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## THE EFFECT OF ETHNIC VIOLENCE ON AN EXPORT-ORIENTED INDUSTRY

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# ABSTRACT

## The Effect of Ethnic Violence on an Export-Oriented Industry*

This paper investigates the effects of ethnic violence on export-oriented firms and their workers. Following the disputed 2007 Kenyan presidential election, export volumes of flower firms affected by the ensuing violence dropped by 38 percent and worker absence exceeded 50 percent. Large firms and firms with stable contractual relationships in export markets registered smaller proportional losses and had fewer workers absent. Model calibrations indicate that, to induce workers to come and work over-time, operating costs, on average, increased by 16 percent. For the marginal worker, the cost of going to work exceeded the average weekly income by 320 percent.

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# 1 Introduction

In Africa, election times are risky times: out of the eleven African presidential elections held in 2007 and 2008 the Kenyan and Zimbabwean presidential elections degenerated into large-scale violence and Guinea and Madagascar both witnessed violence associated with parliamentary elections. Beyond their immediate consequence on the affected population, violent conflicts and intense episodes of civil unrest might have negative effects on growth and development by reducing the value of investments and increasing uncertainty.[1] While an expanding body of evidence, mostly from cross-country studies (see, e.g., Alesina et al. (1996), Collier (2007)), confirms the quantitative relevance of this intuition, micro-level evidence of the impact of violent conflict, particularly on firms' operations, remains scarce. This is likely to be attributable to two major empirical challenges involved in establishing the causal effects of violence: *i*) gathering detailed information on the operations of firms before, during and after the violent conflict, and *ii*) constructing a valid counterfactual, i.e., assessing what would have happened to the firms in the absence of the violence.

This paper investigates the economic effects of ethnic violence on firms, using the experience of the Kenyan floriculture sector during the ethnic violence that followed the presidential elections in 2007 as a case study. Beyond its intrinsic interest,[2] two unique features of this sector allow us to overcome the empirical challenges noted above. Flowers, which in Kenya are produced almost exclusively for the export market, are highly perishable. This implies that the daily data on exports, available from customs records at the firm level before, during and after the violence, match day-by-day production activity on the farms. Moreover, flowers are grown and exported by vertically integrated firms and therefore the export data can also be matched with the exact location where flowers are produced.[3] The ethnic violence that followed the elections in Kenya at the end of 2007 did not equally affect all regions of the country where flower firms were located. The detailed information on the time and location of production, therefore, can be combined with spatial and temporal variation in the incidence of the violence to construct several appropriate counterfactuals

[1] Bates (2001, 2008) provides an excellent analysis of political order and economic growth in the context of Africa.

[2] The floriculture sector is one of the three largest earners of foreign currency for Kenya and employs several thousand of workers, mostly poorly educated women, in rural areas.

[3] Other agricultural products, instead, are grown in rural areas and then processed and exported by firms located in the larger towns of Nairobi and Mombasa. This precludes matching production with location. For other sectors, e.g., manufacturing, that are not primarily involved in exports accurate high-frequency data on production or sales do not exist.

to assess the causal impact of the violence on production. The data therefore allows us to estimate the reduced form effect of the violence on production.

The paper further combines the reduced form estimates with information collected through a firm survey designed and conducted by us to i) uncover the main channels through which the violence affected firms, and ii) to calibrate a model of a firm's reaction to the violence. The calibration exercise allows to construct credible bounds on firms' losses and on the costs incurred by workers due to the violence.

The results show that, after controlling for firm-specific seasonality and growth patterns, weekly export volumes of firms in the affected regions dropped, on average, by 38% relative to comparable firms in regions not affected during the period of the violence. The evidence, furthermore, shows that workers' absence, which across firms averaged 50% of the labor force at the peak of the violence, was the main channel through which the violence affected production, rather than transportation problems. We develop a model of production with heterogeneous firms and endogenous labor supply. Consistent with the predictions of the model, the average effect conceals substantial heterogeneity in both firms' exposure and response to the violence. In particular, within narrowly defined locations, large firms and firms with stable contractual relationships in export markets registered smaller proportional losses in production and reported proportionally fewer workers absent during the time of the violence, even after controlling for characteristics of the labor force, working arrangements and ownership.[4]

Firms responded to the violence by compensating the workers that came to work for the (opportunity) costs of coming to the farm during the violence period and by increasing working hours to keep up production despite severe worker absence. As a result, despite the temporary reduction in the labor force, the calibration exercise reveals that the weekly wage bill during the violence period increased by 70% for the average firm. Given the relatively low share of labor costs in the industry, the figure translates into a 16% increase in operating costs due to the violence. This provides a lower bound since it does not include other expenses, such as hiring of security, extra-inputs, etc. Even taking into account the 10% depreciation of the Kenyan shilling, the lower revenue and cost increases suggest that the average firm operated at a loss during the period of the violence.

[4]Firms affiliated with the industry business association also suffered lower reductions in export volumes. After accounting for these characteristics, there is no evidence that foreign-owned firms or firms more closely connected to politicians suffered differential reductions in exports. Consistent with the theoretical predictions, once workers' absence is directly controlled for, the location, size and marketing channels of the firms do not explain production losses.

Workers who did attend work were compensated by the firms for the opportunity cost of going to work. However, at the average firm, about 50% of the labor force did not come to work for at least one week during the period of the violence. Those absent had higher costs of going to work during the violence; and the calibration exercise suggests that these costs were more than three times higher than normal weekly earnings for the marginal worker. The estimates, therefore, suggest large welfare costs of the violence on workers.

The specific advantages presented by the Kenyan setting for identifying the effects of violence on workers and firms come at various costs. First, (almost) no violence was registered at, nor directed towards, flower firms. This eliminates channels that might operate in contexts with more severe episodes of violence. Second, the short and unanticipated, although intense, nature of the ethnic violence considered focuses our analysis on short-run effects. While the short duration of the violence allowed us to conduct a retrospective survey shortly after the violence ended, its unanticipated nature implies that in different contexts firms might be able to take precautionary measures. Third, the high unit values and especially the perishability have led to flower firms that are vertically integrated from production to exporting. This might have solved coordination problems along the chain and provided higher incentives to reduce losses relative to lower value agricultural commodities produced by smaller farmers and marketed by intermediaries. For all these reasons, caution is needed in order to extrapolate the lessons about mechanisms and incentives learned by this study to other contexts.

This work is related to the growing literature on the microeconomics of violence and civil conflict (see, e.g., Blattman and Miguel (2009) for a survey of the literature). The literature on the effects of violence has mostly focused on population and human capital issues.[5] While there is a literature linking exports of natural resources to civil conflict at the macro-level, micro-evidence on the relationship between firms and conflict is scarce. The closest work to ours is that of Abadie and Gardeazabal (2003) and of Guidolin and La Ferrara (2007), both of which also look at a particular conflict. Abadie and Gardeazabal (2003) study the impact of the Basque civil war on growth in the Basque region by constructing a counterfactual region and compare the growth of that counterfactual region to the actual growth experience of the Basque country.[6] They then look at stock market returns of firms who operated in the Basque region when the terrorist organization announced a truce and

[5] See, e.g., Akresh and De Walque (2009), Blattman and Annan (2010), Dupas and Robinson (2010), Leon (2010) and Miguel and Roland (2010).

[6] Using a different methodology, Besley and Mueller (2010) infer the peace dividend in Northern Ireland from cross-sectional and temporal variation in housing prices.

find that the announcement of the cease-fire led to excess returns for firms operating in the Basque region. Guidolin and La Ferrara (2007) conduct an event study of the sudden end of the civil conflict in Angola, which was marked by the death of the rebel movement leader in 2002. They find that the stock market perceived this event as "bad news" for the diamond companies holding concessions there. The main difference between these papers and ours is that this study provides evidence on the effect of conflict on firms using firm-level export and survey records, rather than stock-market data. In contrast to stock market reactions, in which the channels through which the violence affects the firms remain black-boxed, our data allow us to unpack the various channels through which the violence has affected firms' operations. Furthermore, combining the reduced form estimates with survey evidence, we are able to back out lower bounds to the profits and welfare losses caused by the violence. Dube and Vargas (2007) provide micro-evidence on the relationship between export and civil violence in Colombia. They find that an increase in the international price of labor-intensive export commodity reduces violence while an increase in the international price of a capital-intensive export good increases violence. We do not investigate the channel through which investment and production in the flower industry might have affected the conflict; instead, we condition on locations in which flowers are already grown and study the response of producers to the violence.[7] Finally, Dercon and Romero-Gutierrez (2010) and Dupas and Robinson (2010) provide survey-based evidence of the violence that followed the Kenyan presidential elections. Dupas and Robinson (2010), in particular, find, consistently with the results in this paper, large effects of the violence on income, consumption and expenditures on a sample of sex-workers and shopkeepers in Western Kenya.

The remainder of the paper is organized as follows. Section 2 provides some background information on the Kenyan flower industry, the post-election violence and describes the data. Section 3 presents the theoretical framework. Section 4 presents the estimation strategy and empirical results. Section 5 offers some concluding remarks.

[7] Somewhat related to this research are Pshisva and Suarez (2004) who study the effect of kidnappings on firm investment in Columbia. Collier and Hoeffler (1998), Besley and Persson (2008) and Martin et al. (2008) provide examples of macro-level evidence on the relationship between trade and civil conflict.

# 2 Background and Data

## 2.1 Kenyan Flower Industry

In the last decade Kenya has become one of the leading exporters of flowers in the world overtaking traditional leaders such as Israel, Colombia and Ecuador. Exports of cut flowers are among the largest sources of foreign currency for Kenya alongside tourism and tea. The Kenyan flower industry counts around one hundred established exporters located in various clusters in the country.

Since flowers are a fragile and highly perishable commodity, growing flowers for exports is a complex business. In order to ensure the supply of high-quality flowers to distant markets, coordination along the supply chain is crucial. Flowers are hand-picked in the field, kept in cool storage rooms at constant temperature for grading, then packed, transported to the airport in refrigerated trucks, inspected and sent to overseas markets.

The industry is labor intensive and employs mostly low-educated women in rural areas. The inherent perishable nature of the flowers implies that post-harvest care is a key determinant of quality. Workers, therefore, receive significant training in harvesting, handling, grading and packing, acquiring skills that are difficult to replace in the short-run.

Because of both demand (e.g., particular dates such as Valentines' Day and Mother's Day) and supply factors (it is costly to produce flowers in Europe during winter), floriculture is a business characterized by significant seasonality.

Flowers are exported from Kenya either through the Dutch auctions located in the Netherlands, or through direct sales to wholesalers and/or specialist importers. In the first case, the firm has no control over the price and has no contractual obligations for delivery. In the latter, instead, the relationship between the exporter and the foreign buyer is governed through a (non-written) relational contract.

## 2.2 Ethnic Violence

Kenya's fourth multi-party general elections were held on the $27^{th}$ of December 2007 and involved two main candidates: Mwai Kibaki, the incumbent, a Kikuyu hailing from the Central province representing the Party of National Unity (PNU), and Raila Odinga a Luo from the Nyanza province representing the main opposition party, the Orange Democratic Movement (ODM). The support bases for the two opposing coalitions were clearly marked

along ethnic lines.[8]

Following an initial victory declaration by ODM on the $29^{th}$, the head of the Electoral Commission of Kenya declared Kibaki winning by a margin of 2% on the afternoon of the $30^{th}$. Odinga accused the government of fraud.[9] Immediately after the election results were declared, a political and humanitarian crisis erupted nationwide. Targeted ethnic violence broke out in various parts of the country where ODM supporters, especially in Nyanza, Mombasa, Nairobi and parts of the Rift Valley, targeted Kikuyus who were living outside their traditional settlement areas of the Central province. This first outburst of violence, which lasted for a few days, was followed by a second, somewhat less intense, outbreak of violence between the $25^{th}$ and the $30^{th}$ of January. This second phase of violence happened mainly in the areas of Nakuru, Naivasha and Limuru as a revenge attack on ODM supporters.[10] Sporadic ethnic violence and chaos continued until a power sharing agreement was reached on the $29^{th}$ of February. By the end of the violence some 1,200 people had died in the clashes and at least 500,000 were displaced and living in internally displaced camps (Gibson and Long (2009)). The main export sectors (tourism, tea and flowers) suffered significantly from the violence, as reported in the media.[11] Figure 1 shows that the floriculture sector was not, however, uniformly affected.

## 2.3 Data

*Firm Level Data*

Daily data on exports of flowers from customs records are available for the period from September 2004 to June 2010. We restrict our sample to established exporters that export throughout most of the season, excluding traders. This leaves us with 104 producers. The firms in our sample cover more than ninety percent of all exports of flowers from Kenya.

To complement the customs records, we designed and conducted a survey of the

[8] Kibaki's support base was primarily in the Central Province, parts of the Eastern province and parts of Nairobi. Raila Odinga had a strong support base in the Nyanza and Western provinces, Nairobi, North-Eastern province and the Coast.

[9] According to international electoral observers from the EU as well as the US (the International Republican Institute for instance), the elections were flawed with severe discrepancies between the parliamentary and presidential votes. For further details, see http://www.iri.org/africa/kenya or http://www.senate.gov/~foreign/testimony/2008/MozerskyTestimony080207a.pdf

[10] Detailed accounts can be found in Kenya National Commission on Human Rights (2008), Independent Review Commission (2008) and Catholic Justice and Peace Commission (2008).

