Violence, Political Instability, and International Trade: Evidence from Kenya's Cut Flower Sector

Andrew Muhammad[a], Anna D'Souza[b], William Amponsah[c]

October 2011

[a] Economic Research Service, U.S. Department of Agriculture; amuhummad@ers.usda.gov

[b] Economic Research Service, U.S. Department of Agriculture; adsouza@ers.usda.gov

[c] School of Economic Development, Georgia Southern University; waamponsah@georgiasouthern.edu

Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24-26, 2011

Acknowledgements: The authors would like to thank participants at the 2011 annual meeting of the Agricultural and Applied Economics Association.

The views expressed in this paper are those of the authors, and may not be attributed to the Economic Research Service or the U.S. Department of Agriculture.

Violence, Political Instability, and International Trade:
Evidence from Kenya's Cut Flower Sector

Abstract: We assess whether and how violence and political instability affect trade between developed and developing countries considering the special case of EU imports of Kenyan roses after the 2007/08 post-election violence and political instability in Kenya. Using the Rotterdam model to estimate EU demand for roses from Kenya and other global competitors, we find evidence of a structural change in the import growth rate for Kenya, approximately equivalent to an 18.6% tariff. These results highlight the importance of non-tariff barriers to trade and contribute to the growing literature on the role of insecurity and instability in hindering international trade.

JEL Codes: F14, F23, F59, O13, Q17
Keywords: Kenya, Africa, EU, election violence, cut flowers, roses, imports, international trade.

1. INTRODUCTION

On December 30th, 2007, widespread violence erupted in Kenya following a declaration of results from the contested presidential election held three days earlier. Unexpectedly, one of the most stable and prosperous democracies in sub-Saharan Africa was in the midst of civil conflict and political crisis. By the time a power-sharing agreement was signed on February 28th, 2008 between the two presidential contenders (President Mwai Kibaki and opposition candidate Raila Odinga), over a thousand people were killed, more than a half million people were displaced, and property worth billions of dollars was damaged (United Nations High Commissioner for Human Rights, 2008). Unsurprisingly, the violence and political instability caused disruptions in economic, political, and social activities.

In this paper, we examine the impact of this political instability and violence on one of Kenya's leading export sectors – the fresh cut flower sector. This sector is primarily export oriented and is the second largest foreign exchange earner, after tea (Kenya Ministry of Agriculture, 2010). Kenyan flowers are exported mostly to the European Union (EU). We consider whether concerns over political instability following the election violence led to a permanent change in the way in which EU firms import fresh cut flowers from Kenya vis-à-vis other major global competitors. In particular, the conflict may have caused a fundamental shift in how EU firms respond to import-determining factors such as prices in exporting countries and in how total flower demand is allocated across supplying countries.

When importers are risk averse, increased uncertainty and instability in a given country could have a negative impact on imports from that country while simultaneously increasing the demand for identical or similar products from less risky source countries (Wolak & Kolstad, 1991). This may be especially true for fresh cut flowers, which are highly perishable, thus requiring a stable and effective supply chain and an efficient transportation system. Over the recent years, cut flower importers and retailers in the EU established contractual relationships with Kenyan producers to ensure adequate supplies and timely delivery. This vertical relationship requires a readily accessible laborforce (Hale & Opondo, 2005). More specifically, farm workers are a key component in the global supply chain because export orders must be satsfied in a short time to ensure fresh delivery. A breakdown in the supply chain could result in significant financial losses (Riisgaard, 2009).

The primary objectives of this study are to analyze the competition between exporting countries in the EU flower market and to identify the structural change, if any, in import behavior due to the post-election violence and political instability in Kenya. We focus on fresh cut roses,

Kenya's leading flower export. Of particular interest to our analysis is the relationship between Kenya and competing developing country exporters such as Ecuador, Ethiopia, Tanzania, and Uganda.

We estimate the demand for fresh cut roses in the EU assuming an Armington (1969) framework. More specifically, we consider rose exports to be heterogeneous due to factors specific to the country of origin which allows for assessing the competition among exporting countries in a given destination market . In the analysis, we account for potential structural change induced by the political violence and political instability. We use the absolute price version of the Rotterdam model (Clements & Theil, 1978) to estimate EU demand, and we determine the pattern of structural change by applying a gradual switching regression method as specified by Moschini and Meilke (1989) and Ohtani, Kakimoto, and Abe (1990). This procedure allows us to assess the structural change in importer responsiveness to changes in export prices by country and to determine how total import expenditures are allocated across exporting countries. Additionally, we are able to assess the structural change in import growth rates for each exporting country holding prices and total expenditures constant.

We use monthly data from January 2001 to December 2010 for the major exporting countries and regions involved in the global trade of fresh cut roses. During this period, Kenya, Ecuador, and East Africa (an aggregation of Ethiopia, Tanzania, and Uganda) accounted for over 80% of EU imports of roses on average and separately accounted for 52%, 15%, and 14%, respectively.

Overall, our empirical analysis reveals evidence of a structural change in the import growth rate for Kenyan fresh cut flowers after the 2007/08 post-election violence and political instability. Before the events in Kenya, the import growth rate was approximately 3% per year, but thereafter, the growth rate declined to approximately –2%. However, we do not find evidence that EU importers responded differently to import prices. Nor do we find evidence of structural change in how total import expenditures were allocated across the supplying countries. But given the importance of the fresh cut flower sector for Kenyan exports and more generally economic growth, the depressed import growth rates could have potentially serious implications for the country's economic prospects.

Further, our findings suggest that even short stints in instability and violence can lead to significant changes in importer behavior with long-term repercussions for international trade if, for example, the results reflect a loss of long term contracts to competitors due to a decline in trust on

the side of EU traders. These findings complement – and are consistent with – two recent microeconomic studies that analyze the impact of the Kenyan conflict on the behavior of flower exporting firms using firm-level data. Ksoll, Macchiavello, & Morjaria (2009; 2010) find a 24 percent reduction in flower exports, a 38 percent reduction in exports for firms in conflict-affected areas, and a 50 percent increase in worker absence as a result of the conflict. They also find that firms consolidated their shipments and exported less frequently during the conflict period, most likely in reaction to higher security expenses. While these analyses demonstrate an immediate and significant impact of the violence on the operations and the performance of exporting firms, the current paper provides a more comprehensive macroeconomic picture of the fresh cut flower sector. We focus more broadly on changes in the trade patterns between the EU, Kenya, and other major global competitors.

