Guns and Roses: Flower Exports and Electoral Violence in Kenya

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Abstract

This paper studies how firms react to electoral violence. Predictions derived from a model of firms reaction to violence are tested using Kenya flower exporters during the 2008 post-election violence. The violence reduced exports primarily through workers absence and had heterogenous effects: firms with direct contractual relationships in export markets and members of the business association had higher incentives and lower costs of reacting to the violence and suffered smaller production and workers losses. Model calibrations suggest that the average firm operated at a loss during the violence and absent workers suffered welfare losses at least three times larger than weekly earnings. The results show how the impact of violence on trade is mediated by different institutional arrangements associated with export.

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1 Introduction

This paper studies the effects of electoral violence on an export oriented industry. Export development is important to promote growth and poverty reduction in low income countries (see, e.g., Rodrik (2005)). In many countries, however, growth and exports are hindered by instability and frequent disruptions in production. In the African context, violent conflicts, particularly at election times, are a common cause of instability and disruption in production (see, e.g., Bates (2001, 2008)). During the period from 1990 to 2007, 19% of the 213 elections which took place in Sub-Saharan Africa witnessed electoral violence (see Straus and Taylor (2009) and Table [A1] for an update).[1]

An expanding body of evidence from cross-country studies (see, e.g., Alesina et al. (1996), Collier (2007), Glick and Taylor (2010)) shows that violent conflicts has negative effects on growth, investment and trade at the macro level. While necessary to understand the channels through which violence affects firms and formulate appropriate policies, micro-level evidence on the impact of violence on firms' operations, however, remains scarce. There are two major empirical challenges to provide micro-level evidence: 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 mechanisms and costs of disruptions induced by the post-electoral violence in 2008 on Kenyan floriculture, one of the largest earner of foreign currency and employer of poorly educated women in rural areas. The setting of this study allows to overcome the two empirical challenges identified above. Kenyan flowers are produced almost exclusively for the export market. 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.[2] The ethnic violence that followed the elections in Kenya at the end

[1] Straus and Taylor (2009) list cases with twenty or more deaths. For comparison, Blattman and Miguel (2009) define civil wars as internal conflicts that count more than 1,000 battle deaths in a single year and civil conflicts as those that count at least 25 deaths per annum. The International Foundation for Electoral Systems (IFES) defines "*election violence [a]s any harm or threat to any person or property involved in the election process, or to the election process itself, during the election period*" (see `http://www.ifes.org`).

[2] Other perishable 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., most manufacturing, that are not primarily involved in exports, accurate high-frequency data on production or sales do not exist.

of 2007 did not equally affect all regions of the country where flower firms are 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 to assess the causal impact of the violence on production. The data, in particular, allow us to estimate firm-specific reduced form effect of the violence on production that control for both seasonality and growth effects.

We complemented the administrative data by designing and conducting a survey of flower firms in Kenya shortly after the end of the violence. The survey collected information on how firms were affected by and reacted to the violence. Beside underpinning the formulation of a theoretical model of a firm's reaction to the violence, the survey is combined with the administrative data to shed light on the mechanisms through which the violence affected the firms. Finally, the combination of firm-specific reduced form estimates obtained from the administrative records with information collected through the survey allows us to calibrate the model and construct 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 what would have happened had the violence not occurred. Guided by the predictions of the model, we investigate the mechanisms through which the violence affected the firms and show two sets of results. First, the evidence 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. Second, we explore sources of heterogeneity in both firms' exposure and response to the violence. Within narrowly defined locations, we find that 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. These results hold even after controlling for characteristics of the labor force (gender, education, ethnicity), working arrangements (percentage of seasonal vs. permanent employees, housing programs on the farm, fair trade certification) and ownership (foreign, politically connected).[3] We also find that firms affiliated with the industry business association suffered lower reductions in export volumes. Perhaps surprisingly, after accounting for these characteristics, we find no evidence that foreign-owned firms, firms more closely connected to

[3]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.

politicians, or fair trade certified firms suffered differential reductions in exports and workers losses. Taken together, the evidence suggests that institutional arrangements developed to export in integrated non-traditional agricultural value chains gave firms higher incentives to react and limit the disruptions caused by the violence.