[11] See, e.g., *The International Herald Tribune* (29/01/2008), *Reuters* (30/01/2008), *China Daily* (13/02/2008), *MSNBC* (12/02/2008), *The Economist* (07/02/2008, 04/09/2008), *The Business Daily* (21/08/2008), *The East African Standard* (14/02/2008).

industry. The survey was conducted in the summer following the violence through face-to-face interviews by the authors with the most senior person at the firm, which on most occasions was the owner. A representative sample of 74 firms, i.e., about three quarters of the sample, located in all the producing regions of the country, was surveyed. Further administrative information on location and ownership characteristics was collected for the entire sample of firms (see Table [1]).

*Location and Days of Violence*

Table A1 in the Appendix reports the various towns in which flower firms are located (see also Figure A1). We then classify whether firms are located in areas that were affected by the conflict or not. The classification of whether a particular location suffered conflict or not is not controversial. The primary source of information used to classify whether a location suffered conflict or not is the Kenya Red Cross Society's (KRCS 2008) *Information Bulletin on the Electoral Violence*. These bulletins contain daily information on which areas suffered violence and what form the violence took (deaths, riots, burning of property, etc.). This information is supplemented by various sources, as further described in the Data Appendix. Table A2 in the Appendix outlines the calendar of events which we use as a basis for defining the days of violence occurrence. The first spike took place from the $29^{th}$ December to $4^{rd}$ January while the second spike took place from $25^{th}$ to $30^{th}$ of January. Results are robust to different choices.

# 3 Theoretical Framework

This section presents a theoretical framework to understand how firms were affected by, and reacted to, the violence. Apart from delivering predictions which are tested in the next section, the model can be calibrated combining the reduced form estimates of the effects of the violence on production with survey data to uncover the effects of the violence on firms' profits and workers' welfare.

## 3.1 Set Up

Consider a firm with the following production function

$$q = \theta N^{\beta} \left[ \int_{i \in N} l_i^{\frac{1}{\alpha}} di \right]^{\alpha}, \tag{1}$$

where, with some abuse of notation, $N$ is the set as well as the measure of hired workers, i.e., $i \in N$; $l_i$ is the hours worked by each worker $i$; and $\theta$ is a firm specific parameter. The production function allows for productivity gains due to specialization through the term $N^{\beta} > 0$. Worker $i's$ utility function is given by $u(\cdot) = c_i - \frac{l_i^{1+\gamma}}{1+\gamma}$, where $c_i$ denotes her income and $\gamma > 0$. Each worker has a reservation utility $\overline{u}$. The firm sells the flowers in a competitive market taking as given price $p$. The firm also incurs other fixed costs $K$.

In practice, firms in the flower industry hire and train workers at the beginning of the season, i.e., September to October. Since we are interested in studying a short episode of ethnic violence which happened in the middle of the season, we take the pool of hired and trained workers $N$ as given and focus for now on the firm's choice of hours worked $l_i$, which can be adjusted throughout the season.[12] When studying the firm's reaction to the ethnic violence, we will allow the firm to partially adjust the labor force as well.

Taking into account prices, fixed and variable costs, the profits of the firm can be written as

$$\Pi(\theta) = p\theta N^{\beta} \left[ \int_{i \in N} l_i^{\frac{1}{\alpha}} di \right]^{\alpha} - \int_{i \in N} w_i l_i di - K. \tag{2}$$

The firm offers a contract to each worker which specifies the amount of hours to be worked, $l_i$, and a wage per hour, $w_i$. There is a large pool of identical workers from which the firm can hire and, therefore, each contract offered by the firm satisfies the worker's participation constraint with equality. Since a worker's income is equal to $c_i = w_i l_i$, the binding participation constraint implies $w_i l_i = \frac{l_i^{1+\gamma}}{1+\gamma} + \overline{u}$. It is easy to check that the profit function of the firm is concave and symmetric in $l_i$ and, therefore, the optimal solution entails $l_i = l_j$, $\forall i, j \in N$. For convenience, we set $\overline{u} = 0$ and denote $\eta = \beta + \alpha$, with $\eta \in (\frac{1}{1+\gamma}, 1]$. The profit function can then be rewritten as

$$\Pi(\theta) = p\theta N^{\eta} l - N \frac{l^{1+\gamma}}{1+\gamma} - K. \tag{3}$$

The firm chooses the optimal $l$ taking as given $N$, $\theta$ and $p$. The following Lemma characterizes a firm production, wages and profits in normal times.

**Lemma**

*Denote by* $R^* = \left(p\theta N^{\eta-1}\right)^{1+\frac{1}{\gamma}}$ *the revenues per worker in normal times. Then, a worker's income is* $c^* = \frac{1}{\gamma+1} R^*$, *total production is* $q^* = \frac{R^*}{p} N$, *profits are* $\Pi^* = \frac{\gamma}{\gamma+1} R^* N - K$

[12] It is straightforward to relax this assumption, and show that the optimal $N$ is an increasing function of $\theta$. Considering this would not alter the predictions obtained below.

*and hours worked are* $l^* = (R^*)^{\frac{1}{1+\gamma}}$ .

## 3.2 Ethnic Violence: Workers' Absence

The main channels through which firms were differentially affected across regions by the violence have been i) the absence of workers, and ii) transportation problems. This section considers the first channel, and relegates to the appendix an extension of the model that deals with transportation problems.

In line with interviews conducted in the field, we assume that the shock was completely unanticipated by firms. Since violence was not targetted towards firms but rather individuals in the general population, we model the violence as an exogenous shock to the reservation utility of workers. In particular, assume that worker $i$ faces a cost $v_i \geq 0$ of coming to work during the period of violence. The costs $v_i$ are independently drawn from a distribution with continuous and differentiable cumulative function $F(v, \mathbf{C})$, where $\mathbf{C}$ parameterizes the intensity of the violence at the firm's location. The cost $v_i$ captures, in a parsimonious way, various reasons why many workers found it harder to go to work, e.g., i) psychological and expected physical costs due to the fear of violence during the commuting and/or on the farm, ii) the opportunity cost of leaving family and properties unguarded while at work, and iii) the opportunity cost of fleeing to the region of origin for security reasons or to be closer to family members that were experiencing violence.

Given cost $v_i$, a worker offered a wage $w_i^c$ to work for $l_i^c$ hours comes to work if

$$w_i^c l_i^c - \frac{(l_i^c)^{1+\gamma}}{1+\gamma} \geq v_i, \tag{4}$$

where the notation makes explicit that the firm re-optimizes the wage policy at the time of the violence and might choose to compensate workers for the extra costs incurred to come to work.

In adjusting the labor force to the new circumstances, the firm keeps the "cheapest" workers, i.e., an interval of workers that have low realizations of the shock $v_i$. Furthermore, due to the symmetry of the production function, it is optimal for all workers kept at the farm to work $l^c$ hours. The optimal policy for the firm, therefore, consists of choosing i) the threshold $v^c$ such that workers with $v_i \leq v^c$ come to the farm, and ii) the hours worked by each worker, $l^c$. For simplicity, we maintain the assumption that the firm can offer different

wage contracts $w_i^c$ to each worker $i$.[13] The problem of the firm can then be rewritten as

$$\max_{v,l} \Pi^c = p\theta \left(N \times F(v, \mathbf{C})\right)^{\eta} l - \left(N \times F(v, \mathbf{C})\right) \frac{l^{1+\gamma}}{1+\gamma} - N \int_0^v s dF(s, \mathbf{C}) - K. \tag{5}$$

Assuming an interior solution in which the share of workers that come to work during the violence is $\sigma_c = F(v^c, \mathbf{C}) < 1$, the first order conditions imply

$$l^c = l^* \sigma_c^{\frac{\eta-1}{\gamma}} > l^* \text{ and } v^c = \eta \left(R^*\right)^{\frac{\gamma}{1+\gamma}} \left(\sigma_c\right)^{\eta-1} l^c - \frac{\left(l^c\right)^{1+\gamma}}{1+\gamma}. \tag{6}$$

The two first order conditions deliver several implications.[14] First, the reduced form effect of the violence on production, $\Delta^c = \ln\left(\frac{q^c}{q^*}\right)$, is given by

$$\Delta^c = \underbrace{\eta \ln \sigma_c}_{\text{retained workers}} + \underbrace{\ln\left(\frac{l^c}{l^*}\right)}_{\text{extra hours worked}} = \frac{\eta(1+\gamma)-1}{\gamma} \ln\left(\sigma_c\right). \tag{7}$$

The effect of the violence on production, therefore, can be decomposed into two effects: the negative effect coming from worker losses, $\eta \ln \sigma_c < 0$, is partially offset by a positive effect on the hours worked, $\ln\left(\frac{l^c}{l^*}\right) > 0$. This also clarifies that, since the share of workers coming to work during the violence is endogenously chosen by the firm, the relationship between $\Delta^c$ and $\sigma_c$ gives a biased estimate of $\eta$, i.e., $\frac{\eta(1+\gamma)-1}{\gamma} < \eta$.

Second, denoting by $\mu = \frac{\eta(1+\gamma)-1}{1+\gamma}$ and substituting $\Delta^c$ and $l^c$ in the first order condition for $v^c$, we obtain, after some manipulation,

$$v^c = \mu R^* \times \sigma_c^{-\frac{(1-\eta)(1+\gamma)}{\gamma}} = \mu R^* \times e^{-\frac{1-\eta}{\mu}\Delta^c}. \tag{8}$$

The estimated effect of the violence on production, $\Delta^c$, therefore, can be combined with information on revenues per worker during normal times, $R^*$, to recover the extra cost

[13] None of the qualitative results are affected by allowing the firm to offer worker-specific wages $w_i^c$. In practice, firms arranged transportation and accommodation for the workers that had problems coming to the farm. Some part of the costs, therefore, have been worker-specific. If, however, firms had to pay a common wage, inframarginal workers would have actually benefited from the violence in the form of higher working hours and wages.

[14] We assume that the second order condition is satisfied, i.e., $\frac{\partial^2 \Pi^c}{\partial l^2} < 0$, $\frac{\partial^2 \Pi^c}{\partial v^2} < 0$ and $\frac{\partial^2 \Pi^c}{\partial l^2} \cdot \frac{\partial^2 \Pi^c}{\partial v^2} - \left(\frac{\partial^2 \Pi^c}{\partial l \partial v}\right)^2 > 0$. While it is easy to check that $\frac{\partial^2 \Pi^c}{\partial l^2} < 0$ holds, it is significantly harder to establish whether the two other conditions also hold. It is possible to show, however, that the conditions hold in a number of cases, e.g., when $F(\cdot)$ is either uniform or exponential for reasonable parameterizations of the production function.

incurred by the marginal worker coming to work during the time of the violence, $v^c$. This expression forms the basis of the calibration exercise at the end of the next Section.[15]

## 3.3 Heterogeneity in the Reduced Form Effects

This section discusses two comparative statics results that suggest heterogenous reduced form effects of the violence on production depending on firm's size and marketing channel. In interpreting the empirical results, however, it is important to bear in mind that unobservable characteristics might drive both a firm's size and/or choice of marketing channel, as well as a firm's exposure and reaction to the violence. While evidence on heterogeneous effects, therefore, does not identify a causal effect of a particular firm's characteristic on production at the time of the violence, these predictions provide a further avenue for testing the model.

*Size Effects*

The model implies that the reduced form effect of the violence on production, $\Delta_c$, is heterogenous across firms. Consider first a proxy for the size of the firm, given by the quantity produced in normal time, $q^*$. The equation (8) can be rewritten as

$$v^c \times F(v^c, \mathbf{C})^{\frac{(1-\eta)(1+\gamma)}{\gamma}} = \frac{\mu p q^*}{N}. \tag{9}$$

Straightforward implicit differentiation of equation (9) gives $\frac{\partial v^c}{\partial q^*} > 0$ and, by equation (7), $\frac{\partial \Delta^c}{\partial q^*} > 0$.[16]

*Marketing Channels*

Some firms in the industry export flowers through direct relationships with foreign buyers. In these relationships the firm receives a unit price $p_d$ which is agreed upon at the beginning of the season for delivering a pre-specified quantity $q^*$. Firms suffer a penalty for failing to deliver the agreed quantity.[17]

[15] In order to recover $v^c$, knowledge of the parameters $\gamma$ and $\eta$ is required. Note, however, that the share of the wage bill in revenues, which can be obtained from the survey, is equal to $\frac{1}{1+\gamma}$, and that, for a given $\gamma$, an estimate of $\eta$ can be recovered from the relationship between the effects of the violence on production, $\Delta^c$, and the share of workers coming at the firm, $\sigma_c$, as suggested by equation (7).

[16] While implicit differentiation of equation (9) implies $\frac{\partial \Delta^c}{\partial N} < 0$, if $N$ was endogenously chosen by the firm, the model would predict a positive correlation between $\Delta^c$ and $N$. Since export data are available for all firms in the sample while labor force is available only for surveyed firms, it is convenient to measure size in terms of export volumes and avoid the unnecessary complication of endogenizing $N$ in the model.

[17] These relationships are typically not governed by written contracts. The penalty that the firm suffers when not delivering the agreed quantity $q^*$ comes in the form of a loss in reputation.

For simplicity, assume that if the firm delivers a quantity $q < q^*$ to the buyer, the firm incurs a penalty $\Omega(q^* - q) > 0$. The penalty is zero otherwise. We are not interested in explicitly deriving the optimal shape of the penalty schedule, which will be negotiated by the two parties to achieve various objectives, e.g., to share risk and provide incentives.[18] We note, however, that the firm can always sell flowers to the spot market at a price $p$. Therefore, a *necessary* condition on the shape of the penalty function $\Omega(\cdot)$ to induce the firm to ship flowers to the buyer is

$$p_d - \frac{\partial \Omega}{\partial q} \geq p, \tag{10}$$

if $q \leq q^*$.[19] Inspection of equation (9) when $p$ is replaced by $p_d - \frac{\partial \Omega}{\partial q}$ shows that, in responding to the violence, a firm engaged in a contract with a direct buyer has stronger incentives to retain workers and produce a higher quantity relative to a firm which takes prices as given on the spot market.