Our analysis contributes to a large literature on the linkages between economic outcomes (e.g., economic growth, international trade) and (i) insecurity (e.g., corruption, imperfect contract enforcement) and (ii) instability (e.g., coups, internal and external conflicts, terrorism). Using cross-country data over three decades and controlling for various factors that impact economic growth, Alesina, *et al.* (1996) find that countries with a higher degree of political instability experience lower growth in per capita GDP. Anderson and Marcouiller (2002) argue that insecurity can serve as a hidden tax on trade, raising the price of traded goods and placing certain countries at a comparative disadvantage. Nunn (2007) argues that imperfect contract enforcement can be a larger barrier than resource endowments. Belloc (2006) provides a broad survey of the literature linking factors in domestic institutional environments to international trade patterns. Generally, poor functioning domestic institutions and insecurity increase transaction costs between exporters and importers and thus reduce the incentives to create and maintain trading relationships.

Several recent studies analyze more explicitly the consequences of conflict and violence.[1] For example, Blomberg, *et al.* (2004) examine the impact of various forms of violence on economic growth, and Blomberg and Hess (2006) examine their impact on international trade. The authors estimate a series of regression models (and additionally a structural VAR model in the case of growth rates) using over three decades of annual data from 177 countries. They find that terrorism, internal conflicts, and external conflicts have economically and statistically significant impacts on both economic growth and bilateral trade. In fact, the latter article shows that the presence of

[1] Blattman and Miguel (2010) present a review of the literature on the economic causes and consequences of civil wars.

violence can be equivalent to as much as a 30% tariff. Similarly, our analysis provides evidence of the "hidden tax" on international trade resulting from violence and instability.

The remainder of the paper proceeds as follows. In the next section we provide an overview of the fresh cut flower sector in Kenya – both from a domestic and an EU perspective. In section three, we describe the post-election instability and violence and the implications for the cut flower sector. In section four, we present the empirical model and data used to estimate the demand for imported roses in the EU. In section five, we describe the estimation procedure and we discuss the main results. In the last section, we conclude with a brief summary and a discussion of implications of the research findings.

2. THE CUT FLOWER SECTOR IN KENYA

The production of cut flowers in Kenya began with the investment of Europeans living in Kenya in the 1960s and 1970s (Hughes, 2000). Major investment over the past two decades and duty-free access to the EU has contributed to strong growth in the sector. Today Kenya is one of the world's largest exporters of fresh cut flowers, including roses, carnations, statice, alstromeria, lilies and hypericum. The sector is estimated to employ approximately 50,000 to 60,000 people directly and over 500,000 people indirectly (Kenya Flower Council, 2009). The cut flower sector is part of the horticulture industry, which is a core component of Kenyan agriculture. The agricultural industry accounts for about one quarter of GDP and 60% of export earnings and is the source of livelihood for the majority of Kenyans (International Monetary Fund, 2010). The Government of Kenya has supported the industry by establishing enabling legislation, intellectual property rights, functional quality control and other regulatory regimes, and market incentives for private enterprises to thrive. The Horticultural Crops Development Authority was established by the Government of Kenya under the Agriculture Act of 1967 to help develop and regulate the horticulture industry, which includes flowers, fruits and vegetables. Over the past decade, annual growth rates in horticulture have been between 15% and 20%, with earnings of approximately US$ 30 billion in 2009 (Kenya Ministry of Agriculture, 2010). Furthermore, horticulture is one of the fastest growing sectors in the Kenyan economy, largely attributable to cut flower exports (Barrientos, Dolan, & Tallontire, 2003).

Kenya is a major global supplier of flowers. The success of the cut flower sector is due to several key factors, namely, an ideal climate, good infrastructure, proximity to large import markets, and an enabling policy environment. According to the Horticultural Crops Development Authority, over 2,000 hectares of agricultural land in Kenya is used for cut flower cultivation. The major

flower-growing areas are Naivasha, Thika, Limuru, Nairobi and the Athi river plains in the west, and the Nakuru, Nanyuki, Mount Kenya region, and Eldoret in the north. Naivasha – located about 100 kilometers northwest of Nairobi – accounts for about 50% of the total land under cut flower cultivation, and about one-quarter of all flower exporters are located in the region. Additionally, the area is in close proximity to the Jomo Kenyatta International Airport and it is linked by the Nairobi-Nakuru highway; well-developed transportation networks are particularly important since fresh cut flowers are highly perishable.

There are currently about 160 flower growers who constitute mainly medium to large scale commercial operations. However, according to Kiptum (2005), the flower industry has been dominated by 24 very large commercial enterprises which contribute more than 72% of the total flower exports and which cultivate land of between 20 to 100 hectares each, and employ about 250 to 6,000 workers each. These large scale growers are a combination of foreign-owned and/or joint ventures between foreigners and Kenyan entrepreneurs. The predominant investors are European producers who outsource the cultivation of flowers to Kenya during the winter season in Europe. Such operations are vertically integrated and require high capital investments in green houses, excellent managerial skills and marketing infrastructure (such as freight-forwarding and cargo planes), research laboratories, advanced technology and cultivation techniques. Large-scale cultivation accounts for about 97% of Kenya's exports of cut flowers. These exporting firms have marketing networks located in Europe to assist in the sale, distribution and collection of market information. Smaller scale growers, on the other hand, tend to be locally owned with low capital investments and less advanced technology; they usually concentrate on growing summer flowers that are grown outdoors.

In 2008, floriculture exports in Kenya were approximately US$ 600 million, with the EU being the primary destination (Kenya Flower Council, 2009).[2] Roses make up over 70% of all trees, plants, buds, roots, flowers and foliage exported from Kenya (Muhammad, 2009). According to the United Nations, EU member states accounted for eight of the top ten importing countries and over 60% of global rose trade in 2009 (US$ 2.4 billion). EU imports of Kenyan roses increased steadily from around 3 million kilograms (kg) per month in 2002 to about 6 million kg in 2008 and 2009 (see

[2] EU countries account for over 90% of Kenya's flower exports.

figure 1). In 2010, rose imports in the EU were valued at US$ 741 million; Kenya – the leading supplier – accounted for about half of this total.[3]

The EU imports significantly less roses from the other global suppliers. Imports from Ecuador average about one million kg per month since 2001. Imports from other East African countries (Ethiopia, Tanzania, and Uganda) are relatively small as well, though average imports from these countries increased from about one million kg per month in 2006 to three million kg per month in 2010. Recently, Ethiopia has emerged as a global competitor in international cut flower trade, particularly in the EU market; this may have been due in part to the post-election violence and political instability in Kenya. For instance, during the February 2008 Valentine's Day season (when EU demand for roses is relatively high), it was reported that rose exports from Ethiopia to the EU were particularly high due to the ongoing violence in Kenya (Muhammad, 2009).