Firms responded to the violence by compensating the workers that came to work for the (opportunity) costs of coming to work during the violence period and by increasing working hours to keep up production despite severe workers 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. This provides a lower bound to the increase in costs 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.

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 findings from this study are relevant to countries interested in fostering non-traditional agricultural value chains.[4] In particular, the incentives associated with integrated value chains in non-traditional agriculture and a well-functioning business association enabled firms to quickly respond to the violence through both horizontal and vertical coordination along the supply chain. This also suggests that even larger negative effects might be expected in traditional agriculture value chains in which domestic traders and processors market the fresh produce of smaller farmers, often for the local market. Second, as in our study, even in contexts characterized by intense and prolonged episodes of violence, the available evidence suggests that the most important effects of violence on firms are caused by the flight of employees and the unreliability of transport, rather than by physical destruction (see, e.g., Collier and Duponchel (2010) for Sierra Leone).

This work thus provides firm-level evidence on the mechanisms that underpin the

[4]In many African countries, export revenues are very highly concentrated in few primary, including agricultural, sectors. The success of floriculture in Kenya has led several other Sub-Saharan countries, most notably Ethiopia, but also Tanzania, Uganda and others, to promote the development of the industry.

impacts of conflict on international trade. The existing literature has studied trade disruptions at a more aggregate level. For instance, Glick and Taylor (2010) show that wars affect not only the parties directly affected, but also trade with *third* parties, while Nitsch and Schumacher (2004) show that terrorism within a country affects trade with other countries.[5] Our paper documents that the institutional arrangements used by firms to participate in international value chains are important in determining the impact of conflict on trade. In doing so, it adds to a handful of papers providing micro-level evidence on the relationship between conflict and firms.[6] 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 terrorist conflict 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. They then look at stock market returns of firms who operated in the Basque region when the terrorist organization announced a truce and 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 our 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, 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 workers welfare losses caused by the violence. Dube and Vargas (2007) provide micro-evidence on the relationship between export and 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, production and exports in the flower industry might have affected the conflict; instead, we condition on locations in which flowers

[5]Collier and Hoeffler (1998), Besley and Persson (2008) and Martin et al. (2008) provide further examples of macro-level evidence on the relationship between trade and civil conflict.

[6]Almost all papers in the microeconomic literature of violence and civil conflict focus on the impacts of conflict on investment in human capital and children, e.g., Akresh and De Walque (2009), Blattman and Annan (2010), Leon (2010) and Miguel and Roland (2010). This part of the literature is surveyed in Blattman and Miguel (2009).

are already grown and study the response of producers to the violence. 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-electoral 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.

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 producers 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 Electoral Violence

Kenya's fourth multi-party general elections were held on the 27^{th} of December 2007 and involved two main candidates: the incumbent Mwai Kibaki was running for a re-election, 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 (see Kimenyi and Shughart (2010), Bratton and Kimenyi (2008) and Gibson and Long (2009)).

Polls leading up to the elections showed that the race would be close. Little violence occurred on election day, and observers considered the voting process orderly. Exit polls gave a comfortable lead to the challenger, Odinga, by as much as 50% against 40% for Kibaki. The challengers led on the first day of counting (28^{th}, December) lead to an initial victory declaration by ODM (29^{th}, December). However on the 29^{th}, the head of the Electoral Commission of Kenya declared Kibaki the winner, by a margin of 2%. The hasty inauguration of Kibaki on the afternoon of the 30^{th} December resulted in Odinga accusing the government of fraud.[7] Within minutes of the announcements of the election results, 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 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.[8] Sporadic 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 economic effects of the crisis

[7] According to domestic and international observers the vote counting was flawed with severe discrepancies between the parliamentary and presidential votes (see, e.g., http://www.iri.org/africa/kenya or http://www.senate.gov/~foreign/testimony/2008/MozerskyTestimony080207a.pdf

[8] See, Kenya National Commission on Human Rights (2008), Independent Review Commission (2008) and Catholic Justice and Peace Commission (2008).

were extensively covered in the international media.[9]

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 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

We classify whether firms are located in areas that were affected by violence or not.[10] The primary source of information used to classify whether a location suffered from violence 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. 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.[11]

[9] 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).