## 3.4 Summary of Predictions

The framework delivers a set of testable predictions on the short-run effects of the violence on the firms. To summarize, the model suggests:

1. Export volumes decrease due to the violence. In the Appendix we also show that i) the likelihood of exporting on any given day also decreases because of the violence, but ii) export volumes conditional on exporting, however, might either increase or decrease as a consequence of the violence depending on the relative importance of workers losses versus transportation problems.

2. The "reduced form" effect of the violence on production is greater for smaller firms and firms selling mainly to the auctions.

3. For the predictions in 2), the mechanism works through workers' losses. Smaller firms and firms selling mainly to the auctions, therefore, lose a higher proportion of their workers. Furthermore, if workers' losses are directly controlled for, those firms *do not* suffer larger reductions in exports.

[18] In the simplified environment of our model, the optimal penalty inflicts a very large punishment as soon as the quantity deviates from $q^*$. This type of penalty is unlikely to be feasible and optimal in practice.

[19] Note that $\frac{\partial \Omega}{\partial q} < 0$ allows for $p_d < p$. If this condition was violated at $q^*$, the firm would prefer to reduce the shipment to the buyer and obtain higher prices on the spot market.

# 4 Evidence

This section presents the empirical results. Section 4.1 discusses the identification strategy, presents the reduced form effects of the violence on production, and discusses a variety of robustness checks. Section 4.2 presents reduced form evidence of the effects of the violence on other outcomes as well as evidence of heterogenous effects, as predicted by the model (point 2) above and Section 7 (Appendix). Section 4.3 introduces information from the survey to disentangle the main channel through which the violence affected the industry. It also reports further results that confirm the predictions of the model (point 3) above. Finally, section 4.4 reports results from the calibration exercise and offers some remarks on the long-run effects of the violence.

## 4.1 Reduced Form Estimate of the Effect of Violence on Exports

In this Section we quantify the effects of the violence on firms' exports. The location and timing of the violence was driven by the interaction between political events at the national and local level and regional ethnic composition (see Gibson and Long (2009)). Therefore, the occurence of violence in any location was not related to the presence of flower firms. In fact, intense violence was registered in many locations outside of our sample, i.e., in places without flower firms (e.g., certain slums in Nairobi and other major towns). To assess the effect of the violence on the industry we condition on flower firms location and exploit the cross-sectional and temporal variation in the occurence of violence between "conflict" and "no-conflict" regions.[20]

Table [1] reports summary statistics for the industry in the two regions. Panel A reports data from the administrative records while Panel B focuses on information obtained through the survey. Both Panels show that firms in the regions affected by the violence are similar to firms in regions not affected by the violence. It is important to stress that our identification strategy *does not* rely on the two groups of firms being similar along time-invariant characteristics, since these are always controlled for by firm fixed effects. Finally,

[20] In some locations flower farms are relatively large employers. To eliminate concerns that a firm's response and behavior at the time of the crisis affected the intensity and/or duration of violence in its location, we take a reduced form approach. We classify locations as having suffered violence or not during a pre-specified time spell which is kept constant across locations involved during the same spike (see Tables A1 and A2 for details). In other words, we do not exploit the fact that violence in Nakuru started a day before than in Naivasha during the second spike, or the fact that the violence lasted fewer days in Limuru. Apart from endogeneity concerns, this variation is also difficult to document in a consistent way.

Panel C shows that the sample of surveyed firms is representative of the entire industry. To focus on the effects of the violence, however, firms in the conflict region were over-sampled in the survey.

Table [2] presents estimates of the short-run impact of the violence. In order to estimate the impact of the violence on production, it is necessary to control for both seasonal and growth patterns in the industry. Let $Y(i)^C_{T,S}$ be the exports of flowers by firm $i$ located in region $C$, in period $T$ of season $S$. The indicator $C$ takes values $C \in \{0,1\}$ depending if the firm location is affected by the violence ($C=1$) or not ($C=0$). The indicator $T$ takes values $T \in \{0,1\}$ depending on whether the figure refers to the time of the season during which the violence happened ($T=1$) or during a control period which we set as being the ten weeks preceding Christmas ($T=0$). Finally, the indicator $S$ takes value equal to $S=1$ in the season during which the violence occurred and $S=0$ in the previous season. With this notation, a firm was directly affected during a particular spike of violence if and only if $V = C \times T \times S = 1$.

Panel A focuses on the first spike of violence, while Panel B focuses on the second spike. The two panels, therefore, differ in their definition of the violence period $T=1$ (but not of the control period $T=0$). The two panels also differ in the division of firms across locations classified as being affected by the violence, i.e., $C$. In Panel A there are 19 firms affected by the violence, while in Panel B 54 firms are located in regions affected by the second spike of violence. In both panels the sample includes 104 firms.

Under the assumption that the pattern of growth in exports within a season is constant across seasons, it is possible to estimate the effects of the violence on production for each firm $i$ by looking at the following difference-in-difference

$$\widehat{\gamma}^C(i) = \underbrace{(Y^C_{T=1,S=1} - Y^C_{T=1,S=0})}_{\Delta^C_{T=1}(i)} - \underbrace{(Y^C_{T=0,S=1} - Y^C_{T=0,S=0})}_{\Delta^C_{T=0}(i)}. \tag{11}$$

The first difference, $\Delta^C_{T=1}(i)$, compares exports during the time of the violence with exports at the same time in the season in the previous year. This simple difference, however, confounds the effects of the violence with a firm's growth rate across the two seasons. The second difference, $\Delta^C_{T=0}(i)$, provides an estimate of the firm's growth rate comparing the control periods in the two seasons. Under the assumption that growth patterns are constant throughout the season, the difference-in-difference $\widehat{\gamma}^C(i)$ provides an estimate of the effects

of the violence which controls for a firm's growth rate.[21]

Clearly, the same estimate $\widehat{\gamma}^C(i)$ can be rewritten as

$$\widehat{\gamma}^C(i) = \underbrace{(Y^C_{T=1,S=1} - Y^C_{T=0,S=1})}_{\Delta^C_{S=1}(i)} - \underbrace{(Y^C_{T=1,S=0} - Y^C_{T=0,S=0})}_{\Delta^C_{S=0}(i)}. \tag{12}$$

The first difference $\Delta^C_{S=1}(i)$, however, confounds the effects of the violence with seasonal fluctuations. Under the same assumption discussed above, the difference $\Delta^C_{S=0}(i)$ controls for seasonal variation using the firm's seasonal pattern in the previous season as a control. In sum, the difference-in-difference $\widehat{\gamma}^C(i)$ provides a reduced form estimate of the effects of the violence which controls for both growth and seasonal variation at the firm level.

The bottom rows in Panel A and Panel B of Table [2] report the average $\widehat{\gamma}(i)$ across firms in regions affected and unaffected by the violence for the two spikes of violence. The results in Panel A show that the violence had a dramatic impact on the 19 firms that were directly affected by the first spike of violence. Panel B shows that the larger group of 54 firms that were directly affected by the second spike of violence also suffered a reduction in exports, although the magnitude is smaller. In particular, we find that during the second spike of violence firms suffered a reduction of 30% in their exports of flowers.[22]

The two Panels highlight further differences between the two spikes of violence. Rows 3a and 3b in the two panels report the simple differences $\Delta^C_{T=1}(i)$ and $\Delta^C_{S=1}(i)$. Row 3a in Panel A suggests that the first spike of violence also affected firms that are not located in regions directly involved in violence. The difference $\Delta^{C=0}_{S=1}$ reveals a significant difference within the no-conflict region during the period of violence compared to the days before the violence. This possibly suggests a country-wide effect of the violence which made it difficult for firms to export, e.g., bottlenecks on the road network and airport traffic reductions, as also discussed in Glauser (2008). Panel B, in contrast does not find evidence of large negative indirect effects of the second spike of the violence on firms located in towns not directly involved in the violence.

*Spillovers Across Regions*

Under the assumption that any changes in the seasonality across seasons is the same for the Conflict and No-Conflict areas, firms in regions not directly affected by the violence

[21] Appendix Table A3 uses data from the two seasons preceding the violence and shows that seasonality patterns are constant across seasons.

[22] Because of the larger sample of firms directly affected during the second spike, these are the estimates that were used in Section 4.4 to calibrate the model.

could also be used as a control group to estimate the direct effects of the violence.[23] Defining by $\overline{\Delta}^{C} = \frac{1}{N_C}\Sigma_{i \in C}\widehat{\gamma}^{C}(i)$ the average of the difference-in-difference estimates for each firm in region $C$, a triple difference estimate of the direct impact of the violence is given by

$$\Delta = \overline{\Delta}^{C=1} - \overline{\Delta}^{C=0}. \tag{13}$$

The triple difference estimates are presented in Column (C) of Row 4 in each of the two panels. This estimate, however, needs to be interpreted with caution since it could be contaminated by spillover effects. In particular, Panel B of Table [2] shows that firms not located in towns affected by the second spike of violence increase their exports volumes relative to the previous years. While this could also be due to changes in seasonality patterns, the evidence is also consistent with firms not directly affected by the violence picking-up some of the export losses of firms directly affected.

*Conditional Regressions*

Panel A in Table [3] performs a similar exercise using daily export data. The estimated regression is given by

$$y^{C,d\times w}_{T=1,S=1}(i) = \alpha_i + \mu^{w}_{C} + \eta^{d}_{C} + \lambda^{S}_{C} + \theta \mathbf{I}_{S=1} \times \mathbf{I}_{T=1} + \gamma_{DDD}\left(\mathbf{I}_{S=1} \times \mathbf{I}_{T=1} \times \mathbf{I}_{C=1}\right) + \varepsilon^{C,d\times w}_{T,S}(i) \tag{14}$$

where $y^{C,d\times w}_{T=1,S=1}(i)$ denotes exports of firm $i$, in day $d \times w$, with $d$ indexing the day of the year (e.g., January $20^{th}$), and $w$ the day of the week (i.e., Monday, Tuesday...). Region $C \in \{0,1\}$ and period $T \in \{0,1\}$ are defined as above while season $S \in \{-2,-1,0,1\}$ is defined over all available years, i.e. three season pre-dating the conflict and the conflict season. The specifications, control for firm-specific effects $\alpha_i$, day of the year $\times$ region-specific effects $\eta^{d}_{C}$, season $\times$ region-specific effects $\lambda^{s}_{c}$, and day of the week $\times$ region-specific effect $\mu^{w}_{C}$. Finally, $\varepsilon^{C,d\times w}_{T,S}(i)$ is an error term.[24]

The indicator functions $\mathbf{I}_{S=1}$, $\mathbf{I}_{T=1}$ and $\mathbf{I}_{C=1}$ take values equal to one in, respectively,

[23] Appendix Table A3 uses data from the two seasons preceding the violence and shows that seasonality patterns are also very similar across regions.

[24] From the point of view of statistical inference, there are two main concerns. First, production and, therefore shipments of flowers of a given firm are likely to be serially correlated within each firm, even conditional on the fixed effect. If shipment to a particular buyer has occurred today, it is less likely that another shipment to the same buyer will occur tomorrow. Second, across firms, error terms are likely to be correlated because firms are geographically clustered and, therefore, shocks to, e.g., roads and transport, are correlated across neighboring firms. Throughout the analysis, therefore, standard errors are clustered both at the *firm* and the *season-week-location* level. This non-nested clustering is performed with the codes developed by Cameron et al. (2009).

the season, period and region in which the violence took place, and zero otherwise. Let us define being affected by violence as $V_{STC} = \mathbf{I}_{S=1} \times \mathbf{I}_{T=1} \times \mathbf{I}_{C=1}$, and let $V_{ST} = \mathbf{I}_{S=1} \times \mathbf{I}_{T=1}$.[25] The coefficient of interest is $\widehat{\gamma}_{DDD}$, which provides an estimate of whether, relative to the previous seasons and to the average control period, exports of firms in the conflict areas behaved differently from exports in the no-conflict areas during the period of the violence. All columns in Table [3] report triple difference estimates, with progressively less restrictive assumptions.

Column (1) reports the triple difference estimate allowing for different intercepts for the day of the year, the particular day of the week and season. Column (2) builds on the previous specification controlling for firm fixed effects. Column (3) allows for different season fixed effects in the conflict and no-conflict area. As mentioned above, the floriculture trade is seasonal and the seasonality could be different across locations. Column (4) allows flexibility in the seasonal patterns across regions by defining seasonality at the date level.

Column (4) is the baseline specification which replicates the triple differences in Table [2] once seasonality and growth have been taken into account. The coefficient of interest $\widehat{\gamma}_{DDD}$ for both the first and second outbursts of violence are very similar in magnitude to those estimated in Table [2]. The results in Column (4) are graphically illustrated by Figure [1]. The Figure plots the median residuals of the corresponding baseline regression for firms in the conflict and in the no-conflict regions, when the violence terms $V_{ST}$ and $V_{STC}$ are not included in the specification.

Finally, Columns (5) and (6) allow for firm-specific growth rates as well as firm-specific growth rates and seasonality patterns respectively and show that the estimates of the impact of the violence are very robust to allowing flexible growth and seasonality patterns across firms. Due to the large number of fixed effects being estimated the statistical significance is somewhat reduced in Column (6).