We fit a polynomial trend to the raw import data for the EU (figure 1). We observe that EU imports from Kenya trend upward until the period of political instability, level off shortly thereafter, and then commence a steady decline. These patterns, though not conclusive, suggest that there was a change in EU imports from Kenya beginning in early 2008. In the empirical work that follows, we estimate EU demand for roses by source country in order to quantify potential changes that occurred during and after this time period.

3. THE POST-ELECTION CONFLICT

On December 27, 2007, Kenyans voted in their fourth general election since the return of the multiparty system. Despite serious concerns over voting irregularities by international and domestic observers and evidence from exit polls showing large gains for the opposition party – including a narrow margin of victory for opposition presidential candidate Raila Odinga – on December 30th the Electoral Commission officially declared victory for President Mwai Kibaki. He was sworn in later that day and violence erupted throughout the country. Political instability and wide-spread conflict continued for nearly two months until representatives from the African Union and the United Nations were able to broker a compromise between the political factions. On February 28th, 2008 a power-sharing agreement established the position of Prime Minister for Mr. Odinga and doubled the number of cabinet positions to incorporate more opposition members; Mr. Kibaki remained

[3] This value does not include intra-EU trade. These statistics were obtained from the European Commission, Eurostat statistical database.

President. Violence gradually subsided, though tensions remained high as displaced populations slowly returned to their communities.

The conflict was fought primarily along ethnic lines, between the Luo and Kalenjin (supporters of Odinga) and the Kikuyu, Embu and Meru (supporters of Kibaki). It affected six of eight provinces, mainly in the following regions: Nairobi, Rift Valley, Coast, and Western. According to a report by the Kenya National Commission on Human Rights (2008), community grievances included discrimination in economic and political power and the distribution of wealth, as well as violations of economic, social and land rights. The violence was manifested in several ways: burning and looting of residential and commercial property; targeted violence against small farmers and landholders; and retaliatory targeted violence against migrant workers (Kenya National Commission on Human Rights, 2008).

The conflict impacted all sectors of the economy. Tourism declined as trips were canceled and foreign governments issued travel warnings. Agriculture and manufacturing experienced difficulties as input costs increased, workers were displaced, and transportation became more insecure and unpredictable; also, overall investor confidence declined (International Monetary Fund, 2010). Violence in the central town of Naivasha, which grows most of Kenya's flowers, led to an immediate drop in worker turnout (Muhammad, 2009). And, as mentioned above, firm-level evidence reveals that the cut flower sector experienced negative consequences. Ksoll, Macchiavello, and Morjaria (2009; 2010) find that the conflict had an immediate impact on exporting firms through two main channels – worker absence and transportation difficulties. They argue that the absence of workers was the main driver since flowers need to be harvested at specific times and delays can cause losses in these highly perishable goods. In addition to disrupting the economy, the violence may have had long lasting costs in social coherence such as ethnic distrust and suspicion, reflected in ethno-nationalism after the crisis (Kagwanja, 2009).

4. EMPIRICAL FRAMEWORK

In this section, we present the methodology and empirical framework for modeling the aggregate behavior of importing firms and assessing the effects of the political conflict on EU import demand. Following Armington (1969), imports are assumed to be differentiated by country of origin, which is due in part to product attributes (stem length, bud size, color, etc.), but also in part to perceived differences such as the reliability and consistency of an exporting country. In this context, roses from the *i*th exporting source are treated as an individual good that is part of the product group *roses*.

A good (rose) from one country is considered to be an imperfect substitute for goods (roses) from other sources due to origin specific factors. Letting other product groups be similarly defined, a multistage budgeting process is assumed. First total expenditures are allocated across the various product groups; second, total rose expenditures are allocated across the supplying countries (Seale, Sparks, & Buxton, 1992). For product groups unrelated to roses, preferences are assumed block independent, and for related product groups like other plants and flowers, preferences are assumed blockwise dependent. Block independence indicates that consumption of other goods has no effect on the utility derived from roses. Blockwise dependence indicates that the utility interaction between roses and related product groups is independent of the individual goods within each group (Theil & Clements, 1987). For instance, the utility interaction between roses and carnations are the same regardless of the country of origin. Under these assumptions, we can derive an import demand system limited to roses.

We use the absolute price version of the Rotterdam model to estimate EU demand for roses by source. Let *q* and *p* denote the quantity and price, respectively, *i* and *j* denote the exporting sources, and *n* the number of sources. Following Theil (1980) and Theil and Clements (1987), the demand for roses from the *i*th country is specified as follows:

$$w_{it}\, d(\ln q_{it}) = \theta_i d(\ln Q_t) + \sum_{j=1}^{n} \pi_{ij} d(\ln p_{jt}) + \varepsilon_{it} \qquad (1)$$

where w_{it} is the conditional expenditure share for the *i*th country $(w_{it} = p_{it}q_{it} / \sum_{i=1}^{n} p_{it}q_{it})$. θ_i is the marginal expenditure share ($\theta_i = \partial p_i q_i / \partial \sum_{i=1}^{n} p_i q_i$). Note that θ_i measures how an additional unit of total expenditures is allocated to the *i*th source. $d(\ln Q_i)$ is the Divisia volume index $(d(\ln Q_t) = \sum_{i=1}^{n} w_{it}\, d(\ln q_{it}))$. The Divisia volume index is a measure of the change in real expenditures on all imported roses (Theil, 1980). π_{ij} is the Slutsky price coefficient or relative price effect which measures the impact of the price in country *j* on the quantity imported from country *i*. ε_{it} is a random error term.[4]

Following the methodology of Moschini and Meilke (1989) and Ohtani, Kakimoto, and Abe (1990) and the empirical applications of Gil, *et al.* (2004) and Peterson and Chen (2005), the