[10] In the appendix, Table [A2] lists the towns in which flower firms are located. Figure [A1] shows where these are located within Kenya.

[11] Table A3 in the Appendix outlines the calendar of events which we use as a basis for defining the days of violence occurrence. 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 by 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 θ 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 $u(\cdot) = y_i - \frac{l_i^{1+\gamma}}{1+\gamma}$, where y_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

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

participation constraint with equality. Since a worker's income is equal to $y_i = w_i l_i$, 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, θ and p. The following statement characterizes a firm production, wages and profits in normal times.

Denote by $R^* = (p\theta N^{\eta-1})^{1+\frac{1}{\gamma}}$ *the revenues per worker in normal times. Then, a worker's income is* $y^* = \frac{1}{\gamma+1}R^*$, *total production is* $q^* = \frac{R^*}{p}N$, *profits are* $\Pi^* = \frac{\gamma}{\gamma+1}R^*N - K$ *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 targeted 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 $c_i \geq 0$ of coming to work during the period of violence. The costs c_i are independently drawn from a distribution with continuous and differentiable cumulative function $F(c, \mathbf{C})$, where $\mathbf{C}$ parameterizes the intensity of the violence at the firm's location. The cost c_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 c_i, a worker offered a wage w_i^v to work for l_i^v hours comes to work if

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

where the superscript v 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 c_i. Furthermore, due to the symmetry of the production function, it is optimal for all workers kept at the farm to work l^v hours. The optimal policy for the firm, therefore, consists of choosing i) the threshold c^v such that workers with $c_i \leq c^v$ come to the farm, and ii) the hours worked by each worker, l^v. For simplicity, we maintain the assumption that the firm can offer different wage contracts w_i^v to each worker i.[13] The problem of the firm can then be rewritten as

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

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

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

The two first order conditions deliver several implications.[14] First, by increasing the cost of coming to work for the worker, the impact of violence on production is negative. This is our first prediction. The reduced form effect of the violence on production, $\Delta^v = \ln\left(\frac{q^v}{q^*}\right)$, is given by

[13] None of the qualitative results are affected by allowing the firm to offer worker-specific wages w_i^v. 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., $\frac{\partial^2 \Pi^v}{\partial l^2} < 0$, $\frac{\partial^2 \Pi^v}{\partial c^2} < 0$ and $\frac{\partial^2 \Pi^v}{\partial l^2} \cdot \frac{\partial^2 \Pi^v}{\partial c^2} - \left(\frac{\partial^2 \Pi^v}{\partial l \partial c}\right)^2 > 0$. It is easy to check that $\frac{\partial^2 \Pi^v}{\partial l^2} < 0$ holds. The remaining conditions hold, e.g., when $F(\cdot)$ is either uniform or exponential for reasonable parameterizations of the production function.

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

The effect of the violence on production can be decomposed into two effects: the negative effect coming from worker losses, $\eta \ln \sigma_v < 0$, is partially offset by a positive effect on the hours worked, $\ln\left(\frac{l^v}{l^*}\right) > 0$. [15]

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

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

The estimated effect of the violence on production, Δ^v, therefore, can be combined with information on revenues per worker during normal times, R^*, to recover the extra cost incurred by the marginal worker coming to work during the time of the violence, c^v. This expression forms the basis of the calibration exercise at the end of the next Section.[16]