As noted above, using the no-conflict region as a control group could lead to estimates contaminated by spillover effects. Panel B of Table [3], therefore, repeats the same specifications as in Panel A focusing exclusively on the firms located in the conflict regions. The resulting estimates are very similar to those in Panel A, suggesting that spillovers were of relatively small magnitude.

The violence dummies are defined for the short (i.e., five-to-six-day) periods that correspond to the two spikes of violence. For a variety of reasons, however, it is interesting to consider a longer definition of the violence period. First, sporadic violence occurred

[25] Note that the simple interactions $\mathbf{I}_{T=1} \times \mathbf{I}_{C=1}$ and $\mathbf{I}_{S=1} \times \mathbf{I}_{C=1}$ are absorbed by $\eta_C^d$ and $\lambda_C^S$ respectively.

throughout the month of February. While not directly affecting firms' operation, the violence could have created an uncertain climate that had indirect effects on the industry. Second, (though none of our respondents mentioned this) firms might have tried to store flowers or intensify production in the days immediately following the violence in hope of recovering the losses. Finally, it is interesting to see whether the violence had medium-run effects on the firms (e.g., because of damage to a firm's assets, such as plants, due to workers' absence). Figure [2] reports the cumulative and the medium run-effects of the violence throughout the month of February. While the cumulative effect remains negative and shows that firms never recovered the losses in production incurred during the time of the violence, the Figure also shows that in about one week to ten days after the end of the second spike, firms were not suffering any significant medium-run effects of the violence. The relatively short delay in recovery is consistent with workers returning to their jobs shortly after the violence ended or firms substituting workers.

## 4.2 Effects on Other Outcomes and Heterogeneity

*Reduced Form Effects of the Violence on Other Outcomes*

Table [4] presents results for other outcomes. Column (1) presents the estimate for daily export data and our baseline specification again as in Column (4) of Table [3]. The negative effects on export volumes in a given day can be decomposed into two effects: a decrease in the likelihood of exporting, i.e., the extensive margin, (Column (2)) and a decrease in the export volumes conditional on exporting, i.e., the intensive margins (Column (3)).

Results indicate that the first outbreak of violence had a significant and negative impact on a firm's ability to export. The second episode of violence did not reduce a firm's ability to export. During both episodes, the export volumes conditional on exporting decreased as a consequence of the violence. The model extension presented in the Appendix has ambiguous predictions for the conditional export volumes, since flowers can, though not ideal, be harvested a day or two earlier or later. The evidence suggests that the main problem firms faced was harvesting flowers, not just transporting them to the airport.

Column (4) shows that the unit value in Kenyan Shillings (in logs) increased during both episodes of violence. This result, however, simply captures the substantial depreciation of the Kenyan currency during the violence. The Kenyan Shilling went from a high of 90 KShs/Euro prior to the presidential elections to an exchange rate of 100 KShs/Euro during

the first outbreak and depreciated further to 108 KShs/Euro during the second outbreak. Unreported results confirm that unit values in Euros did not change during the violence. Furthermore, these results confirm that there was no differential effect on unit values in Kenyan Shillings across regions at the time of the violence.

Column (5) documents that there was no effect of the violence on unit weight either. In the case of roses, which represent the vast majority of flowers exported from Kenya, a key determinant of a flower's value is its size which is, in turn, determined by the altitude at which the firm is located. Firms are, therefore, relatively specialized in the size of flowers grown and the evidence confirms that the violence did not affect the composition of exports.

*Reduced Form Effects of the Violence: Heterogeneity Results*

The model delivers testable predictions for heterogeneity in the effects of ethnic violence with respect to a firm's size and marketing channel. Since it is possible that these observable firm characteristics correlate with other unobservable characteristics which drive a firm's exposure and reaction to the violence, the results should not be interpreted as causal effects of firm size or marketing channel on exports during times of violence, but rather as further corroborations of the model.

While firms in the conflict and no-conflict regions appear to be broadly comparable along observable characteristics (see Table [1]) the same is not true across locations within the conflict and no-conflict regions. If locations also differ in the intensity of the violence to which firms have been exposed, it is important to control for location effects when considering heterogeneity.[26]

Table [5] reports the heterogeneity results where we include conflict period $\times$ location fixed effects to control for location effects. The focus is on the second period of violence (as in Panel B of Table [2]) since the small number of firms affected during the first period of violence (19) precludes the estimation of heterogeneous effects. We present results for the interactions of conflict with firm size, marketing channel, membership in the floriculture business association, composition of exports, fair trade certification, whether the firm is politically connected and whether it has a foreign owner. The specification includes all necessary interactions to saturate the equation, i.e., interactions between location, period and season as well as firm fixed effects.

[26] Unreported results show that the effects of the violence appear to have been most pronounced in the locations around Eldoret and Nakuru, i.e., where the violence originally started. Within Naivasha, moreover, the effects of the violence were heterogenous depending on the location of the firm around the lake and relative to the main road.

The evidence supports the predictions of the model with respect to firm size and marketing channels: on average, within locations, smaller firms and firms exporting through the auctions suffered a greater reduction in export volumes during the violence. The last column in the Table shows that these correlations are robust to controlling for several other firm's characteristics. In particular, the results show that members of the Kenya Flower Council, the main industry association, suffered lower reduction in exports during the violence possibly due to coordination in security and transportation. Interestingly, once these firm characteristics are controlled for, there is no evidence that ownership characteristics and fair trade certifications correlate with differential losses in export volumes.

## 4.3 Worker Loss and Transportation Problems

Given the absence of violence targeted towards flower firms or occuring on their premises, the main channels through which the violence affected firms in the conflict region relative to firms in the no-conflict region was through (i) absence of workers and (ii) transportation logistics. Using data from the firm level survey we conducted in Kenya, this section disentangles the relative importance of the two channels.[27]

Before turning to the evidence on production, Table [6] shows that survey responses about the violence are very strongly correlated with the definition of the conflict region that we have used in the reduced form specifications above. In particular, we find that firms located in the conflict regions are significantly more likely to report that i) their operations have been directly affected by the violence, ii) there were days in which members of staff did not come to work because of the violence, iii) the firm experienced a higher proportion of workers absent due to the violence, iv) worker absence caused significant losses in production, v) the firm experienced transportation problems in shipping flowers to the airport and, finally, vi) the firm hired extra security personnel during the violence period.

To disentangle the relative importance of workers' absence and transportation problems in explaining export losses, we use time varying measures collected through the survey. In the interviews we asked, on a week-by-week basis for the period covering January and February 2008, i) how many workers were missing, and ii) whether the firm suffered transportation problems.

[27] As with any retrospective study, information collected about the violence might be contaminated by measurement error (e.g., due to recall bias) and therefore results should be interpreted with caution.

Table [7] reports the results.[28] Column (1) simply recovers an average reduced form effect of the violence at the week level. The estimated coefficient is similar to the estimates obtained in previous specifications. Column (2) and (3) show that the time-varying self-reported measures of workers' losses and transportation problems correlate with lower exports. Column (4) considers the three variables together. It finds that only the percentage of workers absent correlates with the drop in exports. In particular, the conflict dummy is now much smaller while the transportation dummy is halved and statistically insignificant. The results, therefore, suggest that the violence affected production almost exclusively through workers absence, rather than through other channels, including transportation problems. This is consistent with the findings in Table [4] as well as with the interviews on the ground.

Finally, Columns (5) and (6) further corroborate the insights of the model. The model predicts that, in contrast to the reduced form effects in Table [5], once workers' absence is directly controlled for, firm's size and marketing channels do not correlate with export losses, since the effect of those characteristics works precisely through workers' retention. As predicted by the model, the two Columns show that once workers' losses are controlled for, the size and marketing channels of the firm do not correlate with export losses.

In sum, the evidence reported in Table [7] suggests that workers' losses were the main channel through which the violence affected a firm's capacity to produce and export. As clarified by the model, the equilibrium degree of workers' absence was endogenously chosen by the firm taking into account the returns to keep production running and the costs of maintaining workers at the farm. Table [8], therefore, reports correlations between firms observable characteristics and the percentage of workers that were absent during the violence period.

Consistent with the predictions of the model, Table [8] finds a correlation between the size and marketing channels of the firm and the percentage of workers absent during the violence. In particular, among firms located in the regions affected by the violence, we find that firms exporting through the auctions and smaller firms report a higher fraction of workers missing during the violence period. These correlations are robust to the inclusion of a large number of controls, including i) location dummies to account for the intensity of the violence, ii) dummies for housing, social programs and fair-trade-related certifications,

[28] Note that, in contrast to the earlier specifications, the unit of observation is defined at the firm-week level since the survey variables were asked week-by-week. As in the other specifications, however, we control for firm specific growth and seasonality patterns. The regressions are estimated on the sample of interviewed firms only.

iii) characteristics of the labor force, such as gender, education, ethnicity and contract type, iv) owners' identity, and v) product variety and proxies for capital invested in the firm. While the results appear robust across a range of specifications, the same caveat discussed for the results in Table [5] applies here. The correlations of interest in Table [8] should not be interpreted as the causal impact of a firm's characteristic on workers' absence.[29]

## 4.4 The Profits and Welfare Costs of the Violence: Model Calibration

*Model Calibration*

The evidence of the previous sections suggests that the relatively simple model of conflict and firms' export behaviour from Section 3 fits the data quite well, both with respect to the heterogeneity across firms and the specific mechanisms through which the conflict affected firms. In this section, we combine the reduced form estimates of the effects of the violence on production, $\Delta^c$, with information collected through the survey to calibrate the model and provide a lower bound on the short-run profit and welfare losses caused by the violence.

The goal of the calibration exercise is to recover the cost of the violence for the marginal worker going to work in any given farm, $v^c$. As clarified by equation (8) in Section 3, the cost of the violence for the marginal worker $v^c$ can be recovered combining the reduced form estimates of the effects of the violence on production, $\Delta^c$,with knowledge of the firm's revenues per worker during normal times, $R^*$, and estimates of $\eta$ and $\gamma$. Assumptions on the distribution of $v^c$ are not necessary.

Weekly revenues per worker $R^*$ in normal times are easily computed, for each firm, by dividing a firm's export revenues in normal times, available from custom records, by the number of workers employed by the firm, which is available from the survey. In particular, we use median weekly revenues during the control period that preceded the violence, as defined in Table [2]. Information on firms' workers is available for that period.

We assume that the parameters $\gamma$ and $\eta$ are identical across firms. From the expression of profits in normal times it follows that the share of wage costs in revenues is equal to

[29] Unreported results show that neither the ethnicity of the owner nor the ethnicity of the labor force correlate with reductions in exports or workers absence, when using the within-location specifications. However, most of the variation in these variables is across locations, so it is difficult to disentangle these from location effects.

$\psi = \frac{1}{1+\gamma}$. Information collected in the survey suggests $\psi \simeq 0.2$ for a typical firm, implying $\gamma \simeq 4$. Note that weekly earnings per worker in normal times are equal to $c^* = \frac{1}{\gamma+1}R^*$. With $\gamma = 4$ this gives $\widehat{c}^* \simeq 1300$ Kenyan Shillings for workers at the median firm (or 14.5 Euro at pre-conflict exchange rates). This estimate nicely matches the reality on the ground. Wages in the flower industry are set just above the minimum wage, which was (about) two hundred Kenyan shillings (slightly more than 2 Euro) per day immediately before the violence, implying weekly earning of around 1200 Kenyan Shillings. For this reason, we take $\gamma = 4$ as our preferred estimate. As a robustness check, we report results using alternative choices of $\psi$ in the range $\psi \in [0.1, 0.25]$.

Finally, once $\gamma$ is known, the parameter $\eta$ can be recovered estimating equation (7). The equation is the analogue of the specification in Table [7], with the log of the share of retained workers replacing the share of missing workers. Unreported results, show that the estimated coefficient, $\widehat{\beta} = \frac{\eta(1+\gamma)-1}{\gamma}$, is equal to 0.45, implying $\widehat{\eta} = 0.56$ when $\gamma = 4$.[30]

Finally, the reduced form effect of the violence on production $\Delta^c$ is given by the firm-level difference-in-difference as computed in Table [2], which corresponds to equation (11). Note that, since both the reduced form effect of the violence on production, $\Delta^c$ and the revenues per worker in normal times are available for each firm $R^*$ separately, the model can be calibrated for each firm. This allows us to further check the consistency of the model by comparing the (rank of the) share of retained workers reported in the survey with the corresponding estimates from the model calibration. Unreported results show a 0.73 correlation between the two figures which is statistically significant at the 1% level.

*Results on Profits*

The results are reported in Table [9]. The Table reports the main variables of interest for the median firm in the conflict region. The sample is given by the 42 firms who were surveyed in the conflict region. The different Columns in the Table report results using alternative choices of the share of wages in revenues $\psi$. The first two rows of the Table report the two main ingredients of the calibration, i.e., the reduced form effect on production, which corresponds to a 22% drop for the median firm during a week of violence, and the weekly revenues per worker, which is close to 6600 Kenyan Shillings for the median firm in the period preceding the violence. We focus the discussion on the results in Column 3, which is our preferred parametrization, as discussed above. For this parametrization, we also report

[30] A similar estimate of $\eta$ can be recovered from the cross-sectional correlation between log production and log workers. We prefer, however, to recover $\eta$ by estimating equation (7) at the time of the violence, i.e., from the response to an unanticipated shock when the original number of workers $N$ can be taken as given.

figures for the average firm.