[4] The Rotterdam model requires that the following restrictions be met in order to conform to theoretical considerations: $\sum_i \theta_i = 1$ and $\sum_i \pi_{ij} = 0$ (adding up); $\sum_j \pi_{ij}$ (homogeneity), and $\pi_{ij} = \pi_{ji}$ (symmetry). Additionally, the Slutsky price matrix $\mathbf{\Pi} = [\pi_{ij}]$ should be negative semidefinite (Theil, 1980).

structural change in import demand is modeled assuming a common time path for all parameters in the system. Denoting this time path as h_t, the Rotterdam model with structural change is parameterized as follows:

$$w_{it} d(\ln q_{it}) = \alpha_i + \delta_i h_t + (\theta_i + \lambda_i h_t) d(\ln Q_t) + \sum_{j=1}^{n} (\pi_{ij} + \nu_{ij} h_t) d(\ln p_{jt}) + \varepsilon_{it} \qquad (2)$$

The constant term α_i is added to account for import trends, and the term $\delta_i h_t$ is the structural adjustment in the trend effect. Similarly, $\lambda_i h_t$ is the structural adjustment in the expenditure effect and $\nu_i h_t$ is the structural adjustment in the relative price effect. When estimating the model, α, δ, θ, λ, π, and ν are treated as fixed parameters. The hypothesis of $\delta = \lambda = \nu = 0$ implies no structural change.[5] The time path h_t is defined such that equation (2) becomes a gradual switching regression model where:

$$\begin{aligned} h_t &= 0 && \text{for } t = 1, ..., \tau_1 \\ h_t &= (t - \tau_1)/(\tau_2 - \tau_1) && \text{for } t = \tau_1 + 1, ..., \tau_2 - 1. \\ h_t &= 1 && \text{for } t = \tau_2, ..., T \end{aligned}$$

There are three distinct periods to consider when assessing the structural change in demand: the pre-conflict period ($h_t = 0$), the transition period $(h_t = (t - \tau_1)/(\tau_2 - \tau_1))$, and the post-conflict period ($h_t = 1$). τ_1 is the conflict starting point, τ_2 is the starting point of the post-conflict period, and T is the end of the sample period. Note that the transition from the pre-conflict to the post-conflict period can be immediate $(\tau_2 = \tau_1 + 1)$ or gradual $(\tau_2 > \tau_1 + 1)$ depending on the size of τ_2 relative to τ_1 (Moschini & Meilke, 1989). We use the log likelihood value to determine the optimal transition period. More details on this procedure are in the following section.

Of particular interest to our research question is the impact of structural change on the import demand elasticities. The conditional expenditure elasticity with structural change is $\eta_i = (\theta_i + \lambda_i h)/w_i$. Note that η_i measures the percentage responsiveness of imports from the ith exporting country to percentage changes in total import expenditures in the EU. The conditional (income compensated) price elasticity of demand with structural change is $\eta_{ij} = (\pi_{ij} + \nu_{ij} h)/w_i$, where η_{ij} measures the percentage responsiveness of imports from the ith exporting country to a percentage change in the price in exporting country j. Further, we can define a trend elasticity as

[5] Additional restrictions are required for adding-up, homogeneity and symmetry:
$\sum_i \alpha_i = \sum_i \delta_i = \sum_i \lambda_i = \sum_i \nu_{ij} = 0$ (adding up), $\sum_j \nu_{ij} = 0$ (homogeneity), and $\nu_{ij} = \nu_{ji}$ (symmetry).

$g_i = (\alpha_i + \delta_i h)/w_i$, which is also the rate of growth in imports from the *i*th country holding prices and total expenditures constant. If the structural change in demand is significant, we would expect these measures to be statistically different when $h = 1$ and when $h = 0$.

We use monthly data from January 2001 to December 2010 to estimate equation (2), provided by the External Trade Section of the Statistical Office of the European Communities (Eurostat). The data are defined according to the CN8 classification, which includes "fresh cut roses and buds of a kind suitable for bouquets or for ornamental purposes." Import quantities are measured in units of 100 kg and import values are in Euros. Values are on a cost-insurance-freight (CIF) basis and import prices are calculated by dividing the value of the commodity by the quantity, resulting in a Euro per 100 kg unit of measure. We considered the main exporting sources for the analysis: Kenya, Ecuador, and East Africa. The remaining exporting sources are designated as the rest of the world (ROW). East Africa is comprised of Ethiopia, Tanzania, and Uganda. Although flower auctions in Holland play an integral role in supplying roses to the EU, intra-EU trade is excluded from the analysis to avoid the double counting of imports since there is no way to differentiate between intra-EU imports produced in the Netherlands and re-exports.[6]

Table 1 provides descriptive statistics for the variables in the model. During the sample period, imports from Kenya averaged 4.7 million kg and 17.1 million euros per month - over three times the average for East Africa and ROW and over four times the average for Ecuador (in terms of quantity). On average, Kenya and East Africa were the least expensive sources; prices averaged €3.67/kg and €3.81/kg, respectively. Ecuador was considerably more expensive, at €5.52/kg, which is in part due to relative proximity to the EU resulting in higher freight cost. Kenya accounted for the largest share of extra-EU imports averaging 51.7% for the sample period. ROW was second at 18.8%, while Ecuador and East Africa accounted for 15.5% and 14%, respectively.

5. ESTIMATION AND RESULTS

In estimating the Rotterdam model, continuous log differences are typically replaced with finite one-period log differences. Given the importance of seasonality in the cut flower sector and the frequency of the data, we use the 12th difference to control for seasonality (Lee, 1988). Thus, we approximate the quantity and price terms in equation (2) as $d(\ln q_t) \approx \ln q_t - \ln q_{t-12}$ and

[6] Furthermore, in addition to imported roses, it would be ideal to include roses produced and consumed within a member state (domestic sales); however, data on domestic sales are not readily available.

$d(\ln p_t) \approx \ln p_t - \ln p_{t-12}$, respectively. Further, we replace the expenditure share w_{it} with $\bar{w}_{it} = 0.5(w_{it} + w_{it-12})$, which is the expenditure share averaged over the periods t and t-12, and we replace the Divisia volume index $d(\ln Q_t)$ with a discrete measure DQ_t where $DQ_t = \sum_{i=1}^{n} \bar{w}_{it}(\ln q_{it} - \ln q_{it-12})$ (Theil, 1980; Theil & Clements, 1987).