3.3 Heterogeneity in the Reduced Form Effects

Size Effects

This section discusses two comparative statics suggesting heterogenous reduced form effects of the violence on production, Δ^v, depending on firm's size and marketing channel. 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

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

Straightforward implicit differentiation of equation (9) gives $\frac{\partial c^v}{\partial q^*} > 0$ and, by equation (7), $\frac{\partial \Delta^v}{\partial q^*} > 0$.[17] This means that the effect of the violence on production and worker loss is greater

[15] Since the share of workers coming to work during the violence is endogenously chosen by the firm, a reduced form regression of $\Delta^v \ln \sigma_v$ gives a biased estimate of η, i.e., $\frac{\eta(1+\gamma)-1}{\gamma} < \eta$.

[16] In order to recover c^v, knowledge of the parameters γ and η 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 γ, an estimate of η can be recovered from the relationship between the effects of the violence on production, Δ^v, and the share of workers coming at the firm, σ_v, as suggested by equation (7).

[17] While implicit differentiation of equation (9) implies $\frac{\partial \Delta^v}{\partial N} < 0$, if N was endogenously chosen by the

for smaller firms.

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.[18]

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. 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

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

if $q < q^*$.[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 might either increase or decrease as

firm, the model would predict a positive correlation between Δ^v 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.

[18] 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 (see Macchiavello and Morjaria (2010)).

[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.

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.

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 channels 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 occurrence 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 occurrence of violence between "violence" and "no-violence" 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, 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 violence 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 growth across years and the fact that exports within any year follow a seasonal pattern. Let $Y(i)^{L}_{T,W}$ be the exports of flowers by firm i located in location L in period T in winter W. The indicator L takes a value of $L = 1$ if the firm is in a location that is affected by the violence after the election and $L = 0$ otherwise. The indicator L takes a value of $T = 1$ during the weeks in January and early February during which violence occurred and $T = 0$ during our control period, which are the 10 weeks before the end of December. Finally, the indicator W takes value equal to $W = 1$ in the winter during which the violence occurred - that is the winter of 2007/8 - and $W = 0$ for the previous winter. With this notation, a firm was directly affected during a particular spike of violence if and only if $V = L \times T \times W = 1$.

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., L. 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 change in exports between $T = 0$ and $T = 1$ is

[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). 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, sources to establish this variation are somewhat controversial.

constant across winters, it is possible to estimate the effects of the violence on production for each firm i by looking at the following difference-in-difference

$$\widehat{\gamma}^L(i) = \underbrace{(Y^L_{T=1,W=1} - Y^L_{T=1,W=0})}_{\Delta^L_{T=1}(i)} - \underbrace{(Y^L_{T=0,W=1} - Y^L_{T=0,W=0})}_{\Delta^L_{T=0}(i)}. \tag{11}$$

Intuitively, this means - for example - that the worldwide demand for flowers for the time of January and February *relative* to the ten weeks leading up to Christmas did not change. The first difference, $\Delta^L_{T=1}(i)$, compares exports during the time of the violence with exports at the same time in the previous winter. This simple difference, however, confounds the effects of the violence with a firm's growth rate across the two winters, which is of particular importance in a fast-growing sector. The second difference, $\Delta^L_{T=0}(i)$, provides an estimate of the firm's growth rate comparing the non-violence periods - the ten weeks before Christmas - in the two winters. Under the assumption that the growth rate between two successive winters is the same for the weeks before Christmas and in January/February, the difference-in-difference $\widehat{\gamma}^L(i)$ provides an estimate of the effects of the violence which controls for a firm's growth rate.[21]

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.