The estimate suggests that the labor costs in Kenyan Shillings increased by 62% in the median firm. This figure includes both the wages paid for the extra hours worked at the farm for the remaining workers as well as other costs that were paid to compensate workers for the costs $v$. These costs included setting up temporary camps to host workers and/or paying for the logistic necessary to transport workers safely. Given the relatively low share of the wage bill in total costs, however, this increase only translates to an increase in costs of 13% for the median firm, and an increase of 16% on average. This figure provides a lower bound on the increase in costs since it does not include other costs paid during the violence, e.g., hiring of extra security at the farm or to escort flower convoys to the airport, as well as other inputs. The impressions gathered during the interviews, however, is that those costs were relatively low compared to the increase in the wage bill and the logistical costs of having workers come to the flower farm.

The prices received in export markets by the firms were not affected by the violence. The 22% drop in export volumes, therefore, translates into a 22% drop in export revenues in foreign currency. During the violence, however, the Kenyan Shilling depreciated by about 10%, implying that revenues in domestic currency dropped by 10% only. To gather a sense of what these figures imply for profit margins, note that a firm facing an increase in operating costs of 15% and a drop in revenues of 10% will make losses unless its normal operating profits margin is equal to 22%, quite a large number. For example, if the median firm in the sample has a profit margin of only 10% in normal times, i.e., $\pi_m = \frac{\text{Rev. - Op. Cost}}{\text{Rev.}} = 0.1$, its profit margin at the time of the violence becomes $\pi_m^C = 1 - \frac{1.15}{0.9} \times 0.9 = -0.15$. Given the estimates, therefore, the median firm in the conflict region is likely to have operated at a loss during the time of the violence.

*Results on Workers' Welfare*

The estimate suggests that the cost $v^c$ for the marginal worker of going to work during the time of violence was around 3400 Kenyan Shillings, i.e. more than two and a half times the average weekly earning at the median firm. Workers with costs $v \leq v^c$ went to work during the violence and incurred those costs. These workers, however, were compensated by the firm to go to work and, therefore, did not suffer welfare losses. Their costs, instead, are accounted for in the increase in labor costs faced by the firm at the time of the violence, as discussed above.

The estimate $v^c$, in contrast, gives a lower bound on the cost that workers who did not go to work *would have* incurred by going to work during the violence. It is useful to express

$v$ as the sum of two different sets of costs of going to work during the violence: i) the direct cost $\delta$, e.g., physical, psychological and logistical, of going to work during the violence, ii) the opportunity costs, $\sigma$, e.g., the net value of attending to one's property or family, or returning to the region of original provenance.[31] Workers that missed work during the violence, did not suffered the direct cost $\delta$. The opportunity cost $\sigma$, however, can be taken as a proxy for welfare costs imposed by the violence as it gives a measure of a worker's willingness to pay to be able to cope with the violence. Furthermore, since firms set up secure camps close to the farm for workers going to work, there was no violence at the farm, and many of the absent workers were internally displaced and/or returned to their places of origin, it seems that for the typical worker $\delta$ is a quantitatively small component of $v$ relative to $\sigma$.[32]

*Remarks on Long-Run Effects*

The exercise has focused on the short-run impact of the violence. In particular, we have provided bounds to the weekly profit losses for firms and (a proxy for) the welfare losses for workers during the spikes of violence. The violence might have had, however, long-term impacts as well which we are not capturing.

Beyond those direct losses that are independent of whether a worker went to work or not (e.g., the death of a relative), the violence imposed a temporary loss in earnings on those workers that did not go to work for several weeks. There is a large empirical literature on the persistent effects of temporary negative income shocks which work through, e.g., disinvestment in human and/or physical capital (see, e.g., Dupas and Robinson (2010) for a related discussion in the context of the Kenya violence).

For firms, Figure [2] suggests that the violence did not have medium-run effects on production. These results, however, need to be qualified. In the flower industry contracts with direct buyers are renegotiated at the end of the summer. Macchiavello and Morjaria (2010) show that, within firms, those relationships that were not prioritized by the firm during the violence are more likely to break down, and have lower increase in prices at the beginning of the following season, i.e., nine months after the violence, relative to relationships that were prioritized by the firm. Because of the possibility of selling to the auctions and

[31] The nature of the violence as it happens on the ground and the fact that the industry employs women, the benefits of directly engaging in the violence can be disregarded as a quantitatively relevant source of the opportunity cost of going to work.

[32] Note that this proxy does not include the direct loss in weekly earnings due to a worker's absence. While the loss in income does not translate in a loss in welfare in the model since we normalized the reservation utility to $\overline{u} = 0$, it plausibly had a negative impact at times in which retail prices were increasing due to the violence as documented in, e.g., Dupas and Robinson (2010).

forming new relationships, however, these effects are not very large when aggregated at the firm level. In particular, unreported results show that there are only small long-run effects of the violence on volumes and unit values of flowers exported at the firm level.[33]

# 5 Conclusions

This paper combined detailed customs records on production with a representative survey of flower firms to i) provide reduced form evidence of the effects of ethnic violence on production, ii) uncover the main channels through which the violence affected firms operations, and iii) calibrate a model to infer the short-run effects of the violence on profits and workers welfare.

We find that weekly exports volumes and revenues dropped, on average, by 38% relative to comparable firms in regions not affected during the period of the violence. Consistent with the predictions of a model, large firms and firms with stable contractual relationships in export markets registered smaller percentage losses in production. These firms also reported smaller percentages of workers missing during the time of the violence, even after controlling for several characteristics of their labor force and working arrangements at the firm. The main channel through which the violence affected production was through workers' absence, which averaged 50% at the peak of the violence, rather than transportation problems which might have been solved by firms' coordinated action through the industry association.

The model calibration suggests that firms in the affected areas suffered at least a 16% increase in operating costs, on average, due to the violence, in addition to a 30% drop in revenue. While the workers that went to work were compensated by the firms for the (opportunity) cost of doing so, for the remaining 50% of workers the opportunity costs of going to work for a week during the violence must have been at least three times the average weekly income, suggesting large welfare losses.

The absence of violence towards firms as well as on their premises, despite multi-ethnic labor forces in most cases, suggests that the jobs created by the firms might have discouraged participation in the violence. Beyond its effects on rural incomes, it seems that the export oriented nature of the industry further contributed to stabilizing the situations, due to a mix of contractual obligations with foreign buyers and pre-existing institutional

[33] The estimates suggest that several firms incurred net losses during the time of the violence. These short-run losses could translate into worse terms in accessing external finance, worsening a firm's prospect for future growth. The episode of violence under consideration, however, was probably too short to generate persistent effects through this channel.

forums to achieve coordination, i.e., a well-functioning business association. Overall, the evidence suggests a new micro-economic channel on the relationship between violence, local institutions and international trade. Exploring the relevance of this channel in other contexts is an important areas for future research.

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# Appendix

## *A. Model Extension: Transportation Problems*

We now turn to the second mechanism through which the ethnic violence has affected firms operation: transportation problems. The model is modified as follows. In order to export in any given day, firms face a fixed cost of transportation $T$.[34] Firms can, however, store flowers for some days. If a flower is stored for $d$ days, it reaches the final market in good conditions with probability $\delta^{d/2}$. Given the data in our sample, we focus on the case in which firms must ship at least once a week, i.e., after $D = 6$ days flowers are worthless.

In normal times, the firm chooses the optimal frequency of shipment, and then adjusts its labor inputs accordingly. The firms profits when harvesting flowers that are sent after $d$ days, are $\delta^d \Pi^*$, where $\Pi^*$, derived in the main text, now incorporates the transportation costs $Td$. It is easy to show the following:

**Lemma**

*During normal times, the firm ships every day of the week if* $\frac{1-\delta}{T}\Pi^* \geq 1$. *The firm ships* $n \in \{2, 3, 4\}$ *times per week if* $\frac{1}{(1+\delta)^{4-n}} \geq \frac{1-\delta}{T}\Pi^* \geq \frac{1}{(1+\delta)^{5-n}}$ *.Otherwise the firm ships once per week.*

Conditional on the number of shipments, the firm tends to equalize the amount of flowers exported in every shipments. For this reason, the firm either exports everyday of the week, or four times or less per week. In any particular day $d$, the quantity therefore exported by the firm can be decomposed as

$$q_d = \underbrace{\mathbf{I}_d}_{\text{prob. of exporting}} \times \underbrace{\Sigma_{i=0}^{D^*} \delta^i q^*}_{q \mid \text{on exports}},$$

where $\mathbf{I}_d = 1$ is an indicator of whether the firm exports in day $d$ and $D^*$ is the number of days since the previous shipment.

We model the violence as having increased $T$ for a few days. In response, firms re-adjust *i*) their export frequency, *ii*) the quantity exported. The effect of the violence on the likelihood of exporting in any given day is negative, since $\frac{1-\delta}{T}\Pi^*$ decreases. This implies that,

[34] The focus on fixed costs, as opposed to variable costs, deserves some justification. The major component of variable transportation costs for the firm are the freight charges. These were not affected by the ethnic violence and, therefore, can be absorbed in the price $p$. Fixed costs in transportation arise, instead, to send one truck to the airport.

on average, $D^c > D^*$. The quantity of flowers exported in each shipment, however, might either increase or decrease. The quantity of flowers exported in each shipment decreases if firms do not reduce their export frequency, i.e., if $D^c = D^*$. For these firms, the only effect is $q^c < q^*$. For firms for which $D^c > D^*$, however, the quantity of flowers exported in each shipment might increase, since $\Sigma_{i=0}^{D^c} \delta^i q^c \leq \Sigma_{i=0}^{D^*} \delta^i q^*$. For firms that do not suffer from workers' absence, transportation problems cause i) a decrease in the likelihood of exporting, and ii) conditional on exporting, an increase in the export volumes.

## *B. Data Description*

This appendix section provides information supplementary to section 2 on the various data sources used in this paper.

*Transaction-level Export Data of flower firms*

Transaction level data on exports of flowers are obtained from the Kenya Horticultural Development Authority. Each transaction invoice contains the following information: Name of the Kenyan exporter, the name of the foreign consignee/client, the type of produce, the weight (kgs), the units, unit value, total value, date, the destination, the currency and the agreement on freight (C&F, FOB).

*Firm level Survey*

A firm level survey was designed by the authors which covered i) general questions about the firm (history, farm certification, ownership structure, vertical integration, location of farms etc.), ii) contractual relationships in export markets and marketing channels (direct wholesaler and/or auction houses), iii) firm production (covering detailed information on labor force, input use and assets), iv) violence period (effect on operations, loss of workers by week, issues on transportation and air-freight, financial losses and extra-costs incurred). The survey was administrated and implemented by two of the authors between July and September 2008. The survey was administrated to the most senior person at the firm, which on most occasions was the owner. Upon previous appointment, face-to-face interviews of one to two hours were conducted by two of the authors with the respondent.

*Administrative level Data*

We established contacts with the Horticultural Crops Development Authority (HCDA), Kenya Flower Council (KFC) and Kenya Private Sector Alliance (KEPSA) to assist us in

obtaining the location of all firms in the sample. Further, the names of the directors of the firms are obtained from the Registrar of Companies at the Attorney General's Office. These pieces of information allow us to classify the owner's nationality (Kenyan indigenous person, Kenyan Indian or Foreign). For the firms which are under the ownership of Kenyan indigenous persons and Kenyan Indians, we map out whether the owners are politically connected or not. The data are assembled from the Member of Parliament's biographies, Employment History and Business Interests, further snowballing from interviews in the field, and various sources from the internet (e.g., The Kroll Investigative Report). Given the small number of firms, it is widely known in the industry which firms are politically connected. Information for each firm is cross-checked using at least three different sources.

*Days of Violence and Conflict location*

Location are classified as suffering conflict or not based on the Kenya Red Cross Society's (KRCS) *Information Bulletin on the Electoral Violence*. The KRCS issued the bulletins in the early stages of the crisis daily and later on they were issued every 3/4 days till the end of the crisis.[35] The first information bulletin (No. 1 of $3^{rd}$ January 2008) also contained a map which outlined locations where unrest had occurred. We further obtain access to various sources to supplement our understanding on both whether the location suffered conflict and when this took place. These are (i) *Disaster Desk* of the Data Exchange Platform for the Horn of Africa (DEPHA)[36], during the post election violence DEPHA provided maps with hot spots on where and when the violence had occurred,[37](Accessed on 23 September 2008). Similar information is also available from http://www.reliefweb.int which is also under the UN's OCHA. (ii) the open source project known as *Ushahidi* was launched to gather information from the general public on events occurring in near-real time. The general public could on a map of Kenya pin up a town/area where conflict had erupted and when,[38] (iii) the Kenya National Commission on Human Rights Report (2008) which was initiated by the Human Rights organization itself (iv) Independent Review Commission Report (2008) which was initiated by the Government of Kenya to set up a commission into the post election violence. These sources are useful to make sure we are exhaustive and that smaller towns are not missed out. We use these reports to aid our understanding

[35]See Kenya Red Cross Society (2008) for details.

[36]DEPHA's goal is to provide geographic information data and services to the region under the UN's OCHA.

[37]We obtain all the DEPHA maps from: http://www.depha.org

[38]For details about *Ushahidi* see http://www.ushahidi.com/about. For the Kenya project see http://legacy.ushahidi.com/ (accessed on 30 September 2008).

but are aware that there could be an inherent measurement error due to their objective. As mentioned there were two outbreaks of violence. The first one occurred as soon as the election results were announced on the $29^{th}$ December 2007 which lasted until the $4^{th}$ Jan 2008. The second outbreak occurred between the $25^{th}$ January 2007 and $30^{th}$ January 2008. Table [A1] lists which flower producing locations were affected during the two episodes of violence.