In our preliminary analysis, we found that the error in equation (2) was not random but follows a first-order autoregressive process, $\varepsilon_{it} = \rho\varepsilon_{it-1} + \mu_{it}$ where $\varepsilon_{it} \sim N(0,\sigma_\mu)$. Thus to account for autocorrelation, we estimate the model using a maximum likelihood procedure for singular equation systems with autoregressive disturbances as specified by Beach & MacKinnon (1979), where ρ is constrained equal across all equations to preserve the adding-up property. The benefits of the Beach and MacKinnon method are that the log likelihood function is specified such that the error process is stationary (the characteristic roots of ρ lie within the unit circle) and the errors of the initial period have some effect on the parameters.

The first step in the estimation procedure is to determine the transition period. Following Moschini and Meilke (1989), we assume that the optimal transition period should maximize the log likelihood function. Since the conflict was not anticipated, we set the value of τ_1 to that of December 2007. Given τ_1, we assume the following values for τ_2: $\tau_2 = \tau_1 + 1$ (January 2008); $\tau_2 = \tau_1 + 4$ (April 2008); $\tau_2 = \tau_1 + 7$ (July 2008); $\tau_2 = \tau_1 + 10$ (October 2008); and $\tau_2 = \tau_1 + 13$ (January 2009). These values represent an immediate or abrupt transition, and a one-, two-, and three-quarter transition, and one-year transition, respectively. We estimate equation (2) for each value of τ_2. The results are displayed in Table 2. The results indicate that the log likelihood value is maximized when the transition period is one quarter. Therefore in the next step, we assume a one quarter transition period when testing for structural breaks. Our results indicate that the transition period consists of the months during which the violence occurred and that any structural change in importer behavior was apparent immediately after the violence subsided.

We use likelihood ratio (LR) tests to determine the significance of structural change in demand. We consider three separate hypotheses: (i) no structural change in the trend effects ($\delta = 0$); (ii) no structural change in expenditure effects ($\lambda = 0$); and (iii) no structural change in price effects ($\nu = 0$). The results, displayed in Table 3, indicate that structural change in the expenditure and price estimates should be rejected, but the structural change in the trend estimates cannot be rejected.

While we find no evidence that the conflict had an effect on how firms responded to import prices and total expenditures, we do find evidence of a significant change in import trends after controlling for prices and total expenditures. More specifically, we find that the growth rate for imports from Kenya, which was positive (and significant) before the conflict, became negative (and significant) after the conflict, and that imports from Ethiopia, Tanzania, Uganda, and ROW appear to have benefited from this displaced trade (details to follow).

We find that the trend estimates (α_i), which measure the pattern of imports holding prices and total expenditures constant, are significant and positive for Kenya (0.0156) and East Africa (0.0084) and negative for the ROW (-0.0218). Table 4 displays demand estimates for the EU. All estimates are homogeneity and symmetry constrained with first-order autoregressive disturbances. These estimates indicate that imports from Kenya and East Africa were increasing before the conflict, ceteris paribus. However, after the conflict, the structural change estimates (δ_i) indicate a negative trend for Kenya (-0.0257) but a positive trend for East Africa (0.0068).

Next we examine the marginal share of total expenditures that go to each exporting country. Recall that the marginal share estimates (θ_i) measure how a unit increase in total import expenditure is allocated across the four exporting countries. Since Kenya is the leading exporter, we expect its marginal share to be relatively large when compared to the other countries, which is what we find. The results indicate that for every one-euro increase in total imports, on average, 0.51 went to Kenya, 0.16 to Ecuador, 0.15 to East Africa, and 0.18 to ROW. The own-price estimates (π_{ii}) are negative and significant for Kenya, Ecuador and East Africa. Consistent with theory, an increase in the price for a particular source causes EU firms to decrease imports from that source. The cross-price estimates (π_{ij}) indicate a significant competitive relationship (substitutes) between Kenya and Ecuador (0.0393) and between Kenya and East Africa (0.0381). When converted to elasticities, these estimates indicate that a one percent increase in Kenyan prices caused the EU to increase imports from Ecuador and East Africa by 0.26% and 0.27%, respectively.

We find that the expenditures elasticities are statistically significant but not different from unity, which implies that import preferences are homothetic and the conditional expenditure shares (w_i) are independent of the level of total expenditure such that firms spend a constant share of total expenditures on a particular source on average. Table 5 displays the expenditure elasticities and income compensated and uncompensated own-price elasticities. The income compensated price elasticity only accounts for the substitution effect of a price change while the uncompensated price

elasticity accounts for the substitution and income effects. Seale, Sparks, and Buxton (1992) show that the uncompensated own-price elasticity is derived as the difference between the compensated elasticity and marginal share (η_{ii} - θ_i). The estimated own-price elasticities (income compensated and uncompensated) indicate that import demand in the EU is inelastic for all countries. For instance, the uncompensated elasticities indicate that a one percent increase in price is associated with a decline in imports from Kenya by 0.74%, Ecuador by 0.46%, East Africa by 0.34%, and ROW by 0.32%.

Next we derive and compare statistically the growth rates for each country across the two periods: pre- and post-conflict. Since we use annual (12th) differences to estimate the model, the estimated growth rates are annual and not monthly.[7] Following Moschini and Meilke (1989) and Gil, *et al.* (2004), we derive the growth rate estimates using period-specific averages of the expenditure share w_i. For the pre-conflict estimates, we average w over the period January 2001-December 2007, $\bar{\bar{w}}_{it} = \sum_{t=1}^{\tau_1} \bar{w}_{it} / \tau_1$. For the post-conflict estimates, we average w over the period April 2008-December 2010, $\bar{\bar{w}}_{it} = \sum_{t=\tau_2}^{T} \bar{w}_{it} / (T - \tau_2)$.

The results, displayed in Table 6, indicate that Kenya is the only country with a significant negative import growth rate after the conflict. Prior to the conflict, imports from Kenya were increasing by 3% per year on average, but after the conflict, imports were decreasing by 1.9% per year. Although the market share for East Africa more than doubled after the conflict, the growth rate remained unchanged indicating that imports continued to grow at around 7% to 8% per year. For ROW, imports were declining by nearly 10% per year before the conflict; after the conflict however, imports were no longer declining. For Ecuador, we find no statistically significant change in the import growth rate. These estimates represent the change in imports after controlling for any changes due to prices, total expenditures, seasonality, and random disturbances. Therefore, the actual percentage change in EU imports from each country could be very different from the estimated growth rates due to changes in the factors assumed to be constant, namely changes in flower prices across exporting countries and changes in total import expenditures in the EU.