The two Panels highlight further differences between the two spikes of violence. Rows 3a and 3b in the two panels report the simple differences $\Delta^L_{T=1}(i)$ and $\Delta^L_{W=1}(i)$ and Row 4 the difference in difference. Column (A) and (B) report these for the control (the no-violence) and the violence region respectively. Rows 3a and 4 in Column (B) show that estimated coefficients for the simple difference and difference-in-difference estimates for violence are -1.7 and -1.3 (which translate roughly to a 38 % drop in exports, since the dependent variable is measured in the logarithm of kilograms)

Row 3a in Panel A highlights why accounting for seasonality is so important: The simple difference overestimates the effect of violence by -0.4, as it does not take into account the lower demand for flowers in the first few weeks of the year. This is also a possible expla-

[21] Appendix Table A4 uses data from the two seasons preceding the violence and shows that seasonality patterns are constant across seasons and similar across regions.

nation for the difference $\Delta_{W=1}^{L=0}$ within the no-violence region during the period of violence compared to the days before the violence, which is close to the same magnitude as in the previous year ([2b] - [2c]).[22]

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.

Cross-Regional Comparison: Triple Differences

Under the assumption that any change in the seasonality across winters is the same for the violence and no-violence areas (see Table W3 in the Web Appendix), firms in regions not directly affected by the violence could also be used as a control group to estimate the direct effects of the violence. Defining by $\overline{\Delta}^{L} = \frac{1}{N_C}\Sigma_{i \in C}\widehat{\gamma}^{L}(i)$ the average of the difference-in-difference estimates for each firm in location L, a triple difference estimate of the direct impact of the violence is given by

$$\Delta = \overline{\Delta}^{L=1} - \overline{\Delta}^{L=0}. \tag{12}$$

The triple difference estimates are presented in Column (C) of Row 4 in each of the two panels. These estimates, however, needs to be interpreted with caution since it could be contaminated by spillover effects. In particular, the simple difference results of Panel B of Table [2] provide some indication that firms not located in towns affected by the second spike of violence increased their exports volumes relative to the control period (see Column (A) and Row 3a). While this effect is not robust to controlling for seasonality (Row 4), 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] estimates the impact of the violence on production using daily export data. The estimated regression is given by

$$y_{id} = \alpha_i + \mu_L^m + \eta_L^d + \lambda_L^W + \theta \mathbf{W} \times \mathbf{T} + \gamma_{DDD} \left(\mathbf{W} \times \mathbf{T} \times \mathbf{L} \right)_{id} + \varepsilon_{id} \tag{13}$$

where y_{id} denotes exports of firm i on a particular date (e.g., January 20^{th}, 2008). Location $L \in \{0, 1\}$ and period $T \in \{0, 1\}$ are defined as above while winter $W \in \{0, 1\}$ is defined over

[22] While we cannot reject that there was no difference to the previous year, an alternative hypothesis is that there was a country-wide effect of the first spike of violence which made it difficult for firms to export, e.g., bottlenecks on the road network and airport traffic reductions, which is discussed in Glauser (2008).

all available years, i.e. with $W = 0$ indicating the three winters pre-dating the violence and $W = 1$ the winter of 2007/8. m denotes the day of the week (i.e., Monday, Tuesday...). The specifications control for firm-specific effects α_i; day of the year $\times$ location-specific effects η_L^d ; winter $\times$ location-specific effects λ_L^W (where we allow a different λ_L^W for each of the 4 winters)[23]; as well as day of the week $\times$ location-specific effect μ_L^m. Finally, ε_{id} is an error term.[24]

The indicator functions $\mathbf{W}$, $\mathbf{T}$ and $\mathbf{L}$ take values equal to one in, respectively, the winter, period and location in which the violence took place, and zero otherwise. Let us define being affected by violence as $V_{WTL} = \mathbf{W} \times \mathbf{T} \times \mathbf{L}$, and let $V_{WT} = \mathbf{W} \times \mathbf{T}$. The coefficient of interest is $\widehat{\gamma}_{DDD}$, which provides an estimate of whether, relative to the previous winters and to the control period, exports of firms in the violence affected areas behaved differently from exports in the no-violence 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 the winter. Column (2) builds on the previous specification controlling for firm fixed effects. Column (3) allows for different winter fixed effects in the violence and no-violence area (that is different growth across the violence and the no-violence regions between successive winters). 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 effects 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 violence and in the no-violence regions, when the violence terms V_{WT} and

[23]Note that the main effects $\mathbf{T}, \mathbf{L}$ and $\mathbf{W}$ and the interactions $\mathbf{T} \times \mathbf{L}$ and $\mathbf{W} \times \mathbf{L}$ are absorbed by η_L^d and λ_L^W respectively.