## Table 1: Descriptive Statistics

### Panel A: Firms in Areas with and w/out Conflict, Administrative Records

| Variable | Observations | Mean in No-Conflict | SE No-conflict | Mean in Conflict | SE Conflict | *p-value* |
|---|---|---|---|---|---|---|
| Export, Jan+Feb 2007, in Kg '000 | 104 [ = 50 + 54] | 90.60 | 11.20 | 104.67 | 15.65 | 0.48 |
| Foreign Owner | 104 [ = 50 + 54] | 0.34 | 0.06 | 0.42 | 0.06 | 0.37 |
| Indian Owner | 104 [ = 50 + 54] | 0.22 | 0.06 | 0.21 | 0.05 | 0.87 |
| Kenyan Owner | 104 [ = 50 + 54] | 0.36 | 0.06 | 0.32 | 0.06 | 0.61 |
| Politically Connected Firm | 104 [ = 50 + 54] | 0.26 | 0.06 | 0.20 | 0.05 | 0.42 |
| % Exports to Auctions | 104 [ = 50 + 54] | 49.95 | 4.65 | 50.74 | 4.50 | 0.90 |
| % Production in Roses | 104 [ = 50 + 54] | 0.67 | 0.06 | 0.61 | 0.06 | 0.41 |

### Panel B: Firms in Areas with and w/out Conflict, Survey Data

| Variable | Observations | Mean in No-Conflict | SE No-conflict | Mean in Conflict | SE Conflict | *p-value* |
|---|---|---|---|---|---|---|
| Number of Workers Jan 2008 | 74 [ = 32 + 42] | 480.83 | 103.82 | 456.45 | 45.18 | 0.81 |
| % of Female Workers | 74 [ = 32 + 42] | 61.28 | 2.10 | 62.53 | 2.63 | 0.73 |
| % of Temporary Workers | 74 [ = 32 + 42] | 15.86 | 4.11 | 20.66 | 4.12 | 0.43 |
| % of Workers with Primary Education | 74 [ = 32 + 42] | 36.73 | 5.43 | 49.31 | 5.54 | 0.11 |
| % of Workers with Secondary Education | 74 [ = 32 + 42] | 52.08 | 4.99 | 41.08 | 4.89 | 0.12 |
| % of Workers Housed | 74 [ = 32 + 42] | 11.20 | 3.57 | 11.21 | 3.14 | 1.00 |
| Year Firm Created | 74 [ = 32 + 42] | 1997 | 1.03 | 1998 | 0.81 | 0.66 |
| KFC Member | 74 [ = 32 + 42] | 0.63 | 0.09 | 0.52 | 0.08 | 0.35 |
| Fair Trade Certification | 74 [ = 32 + 42] | 0.30 | 0.09 | 0.32 | 0.07 | 0.87 |
| Max Havelaar Switzerland Certification | 74 [ = 32 + 42] | 0.20 | 0.07 | 0.18 | 0.06 | 0.85 |
| Milieu Programma Sierteelt (MPS) Certific | 74 [ = 32 + 42] | 0.40 | 0.09 | 0.50 | 0.08 | 0.40 |
| Number of Insulated Trucks | 74 [ = 32 + 42] | 1.40 | 0.22 | 1.11 | 0.25 | 0.39 |

### Panel C: Surveyed vs. Non-Surveyed Firms, Administrative Records

| Variable | Observations | Mean in Surveyed | SE Surveyed | Mean in Not Surveyed | SE Surveyed | *p-value* |
|---|---|---|---|---|---|---|
| Conflict Region | 104 [ = 74 + 30] | 0.62 | 0.06 | 0.38 | 0.08 | 0.00*** |
| Export, Jan+Feb 2007, in Kg '000 | 104 [ = 74 + 30] | 98.87 | 32.25 | 101.89 | 19.84 | 0.51 |
| Foreign Owner | 104 [ = 74 + 30] | 0.4 | 0.06 | 0.38 | 0.08 | 0.42 |
| Indian Owner | 104 [ = 74 + 30] | 0.23 | 0.05 | 0.23 | 0.07 | 0.54 |
| Kenyan Owner | 104 [ = 74 + 30] | 0.34 | 0.08 | 0.28 | 0.07 | 0.26 |
| Politically Connected Firm | 104 [ = 74 + 30] | 0.24 | 0.05 | 0.21 | 0.06 | 0.37 |
| % Exports to Auctions | 104 [ = 74 + 30] | 51.3 | 4.77 | 49.7 | 3.24 | 0.59 |
| % Production in Roses | 104 [ = 74 + 30] | 0.65 | 0.06 | 0.64 | 0.06 | 0.52 |

***, **, * means statistical significance at the 1, 5 and 10 %-level respectively. Panel A tests differences in sample-means for firms in the regions affected by the conflict and firms in regions unaffected by the conflict using administrative records only. The sample of 104 firms is the universe of established exporters active in the industry at the time of the violence, after excluding the three largest firms and traders. Exports in the first two months of 2007 (in '000 Kgs), % Production in Roses, % Exports to Auctions are computed from official trade statistics (Source: HCDA). Information on Firm Ownership and Political Connectedness is described in the Data Appendix. Panel B tests differences in sample-means for firms in the regions affected by the conflict and firms in regions unaffected by the conflict using information collected through a face-to-face survey designed and conducted by the authors. In total, 74 producers have been surveyed. Firms in the conflict regions were oversampled for the survey to study the effects of the violence in the relevant locations. Panel C shows that surveyed and non-surveyed firms do not differ along administratively collected data.

## Table 2: Effects of Violence: Unconditional Difference in Difference and Triple Difference Estimates

**Panel A: Locations which suffered in the first outbreak of Violence**

| | | | (a) No-Conflict Region<br>Season 1: # of Firms: 85<br>Season 0: # of Firms: 85 | (b) Conflict Region<br>Season 1: # of Firms: 19<br>Season 0: # of Firms: 19 | (c) Conf. - No-Conf. Diff.<br>Total # of Firms 104 |
|---|---|---|---|---|---|
| 1 | Treatment Period | Season 1: Days of Violence<br>[29 Dec 2007 - 4 Jan 2008] | 6.17<br>[2.225] | 5.476<br>[2.683] | -0.695<br>(0.652) |
| 2a | Control Periods | Season 1: Control Period<br>[4 Nov 2007 - 22 Dec 2007] | 6.619<br>[1.497] | 7.185<br>[1.438] | 0.566<br>(0.363) |
| 2b | | Season 0: Days of Violence<br>[29 Dec 2006 - 4 Jan 2007] | 6.363<br>[1.790] | 6.745<br>[1.256] | 0.382<br>(0.366) |
| 2c | | Season 0: Control Period<br>[4 Nov 2006 - 22 Dec 2006] | 6.642<br>[1.614] | 7.066<br>[1.171] | 0.426<br>(0.319) |
| 3a | First Differences | [1]-[2a] | -0.449***<br>(0.129) | -1.709***<br>(0.472) | -1.261***<br>(0.476) |
| 3b | | [1]-[2b] | -0.193<br>(0.193) | -1.270**<br>(0.559) | -1.077**<br>(0.477) |
| 4 | Difference in Difference | ([1]-[2a]) - ([2b]-[2c]) | -0.171<br>(0.179) | -1.389***<br>(0.491) | -1.218**<br>(0.508) |

**Panel B: Locations which suffered in the second outbreak of Violence**

| | | | (a) No-Conflict Region<br>Season 1: # of Firms: 50<br>Season 0: # of Firms: 50 | (b) Conflict Region<br>Season 1: # of Firms: 54<br>Season 0: # of Firms: 54 | (c) Conf. - No-Conf. Diff.<br>Total # of Firms 104 |
|---|---|---|---|---|---|
| 1 | Treatment Period | Season 1: Days of Violence<br>[25 Jan 2008 - 30 Jan 2008] | 7.015<br>[1.207] | 6.09<br>[2.585] | -0.925**<br>(0.391) |
| 2a | Control Periods | Season 1: Control Period<br>[4 Nov 2007 - 22 Dec 2007] | 6.791<br>[1.345] | 6.659<br>[1.632] | -0.132<br>(0.292) |
| 2b | | Season 0: Days of Violence<br>[25 Jan 2007 - 30 Jan 2007] | 6.522<br>[1.910] | 6.42<br>[2.222] | -0.152<br>(0.411) |
| 2c | | Season 0: Control Period<br>[4 Nov 2006 - 22 Dec 2006] | 6.54<br>[1.700] | 6.674<br>[1.426] | 0.033<br>(0.314) |
| 3a | First Differences | [1]-[2a] | 0.224**<br>(0.108) | -0.569**<br>(0.236) | -0.793***<br>(0.259) |
| 3b | | [1]-[2b] | 0.493*<br>(0.264) | -0.330<br>(0.282) | -0.823**<br>(0.385) |
| 4 | Difference in Difference | ([1]-[2a]) - ([2b]-[2c]) | 0.242<br>(0.278) | -0.315**<br>(0.156) | -0.557**<br>(0.285) |

***, **, * denote statistical significance at the 1, 5, 10 percent levels, respectively. Columns (a) and (b) report means of average daily export weight (in log kgs) in rows 1-2(c) (standard deviations are reported in [] parenthesis). Column (c) reports the corresponding difference, with standard errors in ( ) clustered at the firm level. The Conflict region in Panel A is defined as the locations which suffered violence during the first outbreak. These locations are the towns of Eldoret, Kitale, Elburgon, Kericho and Nakuru. The Conflict region in Panel B is defined as the locations which suffered violence during the first and second outbreak. These locations are the towns of Eldoret, Kitale, Elburgon, Kericho, Nakuru, Naivasha and Limuru, see Table A1 for details.

## Table 3: Effects of Violence, Conditional Regression Results

| **Dep. Variable = Log (1 + daily export's in kgs)** | [1] | [2] | [3] | [4] | [5] | [6] |
|---|---|---|---|---|---|---|
| | **Panel A: Conflict and No-Conflict Region, Triple Differences** | | | | | |
| Days of Violence First Outbreak (29 Dec 2007 - 4 Jan 2008) | -0.091 | -0.037 | -0.044 | -0.046 | 0.012 | -0.038 |
| | (0.086) | (0.101) | (0.096) | (0.094) | (0.093) | (0.097) |
| Days of Violence First Outbreak * Conflict location (yes=1) | -1.542*** | -1.836** | -1.801** | -1.789** | -2.106* | -1.988** |
| | (0.397) | (0.896) | (0.893) | (0.892) | (1.153) | (0.994) |
| Days of Violence Second Outbreak (25 Jan 2008 - 30 Jan 2008) | -0.073 | -0.077 | -0.107 | -0.102 | -0.097 | -0.156 |
| | (0.128) | (0.137) | (0.107) | (0.137) | (0.173) | (0.164) |
| Days of Violence Second Outbreak * Conflict location (yes=1) | -0.469*** | -0.462** | -0.405** | -0.415** | -0.424* | -0.34 |
| | (0.166) | (0.192) | (0.154) | (0.199) | (0.264) | (0.297) |
| Conflict location (yes=1) | -0.396 | - | - | - | - | - |
| | (0.417) | | | | | |
| | **Panel B: Conflict Region Only, Difference In Difference** | | | | | |
| Days of Violence Second Outbreak | -0.461*** | -0.462*** | -- | -- | -0.412* | -0.295 |
| | (0.106) | (0.163) | | | (0.204) | (0.188) |
| **Fixed Effects** | | | | | | |
| Firm | no | yes | yes | yes | - | - |
| Day of year | yes | yes | yes | - | - | - |
| Day of week | yes | yes | yes | yes | yes | yes |
| Season | yes | yes | - | - | - | - |
| Day of year * Conflict (yes =1) | | | | yes | yes | yes |
| Season * Conflict (yes=1) | | | yes | yes | - | - |
| Firm * Season | | | | | yes | yes |
| Firm * Week | | | | | | yes |
| Adjusted R-squared in Panel A / B | 0.028 / 0.038 | 0.378 / 0.402 | 0.378 / -- | 0.378 / -- | 0.443 / 0.447 | 0.444 / 0.447 |
| Number of Firms in Panel A / B | 104 / 54 | 104 / 54 | 104 / -- | 104 / -- | 104 / 54 | 104 / 54 |
| Number of observations (Full Sample) | 34087 | 34087 | 34087 | 34087 | 34087 | 34087 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. The sample period are the months from November to January for the four seasons from 2004 to 2008. Conflict regions and days of violence are as described in the text. The day of the year dummies correspond to calendar dates. Day of week dummies are Mondays, Tuesdays .. Sundays. Panel B considers regions affected by the violence only to eliminate concerns about spillover effects across regions. Season dummies are 1, 2...4. Standard errors, clustered at the firm and season-week-location level [see Cameron et al, (2009)] are reported in parenthesis.