[7] Note that if $\log y_t = a + bt$, then $\log y_t - \log y_{t-12} = 12b$.

6. SUMMARY AND IMPLICATIONS

In this paper, we assess whether and how internal conflict and political instability affect international trade, with a particular focus on exports from developing countries, which can be an important source of growth. We consider exports of fresh cut flowers (specifically, roses) from Kenya to the EU as a special case and examine the impact of the 2007/08 post-election violence and political instability in Kenya.

We use the Rotterdam model and monthly EU import data from January 2000 to December 2010 to estimate EU demand for roses from Kenya and other major global competitors. We find no change in how EU firms respond to import prices and total expenditures. However, after controlling for prices and total expenditure, we find a structural change in the growth rate trends in EU imports from Kenya. In particular, before the conflict, the growth rate of EU imports from Kenya was positive (3% annual); after the conflict, it was negative (-1.9% annual), *ceteris paribus*. Given Kenya's important position in the global cut flower trade, this decline may have led to permanent changes in the international trade landscape. In fact, the evidence suggests that the changes brought on by the post-election violence and instability may have benefited other major competitors in East Africa and around the globe.

To quantify the potential impact of the results, we calculate the tariff equivalent of the events in Kenya. In 2007, imports from Kenya totaled approximately 68 million kg, valued at €3.56 per kg. If the rate of growth had remained at 3%, imports would have increased to approximately 74.3 million kg by 2010, other factors held constant. Rather, we found a –2% growth rate, resulting in a projected fall to approximately 64 million kg by 2010. The resulting loss is approximately 10.3 million kg or €36.7 million, valued at 2007 prices. The estimated own-price elasticity for Kenya (-0.745) can be used to assess the price change or tariff rate required to attain a comparable loss. Assuming tariffs are passed through fully to import prices, we find an 18.6% tariff equivalent to the decrease in imports associated with the post-election violence and instability. These results underscore the importance of non-tariff barriers to trade and, in particular, the critical role that insecurity and instability can play in hindering a country's export potential.

Kenya's experiences with instability and its effect on flower trade with the EU are not unique within the Africa context. A decade earlier, the fresh cut flower sector in Zimbabwe experienced an even more severe decline in exports to the EU. In 2000–2001, Zimbabwe was the second leading exporter of roses to the EU, accounting for about one quarter of total EU imports. EU imports from Zimbabwe were valued at nearly €50 million per year, about four times the value

of imports from Uganda and five times the value of imports from Tanzania. At that time, imports from Ethiopia were less than one million euros. Fresh cut rose exports from Zimbabwe to the EU peaked in 2001 and then began a long decline. By 2006, exports to the EU were valued at €17 million, less than exports from Uganda and Ethiopia (about €20 million each). This substantial decline is attributed to several simultaneous factors, including the economic decline of the country, weak institutions, conflict and insecurity, and a decline in agricultural productivity. Power (2003) and Clemens and Moss (2005) suggest that the decline in agricultural productivity may have been caused by the land reform policies of the Zimbabwean government which resulted in farm seizures in 2000. The land reform policies, and the violence that followed, displaced farmers and workers. In fact, these policies may have contributed to the emergence of Ethiopia in EU flower trade since a number of displaced farmers relocated to Ethiopia to continue in cut flower production. The country also experienced election violence and had sanctions imposed by the EU in 2002, compounding the challenges to maintaining a strong fresh cut flower sector. Today, Zimbabwe is no longer a major player in fresh cut flower trade with the EU.

While the Kenyan Government continues to promote the fresh cut flower sector and agricultural-led export growth more generally, the study reveals, that non-economic factors may hinder the country's economic prospects. Despite its large presence in the EU cut flower market, Kenya's leading exporter status is vulnerable to even short bouts of violence or instability given the highly perishable nature of the goods and the importance of a reliable supply chain. And rose production in East African competing exporters has been growing recently as European entrepreneurs seek to diversify their investments across the region. Though these East African countries may not pose an impending threat to Kenya, we do find evidence that EU importers immediately substituted Kenyan roses for roses from these other African countries following the post-election crisis. Therefore, political leaders and policy makers may want to consider the economic costs of conflict and political instability as they seek to support the fresh cut flower sector and other export oriented sectors.

References

Alesina, A., Özler, S., Roubini, N., & Swagel, P. (1996). Political instability and economic growth. *Journal of Economic Growth, 1*(2), 189-211. doi: 10.1007/bf00138862

Anderson, J. E., & Marcouiller, D. (2002). Insecurity and the Pattern of Trade: An Empirical Investigation. *Review of Economics and Statistics, 84*(2), 342-352. doi: doi:10.1162/003465302317411587

Armington, P. S. (1969). A Theory of Demand for Products Distinguished by Place of Production. *International Monetary Fund Staff Papers, 16*(1), 159-178.

Barrientos, S., Dolan, C., & Tallontire, A. (2003). A Gendered Value Chain Approach to Codes of Conduct in African Horticulture. *World Development, 31*(9), 1511-1526. doi: 10.1016/s0305-750x(03)00110-4

Beach, C. M., & MacKinnon, J. G. (1979). Maximum Likelihood Estimation of Singular Equation Systems with Autoregressive Disturbances. *International Economic Review, 20*(2), 459-464. doi: http://www.blackwell-synergy.com/loi/iere/

Belloc, M. (2006). Institutions and International Trade: A Reconsideration of Comparative Advantage. *Journal of Economic Surveys, 20*(1), 3-26. doi: 10.1111/j.0950-0804.2006.00274.x

Blattman, C., & Miguel, E. (2010). Civil War. *Journal of Economic Literature, 48*(1), 3-57. doi: doi: 10.1257/jel.48.1.3

Blomberg, S. B., & Hess, G. D. (2006). How Much Does Violence Tax Trade? *Review of Economics and Statistics, 88*(4), 599-612. doi: doi:10.1162/rest.88.4.599

Blomberg, S. B., Hess, G. D., & Orphanides, A. (2004). The macroeconomic consequences of terrorism. *Journal of Monetary Economics, 51*(5), 1007-1032. doi: 10.1016/j.jmoneco.2004.04.001

Clemens, M., & Moss, T. (2005). *Costs and Causes of Zimbabwe's Crisis*. CGD Notes. Center for Global Development. Washington, D.C.

