.74	0.80	0.88	1.60	29.90	0.16	6.03
Beef	1.42	1.29	1.98				
Dairy	2.42	1.86	3.40				
Poultry	1.56	0.97	2.11				
Sheep, goat and lamb	0.39	0.21	0.38				
Other livestock	0.53	0.31	0.78				
Fishing	0.40	0.26	0.10				
Forestry	0.71	0.41	0.43				
Mining	0.33	0.34	0.36	2.36	95.24	0.09	51.63
Meat & dairy	1.22	2.64	0.86	5.45	25.74	0.28	3.17
Grain milling	0.99	2.19	0.33			0.11	2.94
Sugar & bakery	0.45	1.21	0.58	0.94	10.81	0.96	18.15
Beverages & tobacco	1.41	2.24	1.11	4.78	29.06	0.45	6.81
Manufactured food	0.09	0.22	0.09	1.12	69.57	6.19	81.49
Petroleum	0.55	0.74	0.84	1.68	31.24	2.22	48.42
Textile & clothing	0.53	0.91	0.19	1.38	20.44	0.36	10.49
Leather & footwear	0.30	0.50	0.26	3.28	88.87	0.65	60.65
Wood & paper	0.59	0.94	0.60			2.62	35.50
Printing and publishing	0.40	1.73	0.02	6.41	48.96	19.72	77.52
Chemicals	0.73	1.16	0.85	5.65	71.20	17.32	88.92
Metals and machines	0.84	1.50	1.16	5.66	55.85	17.76	84.57
Non metallic products	2.37	1.82	0.56	1.54	11.06	0.95	12.14
Other manufactures	3.05	3.50	4.68	5.27	22.19	9.08	43.94
Water	1.34	0.77	1.21				
Electricity	1.32	1.05	0.83				
Construction	5.31	8.70	2.28				
Trade	6.52	7.30	4.32				
Hotels	1.00	1.64	1.29				
Transport	6.85	8.74	7.77	13.57	23.15	12.83	29.69
Communication	3.13	2.64	2.64	0.69	3.91		
Finance	6.83	5.09	4.03	0.51	1.50	1.82	7.40

Real estate	5.76	3.56	5.62	0.54	2.25	1.78	10.15
Other services	9.68	7.34	9.15				
Administration	5.05	4.95	2.43				
Health	2.17	1.60	4.77				
Education	7.67	5.35	12.19				
Tot. AGR	**22.42**	**18.98**	**28.49**	**39.18**		**4.82**	
Tot Non AGR	**77.58**	**81.02**	**71.51**	**60.82**		**95.18**	
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**		**100.00**	

Source: author calculations based on Kiringai et al. (2006)