## Table 4: Effects of the Violence, Various Outcomes

| | [1] | [2] | [3] | [4] | [5] |
|---|---|---|---|---|---|
| **Dependent Variable:** | **Baseline Specification** Log (1+ daily export's in kgs) | **Extensive Margin** Export = 1 if firm exports in the day | **Intensive Margin** Log (1+ daily export's in kgs, conditional on Exporting) | **Prices** Log (Unit Value, KShs) | **Unit Weight** Log (Unit Weight, Kgs per Stem) |
| Days of Violence First Outbreak (29 Dec 2007 - 4 Jan 2008) | -0.046 | -0.01 | 0.048 | 0.107** | -0.06 |
| | (0.094) | (0.013) | (0.033) | (0.052) | (0.068) |
| Days of Violence First Outbreak * Conflict location (yes=1) | -1.789** | -0.217** | -0.262*** | -0.06 | -0.008 |
| | (0.892) | (0.107) | (0.083) | (0.131) | (0.058) |
| Days of Violence Second Outbreak (25 Jan 2008 - 30 Jan 2008) | -0.102 | -0.015 | 0.016 | 0.13** | -0.012 |
| | (0.137) | (0.019) | (0.073) | (0.052) | (0.038) |
| Days of Violence Second Outbreak * Conflict location (yes=1) | -0.415** | -0.038 | -0.228** | 0.048 | -0.069 |
| | (0.199) | (0.027) | (0.11) | (0.062) | (0.05) |
| **Fixed Effects** | | | | | |
| Firm | yes | yes | yes | yes | yes |
| Day of week | yes | yes | yes | yes | yes |
| Day of year * Conflict (yes =1) | yes | yes | yes | yes | yes |
| Season * Conflict (yes=1) | yes | yes | yes | yes | yes |
| Adjusted R-squared | 0.378 | 0.314 | 0.546 | 0.586 | 0.684 |
| Number of Firms | 104 | 104 | 104 | 104 | 104 |
| Number of observations | 34087 | 34087 | 21060 | 34087 | 34087 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. The sample period are the months from November to January for the four seasons from 2004 to 2008. Conflict regions and days of violence are as described in the text. The day of the year dummies correspond to calendar dates. Day of week dummies are Mondays, Tuesdays .. Sundays. For the first outbreak of violence the conflict region are the towns of Eldoret, Kitale, Elburgon, Kericho and Nakuru. For the second outbreak of violence the Conflict region is defined as the locations which suffered violence during the first and second outbreak. These locations are the towns of Eldoret, Kitale, Elburgon, Kericho, Nakuru, Naivasha and Limuru. All columns report results from OLS Linear regressions. The dependent variable changes across columns. In Column (1) it is (log) daily export weight, as in Table 3. In Column (2) it is a dummy taking value 1 if a positive amount is exported on a given day, 0 otherwise. In Column (3) it is (log) daily export weight in those days in which a positive amount was exported. In Column (4) it is (log) unit value in KShs. In Column (5) it is (log) unit weight in Kgs per stem. Standard errors clustered at the firm and season-week-location level [see Cameron et al, (2009)] are reported in parenthesis.

## Table 5: Heterogeneity Along Firm Characteristics

| **Dep. Variable = Log (1 + daily export's in kgs)** | Size (1) | Marketing Channel (2) | Only Roses (4) | Business Association (5) | Fair Trade Label (6) | Connectedness (7) | Ownership (8) | All Heterogeneities (9) |
|---|---|---|---|---|---|---|---|---|
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Small Firm (yes =1) | -1.101*** | | | | | | | -0.504** |
| | (0.160) | | | | | | | (0.244) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Only Auction (yes =1) | | -0.545*** | | | | | | -0.769*** |
| | | (0.154) | | | | | | (0.245) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Only Roses Exported (yes =1) | | | -0.008 | | | | | 0.192 |
| | | | (0.115) | | | | | (0.290) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * KFC Member (yes =1) | | | | 0.804*** | | | | 2.134*** |
| | | | | (0.348) | | | | (0.293) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Fair Trade Label (yes =1) | | | | | 0.556*** | | | -0.273 |
| | | | | | (0.129) | | | (0.299) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Politically Connected Firm (yes =1) | | | | | | 0.927*** | | -0.201 |
| | | | | | | (0.369) | | (0.321) |
| Days of Violence (25 Jan 2008 - 30 Jan 2008) * Conflict location (yes=1) * Foreign Owner (yes =1) | | | | | | | -0.082 | -0.176 |
| | | | | | | | (0.234) | (0.312) |
| Number of observations | | | | 416 | | | | 416 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. The specification is as in Table 2, with location defined at the town, rather than region, level. See text for details. The individual heterogeneity dummy are defined as follows - (i) small takes value 1 for firms which export below the median in the control period. (ii) only auction takes value 1 when a firm exports more than 90% to the Dutch export (iii) only roses takes value 1 when the firm exports are more than 90% roses (iv) KFC member takes value 1 when the firm belongs to the Kenya Flower Council (v) politically connected firm takes value 1 when the firm is politically connected (vi) foreign owner takes value 1 when the firm is owned by foreign company. Only the triple interaction is reported for each specification as explained in the text. See Data Appendix for source of variables. The specification allows the intensity of conflict to differ across locations. Location specific growth and seasonality patterns and firm fixed effects are also included. Standard errors in ( ) are obtained by multi-way clustering at the firm-season and conflict-season-period level [see Cameron et al, (2009)].

## Table 6: The Violence, Self-Report

| | [1] | [2] | [3] | [4] | [5] | [6] |
|---|---|---|---|---|---|---|
| **Dependent Variable:** | Did Violence Affect at all the Operations of Your Firm? | Were there any days in which members of your staff did not come to work because of the Violence? | What was the highest proportion of Workers Absent due to the Violence? | To What Extent did Worker Absence Cause a Loss in Production? | Did you Experience Any Transportation Problem to Ship Flowers to the Airport? | Did you Hire Extra Secuirty? |
| Conflict Region (yes=1) | 0.575*** | 0.702*** | 43.898*** | 2.333*** | 0.477*** | 0.311*** |
| | [0.103] | [0.072] | [5.609] | [0.124] | [0.100] | [0.099] |
| Dep. Var. in No-Conflict Region (Mean) | 0.333 | 0.206 | 1.511 | 0.167 | 0.233 | 0.071 |
| Adjusted R-squared | 0.36 | 0.51 | 0.35 | 0.55 | 0.136 | 0.116 |
| Number of Firms | 74 | 74 | 74 | 74 | 74 | 74 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. All the dependent variables in column (1)-(6) are from the firm survey designed and conducted by the authors in the summer following the violence through face-to-face interviews with firm's owners or senior management. The answer to the question in Column [4] is on a scale from 0 (not at all) to 4 (very much). All answers refer to the period during and following the violence i.e. the first six weeks of 2008. Conflict regions are those in which violence broke out in the first and/or second episode, see Appendix for details. The Table reports OLS results. Robust standard errors, clustered at the location level, are reported in parenthesis.

## Table 7: Disentangling Channels: Workers Losses versus Transportation Problems

| **Dependent Variable: Log (1+ weekly exports volumes)** | [1] | [2] | [3] | [4] | [5] | [6] |
|---|---|---|---|---|---|---|
| Week of Violence (yes=1) * Conflict location (yes=1) | -0.414** | | | -0.078 | -0.108 | -0.091 |
| | (0.189) | | | (0.153) | (0.173) | (0.188) |
| % Workers Absent | | -0.014*** | | -0.012*** | -0.014** | -0.014** |
| | | (0.004) | | (0.004) | (0.006) | (0.006) |
| Transportation Problems suffered by firm (yes=1) | | | -0.574** | -0.265 | -0.117 | -0.081 |
| | | | (0.263) | (0.253) | (0.202) | (0.108) |
| Week of Violence (yes=1) * Conflict location (yes=1) * Small Firm (yes=1) | | | | | 0.088 | |
| | | | | | (0.518) | |
| Week of Violence (yes=1) * Conflict location (yes=1) * Only Auction (yes=1) | | | | | | -0.299 |
| | | | | | | (0.708) |
| **Fixed Effects** | | | | | | |
| Firm * Season | yes | yes | yes | yes | yes | yes |
| Firm * Week | yes | yes | yes | yes | yes | yes |
| Adjusted R-squared | 0.815 | 0.814 | 0.815 | 0.821 | 0.82 | 0.82 |
| Number of observations | 3710 | 3710 | 3710 | 3710 | 3710 | 3710 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. The sample includes only 74 interviewed firms for which information on workers absent and transportation problems experienced during the six weeks after the beginning of the violence are available. Since this information was collected retrospectively for each separate week, each observation corresponds to a firm in a given week. % Workers Lost is a week level variable for each firm and transportation problem is a dummy which takes place 1 if during a particular week a firm suffered transport issues. The sample period is as in Table 3. Standard errors in ( ) are obtained by multi-way clustering at the firm and conflict-season-week level [see Cameron et al, (2009)].

## Table 8: Missing Workers, Survey Evidence

| **Dep. Variable = % Workers Lost** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Only Auction (yes=1) | 23.05 | 27.27** | 29.07** | 25.58* | 20.24* | 27.17* |
| | (15.60) | (13.48) | (13.47) | (14.74) | (12.04) | (15.49) |
| Small Firm (yes=1) | 26.51** | 31.86** | 25.47* | 32.51*** | 7.82 | 33.66** |
| | (11.45) | (12.33) | (15.40) | (12.46) | (11.22) | (15.08) |
| Housing Offered (yes=1) | | -16.87* | -20.1* | -14.137 | -27.31** | -17.52 |
| | | (10.07) | (10.33) | (10.83) | (10.26) | (10.85) |
| KFC Member (yes=1) | | | -16.50 | | | |
| | | | (12.73) | | | |
| Fair Trade Certification (yes=1) | | | -3.123 | | | |
| | | | (17.25) | | | |
| Politically connected firm (yes=1) | | | | -19.085 | | |
| | | | | (13.41) | | |
| Foreign Owner (yes=1) | | | | -17.527 | | |
| | | | | (11.73) | | |
| % of Female Workers | | | | | 0.383 | |
| | | | | | (0.269) | |
| % of Workers with Primary Education | | | | | 0.341 | |
| | | | | | (0.278) | |
| Only Roses (yes=1) | | | | | | 0.673 |
| | | | | | | (11.46) |
| No Insulated Trucks (yes=1) | | | | | | -4.015 |
| | | | | | | (14.32) |
| Fixed Effects | location (4) | location (4) | location (4) | location (4) | location (4) | location (4) |
| Observations (firms) | 44 | 44 | 44 | 44 | 44 | 44 |
| Pseudo R-squared | 0.282 | 0.352 | 0.401 | 0.394 | 0.584 | 0.354 |

***, **, * denote statistical significance at 1, 5, 10 percent levels, respectively. % of Workers lost is the highest percentage reported by the firm throughout the violence period, i.e., during the first six weeks of 2008. The sample includes all interviewed firms in the conflict region. Only auction takes value equal to one if the firm exports more than 90% of production to the auctions. Small firm takes value equal to one if the firm is smaller than the median firm in the industry. Housing offered takes value equal to one if the firm provides housing for more than 20% of the permanent labour force. Only roses takes value equal to one if roses are more than 90% of a firm export volumes. No insulated trucks takes value equal to one for those firms that do not own trucks. Robust standard errors are reported in parenthesis.

## Table 9: The Effects of the Violence, Calibration Results

| Variable [N = 42] | Labor Share = 0.1 | Labor Share = 0.15 | Labor Share = 0.2 | | Labor Share = 0.25 |
|---|---|---|---|---|---|
| | | | **Median** | *Average* | |
| % Drop in Revenues (Firm Level Estimate) | 22 | 22 | **22** | *38* | 22 |
| Revenues per Worker (HCDA and Survey) | 6592 | 6592 | **6592** | *9258* | 6592 |
| Weekly Earning, in Kshs | 660 | 989 | **1318** | *1851* | 1648 |
| Welfare Cost of Violence, Mg. Worker | 3817 | 3600 | **3393** | *5939* | 3481 |
| % Increase in Wage Bill | 159 | 95 | **62** | *71* | 42 |
| % Increase in Cost (Lower Bound) | 18 | 16 | **13** | *16* | 12 |
| Average Welfare Loss for Unretained Workers, in Kshs | 5227 | 4911 | **4621** | *19819* | 4331 |

The Table reports figures for the median firm in the conflict region under different assumptions regarding the labour share. For our preferred choice, both median and average figures are reported. The percentage drop in revenue is computed from HCDA data as the firm-specific difference in difference estimate of loss in production underlying Table 2 which controls for both firm-specific growth and seasonality patterns. Revenues per worker in normal times are computed dividing export revenues for the average week in the ten weeks control period before the violence, computed from customs records, by the number of workers employed by the firm in that period, which is available from the survey. Weekly workers earning are calibrated from the model using the firm level figure on revenue per workers, computed combining official export statistics with survey evidence on workers employed by the firm. The welfare cost of violence for the marginal worker and the percentage increase in wage bills follows from the model, using the estimated drop in production. The percentage increase in costs is a lower bound because it does not include increases in other costs, such as chemicals, fertilizers, and hiring of extra security. The percentage increase in costs and the average welfare loss for un-retained workers is computed assuming a uniform distribution. Alternative specifications yield similar results. Average daily wages for workers in the flower industry were marginally above the minimum wage rate before the violence, at about 200 Kshs per day, i.e., 1200 Kshs per week. For this reason, our preferred estimates are the relatively conservative ones reported in the third and fourth columns

## Table A1: Location of Firms and Definition of Violence

| Province | Town (No. of Firms) | First Outbreak of Violence: Conflict =1, No-conflict=0 | Second Outbreak of Violence: Conflict =1, No-conflict=0 |
|---|---|---|---|
| Central | Kiambu (2) | 0 | 0 |
| Central | Kikuyu (1) | 0 | 0 |
| Central | Limuru (10) | 0 | 1 |
| Central | Nyeri (2) | 0 | 0 |
| Central | Thika (19) | 0 | 0 |
| Eastern | Athi River (10) | 0 | 0 |
| Eastern | Timau (3) | 0 | 0 |
| Nairobi | Nairobi (5) | 0 | 0 |
| Rift Valley | Elburgon (1) | 1 | 1 |
| Rift Valley | Eldoret (4) | 1 | 1 |
| Rift Valley | Kericho (1) | 1 | 1 |
| Rift Valley | Kitale (2) | 1 | 1 |
| Rift Valley | Naivasha (25) | 0 | 1 |
| Rift Valley | Nakuru (10) | 1 | 1 |
| Rift Valley | Nanyuki (5) | 0 | 0 |
| Rift Valley | Nyahururu (4) | 0 | 0 |

*Notes*: First Outbreak of Violence: 29 Dec 2007 - 4 Jan 2008. Second Outbreak of Violence: 25 Jan 2008 - 30 Jan 2008. Total No. of firms 104.