Clements, K. W., & Theil, H. (1978). A simple method of estimating price elasticities in international trade. *Economics Letters, 1*(2), 133-137. doi: Doi: 10.1016/0165-1765(78)90049-6

Gil, J. M., Dhehibi, B., Ben Kaabia, M., & Angulo, A. M. (2004). Non-stationarity and the import demand for virgin olive oil in the European Union. *Applied Economics, 36*(16), 1859-1869. doi: 10.1080/0003684042000227877

Hale, A., & Opondo, M. (2005). Humanising the Cut Flower Chain: Confronting the Realities of Flower Production for Workers in Kenya. *Antipode, 37*(2), 301-323. doi: 10.1111/j.0066-4812.2005.00494.x

Hughes, A. (2000). Retailers, knowledges and changing commodity networks: the case of the cut flower trade. *Geoforum, 31*(2), 175-190. doi: 10.1016/s0016-7185(99)00034-2

International Monetary Fund. (2010). Kenya: Poverty Reduction Strategy Paper *IMF Country Report*. Washington, D.C.

Kagwanja, P. (2009). Courting genocide: Populism, ethno-nationalism and the informalisation of violence in Kenya's 2008 post-election crisis. *Journal of Contemporary African Studies, 27*(3), 365-387

Kenya Flower Council. (2009). The Flower Industry in Kenya and Market Data Retrieved June 16, 2011, from http://www.kenyaflowercouncil.org/floricultureinkenya.php

Kenya Ministry of Agriculture. (2010). National Horticulture Policy. Nairobi: Government of Kenya.

Kenya National Commission on Human Rights. (2008). On the Brink of the Precipice: A Human Rights Account of Kenya's Post 2007 Election Violence.

Kiptum, B. K. (2005). *Building Export Markets for Kenyan Flowers: Challenges and Opportunities Facing Small Scale Flower Growers in Kenya*. Paper presented at the ATPS/CTA National Dissemination and Exhibition Workshop on the Flower Industry Nairobi, Kenya.

Ksoll, C., Macchiavello, R., & Morjaria, A. (2009). *Guns and Roses: The Impact of the Kenyan Post-Election Violence on Flower Exporting Firms*. CSAE Working Paper Series. Centre for the Study of African Economies, University of Oxford.

Ksoll, C., Macchiavello, R., & Morjaria, A. (2010). *The Effect of Ethnic Violence on an Export-Oriented Industry*. BREAD Working Paper. Bureau for Research and Economic Analysis of Development.

Lee, J. C. (1988). Nested Rotterdam Model: Applications to Marketing Research with Special References to Telecommunications Demand. *International Journal of Forecasting, 4*(2), 193-206. http://www.elsevier.com/wps/find/journaldescription.cws_home/505555/description#description

Moschini, G., & Meilke, K. D. (1989). Modeling the Pattern of Structural Change in U.S. Meat Demand. *American Journal of Agricultural Economics, 71*(2), 253-261.

Muhammad, A. (2009). Would African Countries Benefit from the Termination of Kenya's Economic Partnership Agreement (EPA) with the EU? An Analysis of EU Demand for Imported Roses. *Journal of Agricultural Economics, 60*(1), 220-238. doi: http://www3.interscience.wiley.com/journal/120775364/grouphome/home.html

Nunn, N. (2007). Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade. *The Quarterly Journal of Economics, 122*(2), 569-600.

Ohtani, K., Kakimoto, S., & Abe, K. (1990). A gradual switching regression model with a flexible transition path. *Economics Letters, 32*(1), 43-48. doi: 10.1016/0165-1765(90)90047-5

Peterson, H. H., & Chen, Y.-J. (2005). The Impact of BSE on Japanese Retail Meat Demand. *Agribusiness, 21*(3), 313-327. doi: http://www3.interscience.wiley.com/cgi-bin/jhome/35917

Power, S. (2003, December). How to Kill A Country: Turning a breadbasket into a basket case in ten easy steps- the Robert Mugabe way. *The Atlantic.*

Riisgaard, L. (2009). Global Value Chains, Labor Organization and Private Social Standards: Lessons from East African Cut Flower Industries. *World Development, 37*(2), 326-340. doi: 10.1016/j.worlddev.2008.03.003

Seale, J. L., Sparks, A. L., & Buxton, B. M. (1992). A Rotterdam Application to International Trade in Fresh Apples: A Differential Approach. *Journal of Agricultural and Resource Economics, 17*(1), 138-149. doi: http://jareonline.org

Theil, H. (1980). *The System-wide Approach to Microeconomics.* Chicago: The University of Chicago Press.

Theil, H., & Clements, K. W. (1987). *Applied Demand Analysis: Results from System-Wide Approaches* Cambridge: Ballinger Pub. Co.

United Nations High Commissioner for Human Rights. (2008). Report from OHCHR Fact-finding Mission to Kenya, 6-28 February 2008. Geneve.

Wolak, F. A., & Kolstad, C. D. (1991). A Model of Homogeneous Input Demand under Price Uncertainty. *American Economic Review, 81*(3), 514-538. doi: http://www.aeaweb.org/aer/

Table 1. *Summary Statistics for Model Variables: January 2001–December 2010*

Country	Mean	Std. Dev.	Min.	Max.
	Monthly Quantity (kilograms)			
Ecuador	946,398	347,992	333,100	1,810,300
Kenya	4,705,073	1,534,441	1,667,900	7,711,800
East Africa	1,398,737	996,987	315,000	3,712,200
ROW	1,412,573	549,559	534,200	2,811,900
	Monthly Value (€)			
Ecuador	5,372,208	2,495,260	1,457,110	12,988,000
Kenya	17,128,900	5,451,303	6,679,374	28,743,400
East Africa	5,015,444	3,399,342	1,340,981	13,081,300
ROW	5,942,935	2,887,667	2,185,465	16,916,700
	Price (€/kilogram)			
Ecuador	5.519	0.755	2.463	7.795
Kenya	3.671	0.288	3.177	4.492
East Africa	3.811	0.551	2.838	5.479
ROW	4.131	0.644	3.028	6.185
	Market Share (%)			
Ecuador	15.49	3.18	9.51	24.50
Kenya	51.67	6.45	30.88	64.47
East Africa	13.99	6.26	4.71	30.02
ROW	18.86	8.97	7.53	42.31

ROW is the rest of the world. Std. Dev. is the standard deviation.