[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 using the Cameron et al. (2009) procedure.

V_{WTL} 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-violence 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 violence 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 precisely to the two spikes of violence. For a variety of reasons, however, it is interesting to consider a longer definition during which violence may have impacted on exports. First, sporadic violence occurred 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.

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. An extension of the model 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

We further explore the mechanisms through which firms were exposed and reacted to the violence by looking for heterogenous effects. In particular, the model delivers testable predictions for heterogeneity in the effects of ethnic violence with respect to a firm's size and marketing channel. While firms in the violence and no-violence regions appear to be broadly comparable along observable characteristics (see Table [1]) the same is not true across locations within the violence and no-violence regions. For example, firms around the Naivasha lake are larger than firms in Limuru. Since 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.[25]

Table [5] reports the heterogeneity results where we include a dummy for the violence period interacted with location dummies to control for location specific 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. In order to maximize sample size, we focus on interactions of the violence dummy with variables that are available for all firms in the industry from the administrative data, and do not consider firms characteristics obtained from the survey. The firms characteristics available in the administrative data are firm size, marketing channels, membership in the floriculture business association, composition of exports, fair trade certification, and ownership characteristics (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 specific dummies.

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.

The results could, in principle, be driven by systematic differences in the composition of the labour force across firms. For example, firms employing a higher percentage of the minority group in a given town might suffer higher workers and export losses. Similarly, women and more educated workers might be differentially affected by the violence. Information collected in the survey, however, suggests that these differences are unlikely to be driving the results. Within narrowly defined locations, the firms characteristics used in Table [5] do not correlate with the ethnic composition, education and gender of the firms employees. Since we allow the intensity of the violence to vary across location in a flexible way, the heterogeneity results are unlikely to be driven by systematic differences across firms

[25]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.

along those dimensions. Firms, however, do differ with respect to the percentage of seasonal workers they employ. In particular, firms exporting through the auctions employ a higher share of seasonal workers. Unreported results, however, show that the findings in Table [5] are robust to the inclusion of the interaction between the share of seasonal workers and the violence dummy. Furthermore, even controlling for the share of seasonal workers, firms exporting through the auctions loose a higher share of workers during the violence (see Table [8] below).

4.3 Worker Loss and Transportation Problems

Given the absence of violence targeted towards flower firms or occurring on their premises, the main channels through which the violence affected firms in the violence region relative to firms in the no-violence region was through a) absence of workers and b) transportation problems. Using data from the firm level survey we conducted in Kenya, this section complements the results in Table [4] to disentangle the relative importance of the two channels.

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 violence region that we have used in the reduced form specifications above. In particular, we find that firms located in the violence 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.

Table [7] reports the results.[26] Column (1) simply recovers an average reduced form effect of the violence at the week level. The estimated coefficient is similar to the esti-

[26]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.

mates 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 violence 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 keeping 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, iii) characteristics of the labor force, such as gender, education, ethnicity and share of seasonal workers, iv) owners' identity, and v) product variety and proxies for capital invested in the firm.[27]

[27]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, once location dummies are included in the regression. However, most of the variation in owner's and workers' ethnicity comes from differences across locations. It

Given the evidence collected in the field, we believe that the set of firm characteristics we can directly control for captures the most relevant dimensions of firms heterogeneity in terms of exposure and reaction to the violence. Still, it is possible that other unobservable characteristics correlate with a firm's exposure and reaction to the violence as well as size and marketing channels. Consequently, caution must be exercised before interpreting the results in Table [5] and Table [8] as causal effects of firm size or marketing channel on exports and workers retention during the violence. Subject to this caveat, the available evidence strongly support the predictions of the model and suggests that the institutional arrangements developed to succeed in competitive and integrated international value chains gave firms higher incentives to react and limit the disruptions caused by the violence.