## Table A2: Calendar of Events

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| DECEMBER | 23 | 24 | 25 | 26 | 27 ELECTION DAY | 28 | 29 First Outbreak of Violence |
| | 30 Elections Results announced | 31 | | | | | |
| JANUARY | | | 1 | 2 | 3 | 4 | 5 |
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| | 20 | 21 | 22 | 23 | 24 | 25 Second Outbreak of Violence as mediation efforts | 26 |
| | 27 | 28 | 29 | 30 | 31 | | |
| FEBRUARY | | | | | | 1 | 2 |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | ..... | 28 Power Sharing Agreement | | |

# Table A3: Placebos -- No Differential Seasonality Across Regions

**Panel A: Regions of Conflict are locations which suffered in the first outbreak of Violence**

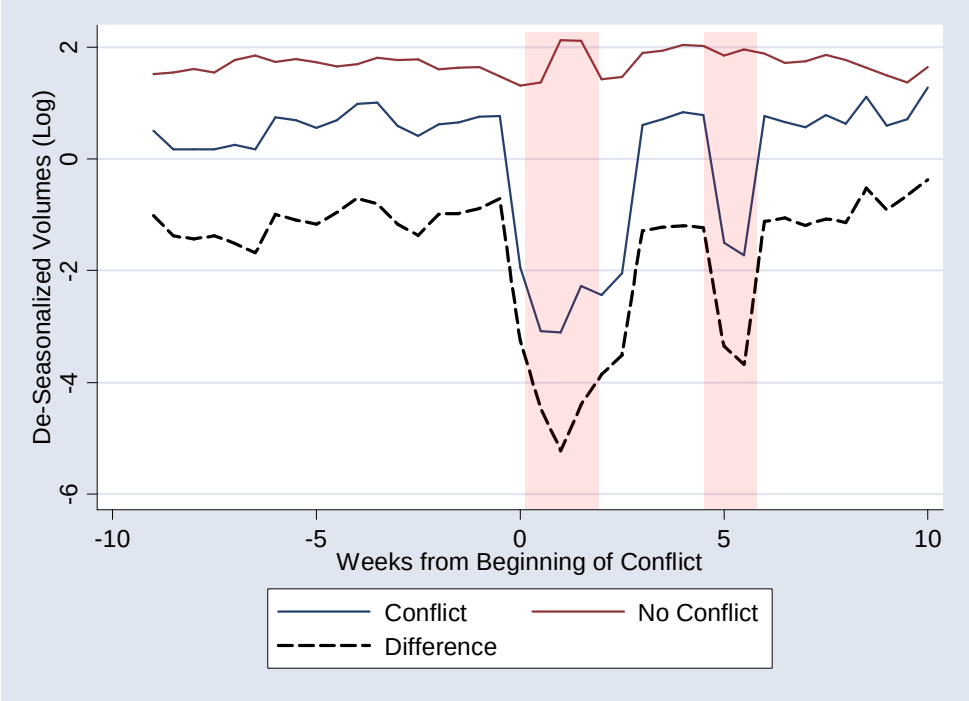
| | | | Non-Conflict Region | Conflict Region | Conflict - Non-Conflict Difference |
|---|---|---|---|---|---|
| 1 | Treatment Period | Season -1:Violence Period [29 Dec 2005 - 4 Jan 2006] | 5.844<br>[2.722] | 6.744<br>[1.986] | 0.899<br>(0.554) |
| 2a | Control Periods | Season -1: Control Period [4 Nov 2006 - 22 Dec 2006] | 6.154<br>[2.269] | 6.81<br>[2.07] | 0.656<br>(0.544) |
| 2b | | Season -2: Violence Period [29 Dec 2004 - 4 Jan 2005] | 6.03<br>[2.226] | 5.95<br>[2.682] | -0.082<br>(0.730) |
| 2c | | Season -2: Control Period [4 Nov 2004 - 22 Dec 2004] | 6.398<br>[1.794] | 6.598<br>[2.145] | 0.2<br>(0.585) |
| 3a | First Differences | [1]-[2a] | -0.309*<br>(0.168) | -0.066<br>(0.484) | 0.243<br>(0.499) |
| 3b | | [1]-[2b] | -0.187<br>(0.321) | 0.794<br>(0.691) | 0.981<br>(0.744) |
| 4 | Regional Difference in Difference | ([1]-[2a]) - ([2b]-[2c]) | 0.057<br>(0.292) | 0.64<br>(0.767) | 0.583<br>(0.801) |

**Panel B: Regions of Conflict are location which suffered in the second outbreak of Violence**

| | | | Non-Conflict Region | Conflict Region | Conflict - Non-Conflict Difference |
|---|---|---|---|---|---|
| 1 | Treatment Period | Season -1: Violence Period [25 Jan 2006 - 30 Jan 2006] | 6.379<br>[2.267] | 6.271<br>[2.287] | -0.109<br>(0.466) |
| 2a | Control Periods | Season -1: Control Period [4 Nov 2005 - 22 Dec 2005] | 6.368<br>[2.17] | 6.196<br>[2.310] | -0.172<br>(0.458) |
| 2b | | Season -2: Violence Period [25 Jan 2005 - 30 Jan 2005] | 6.775<br>[1.724] | 6.696<br>[1.920] | -0.079<br>(0.402) |
| 2c | | Season -2: Control Period [4 Nov 2004 - 22 Dec 2004] | 6.532<br>[1.682] | 6.346<br>[2.006] | -0.186<br>(0.408) |
| 3a | First Differences | [1]-[2a] | 0.011<br>(0.211) | 0.074<br>(0.280) | 0.063<br>(0.350) |
| 3b | | [1]-[2b] | -0.395<br>(0.350) | -0.4255<br>(0.364) | -0.0301<br>(0.503) |
| 4 | Regional Difference in Difference | ([1]-[2a]) - ([2b]-[2c]) | -0.044<br>(0.298) | -0.181<br>(0.412) | -0.137<br>(0.506) |

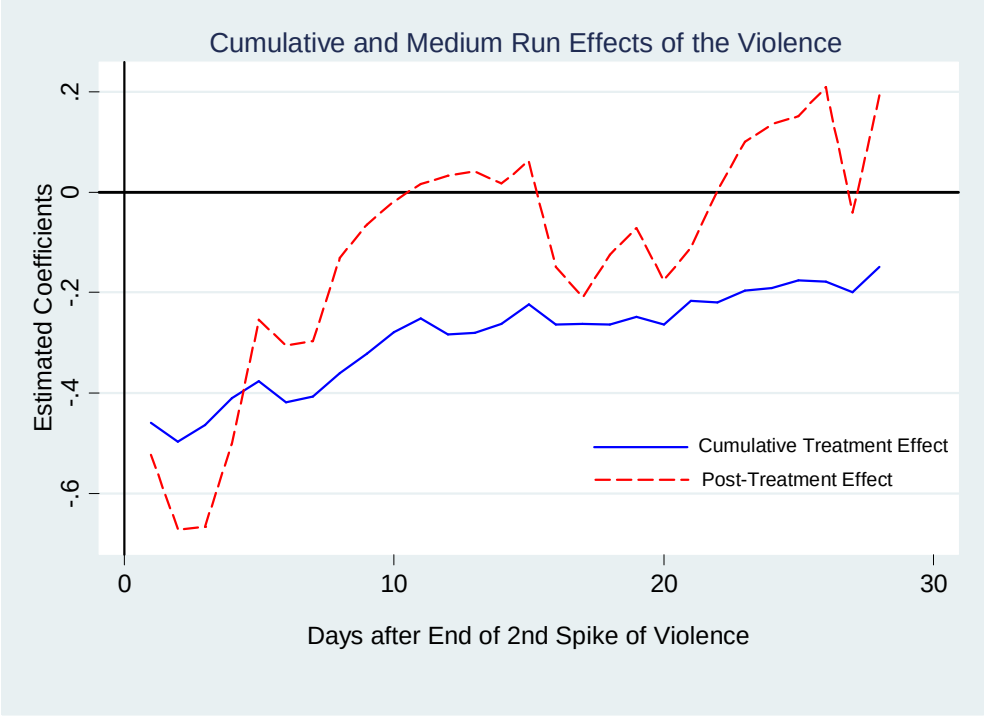
***, **, * denote statistically significance at 1, 5, 10 percent, respectively. Columns (a) and (b) report means of average daily export weight (in log kgs) in rows 1-2(c) (standard deviation are reported in parenthesis). Column (c) reports the corresponding difference, with standard errors in ( ) clustered at the firm level. In Panel A: Conflict region is defined as the locations which suffered violence during the first outbreak. These locations are the towns of Eldoret, Kitale, Elburgon, Kericho and Nakuru. In Panel B: Conflict region is defined as the locations which suffered violence during the first and second outbreak. These locations are the towns of Eldoret, Kitale, Elburgon, Kericho, Nakuru, Naivasha and Limuru, see Table A1 for details.

**Figure 1: Effect of Violence on Export Volumes**



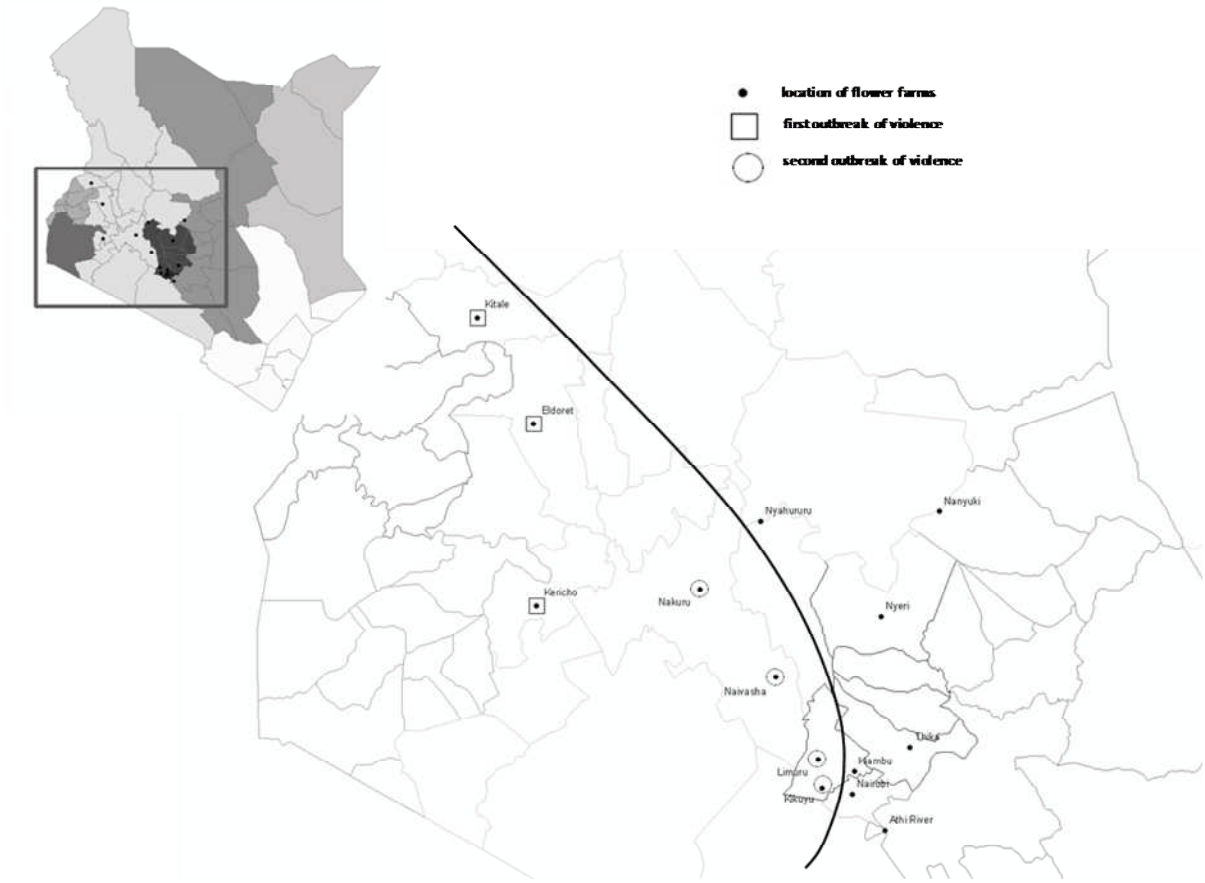

*Notes:* The figure shows the median biweekly residual of a regression that controls for firm specific seasonality and growth patterns in *conflict* and in *non-conflict* locations for the 10 weeks before and 10 weeks after the first outbreak of violence.

**Figure 2: Effect of Violence on Export Volumes**




*Notes:* The figure shows the estimated coefficients of the differential cumulative and medium-run effects of the violence following the second outbreak using the baseline specification in Column IV of Table 3.

## Figure A1: Flower Firms Location and Violence Regions




*Notes*: the figure displays the geographical distribution of the nearest towns to the flower farms as well as whether the relevant locations had been involved in either the first or the second outburst of violence.