Table 2. *Length of transition period and regression log likelihood value*

Transition period	Log likelihood value
Immediate	885.570
One quarter	886.359
Two quarters	885.552
Three quarters	885.385
One year	885.207

Table 3. *Likelihood ratio tests for structural change*

No structural change in the following:	Log-likelihood Value	LR Statistic	$P[\chi_j^2 \leq LR] = 0.95$	P-value
Unrestricted	886.359			
Trends	875.284	22.150	7.82(3)[a]	0.000
Expenditures	883.043	6.632	7.82(3)	0.085
Prices	884.576	3.565	16.92(9)	0.938

[a] Chi-square critical value, with the number of restricted parameters in parentheses.

Table 4. *Import demand and structural change estimates*

Parameter	Ecuador	Kenya	East Africa	ROW
Trend (α_i)	-0.0022	0.0156	0.0084	-0.0218
	(0.0022)	(0.0037)***	(0.0018)***	(0.0027)***
Marginal Share (θ_i)	0.1601	0.5121	0.1522	0.1755
	(0.0243)***	(0.0416)***	(0.0206)***	(0.0298)***
	Price effects matrix (Π)			
Ecuador	-0.0455	0.0393	0.0053	0.0009
	(0.0131)***	(0.0186)**	(0.096)	(0.0124)
Kenya		-0.1202	0.0381	0.0429
		(0.0424)***	(0.0193)**	(0.0263)
East Africa			-0.0255	-0.0179
			(0.0150)*	(0.0130)
ROW				-0.0259
				(0.0235)
	Structural change estimates			
Trend (δ_i)	0.0026	-0.0257	0.0068	0.0162
	(0.0034)	(0.0058)***	(0.0028)**	(0.0041)***
R^2 =	0.33	0.64	0.38	0.32
Durbin-Watson =	2.10	1.79	1.96	2.11

Asymptotic standard errors are in parentheses. Homogeneity and symmetry are imposed on the price effects matrix. ROW is the rest of the world.

***, **, and * denotes 0.01, 0.05, and 0.10 significance level, respectively.

AR(1) parameter = 0.450

Table 5. *Import demand elasticities*

Country	Expenditure (η_i)	Compensated own-price (η_{ii})	Uncompensated own-price (η_{ii})
Ecuador	1.042 (0.158)	-0.296 (0.086)	-0.456 (0.091)
Kenya	0.978 (0.079)	-0.230 (0.081)	-0.742 (0.094)
East Africa	1.105 (0.149)	-0.185 (0.109)[a]	-0.337 (0.109)
ROW	0.948 (0.160)	-0.139 (0.138)[b]	-0.315 (0.127)

Asymptotic standard errors are in parentheses.

Unless specified otherwise, all elasticities are significant at the 0.05 level.

[a] Significant at the 0.10 level. [b] Insignificant estimate.

ROW is the rest of the world.

Table 6. *Growth rate estimates and structural change*

	2001:1-2007:12	2008:4-2010:12	2001:1-2007:12	2008:4-2010:12	Difference
Country	Market Share		Annual growth rates		
Ecuador	0.150	0.158	-0.015 (0.144)	0.003 (0.018)	0.017 (0.022)
Kenya	0.524	0.524	0.030 (0.007)***	-0.019 (0.009)**	-0.049 (0.011)***
East Africa	0.103	0.213	0.082 (0.018)***	0.072 (0.011)***	-0.010 (0.020)
ROW	0.223	0.106	-0.098 (0.012)***	-0.053 (0.033)	0.045 (0.033)

Asymptotic standard errors are in parentheses.

*** and ** denote the 0.01 and 0.05 significance level, respectively.

ROW is the rest of the world.

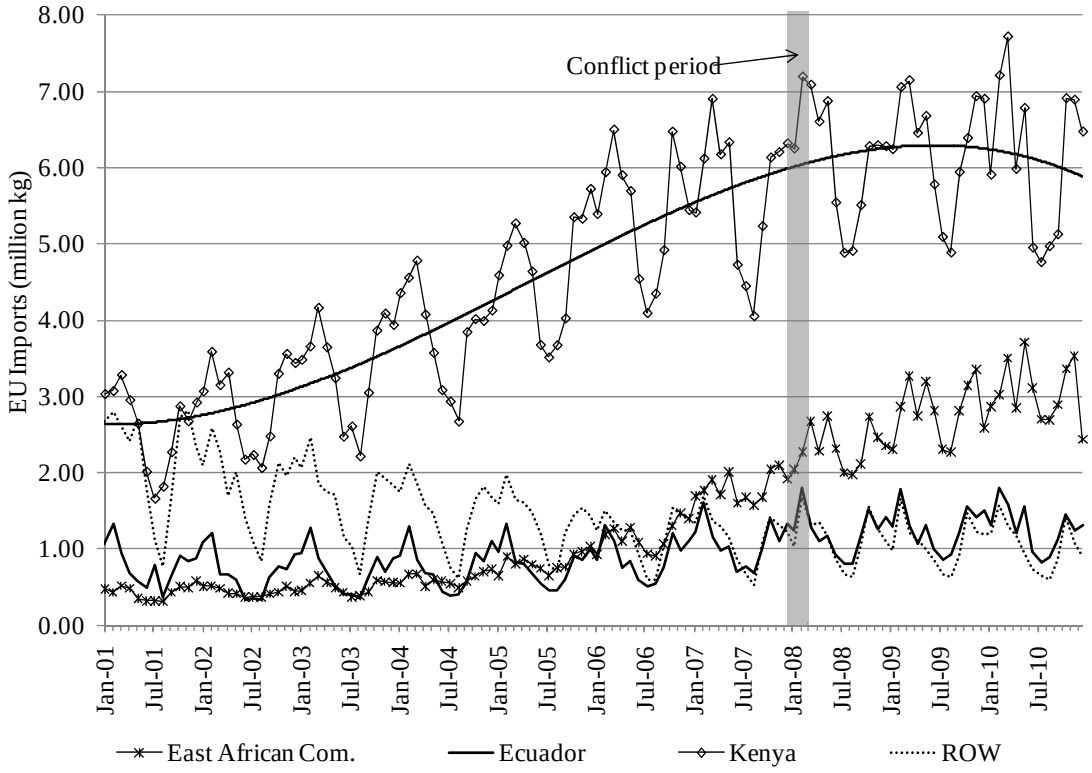

Figure 1. *Rose imports in the EU by source: January 2001–December 2010*

Source: Eurostat