4.4 The Welfare Costs of the Violence: Model Calibration

Model Calibration

This section combines the firm-specific reduced form estimates of the effects of the violence on production, Δ^v, 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, c^v. As clarified by equation (8) in Section 3, the cost of the violence for the marginal worker c^v can be recovered combining the reduced form estimates of the effects of the violence on production, Δ^v,with knowledge of the firm's revenues per worker during normal times, R^*, and estimates of η and γ.

Weekly revenues per worker R^* in normal times are easily computed, for each firm, by dividing a firm's export revenues in normal times, proxied by the median weekly revenues during the ten weeks control period that preceded the violence (which are available from custom records), by the number of workers employed by the firm (which is available, for the same period, from the survey).

We assume that the parameters γ and η 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 $\psi = \frac{1}{1+\gamma}$. 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 $y^* = \frac{1}{\gamma+1}R^*$. With $\gamma = 4$ this gives $\widehat{y}^* \simeq 1300$ Kenyan Shillings for workers at the median firm (or 14.5 Euro at pre-violence exchange rates). This estimate nicely matches the reality on the ground.

is, therefore, difficult to disentangle these from location specific effects.

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 ψ in the range $\psi \in [0.1, 0.25]$.

Once γ is known, the parameter η 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 $\gamma = 4$.[28]

Finally, the reduced form effect of the violence on production Δ^v 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, Δ^v, and the revenues per worker in normal times, R^*, are available for each firm separately, the model can be calibrated for each firm. Note that by comparing the share of retained workers reported in the survey with the corresponding estimates from the model calibration it is possible to further validate the consistency of the model with the data. Results show a 0.73 correlation between the two variables 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 violence region. The sample is given by the 42 firms who were surveyed in the violence region. The different Columns in the Table report results using alternative choices of the share of wages in revenues ψ. 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 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

[28] A similar estimate of η can be recovered from the cross-sectional correlation between log production and log workers. We prefer, however, to recover η 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.

for the costs c. 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 small 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 $\pi_m^v = 1 - \frac{1.15}{0.9} \times 0.9 = -0.15$. Given the estimates, therefore, the median firm in the violence 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 c^v 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 $c \leq c^v$ went to work during the violence and incurred those costs. The model, however, assumes that these workers were fully 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 c^v, 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 δ, e.g., physical, psychological and logistical, of going to work during the violence, ii) the opportunity costs, σ, e.g., the net value of attending to one's property or family, or returning

to the region of original provenance.[29] Workers that missed work during the violence, did not suffer the direct cost δ. The opportunity cost σ, 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 δ is a quantitatively small component of c relative to σ.

The model assumes that workers' participation constraint during normal times is binding. The assumption might be violated, for example, in a dynamic model in which firms must pay efficiency wages and workers earns rents. If that was the case, our results might underestimate the costs imposed by the violence. Consider first those workers that do not come to work because of the violence. In a model with binding participation constraint the loss in weekly earnings is, by definition, fully compensated by higher leisure. In a model without binding participation constraint, instead, the reduction in earnings would not be fully compensated by the increase in leisure and our estimates would miss that effect. Note that the loss in earnings might have been quite severe at a time in which retail prices were increasing due to the violence (see, e.g., Dupas and Robinson (2010)). For the workers coming to work, instead, the non binding participation constraint implies that firms might have not had to fully compensate workers with higher wages. This could happen, e.g., if the incentive compatibility constraint only depends on future wages, and not on the current one, as in the baseline efficiency wage model.

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

[29]Given the nature of the violence and the fact that the industry mostly 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.

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 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.[30]

5 Conclusions

This paper combined detailed customs records on production with a representative survey of flower firms to i) provide evidence of the effects of electoral 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.

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 what would have happened had the violence not occurred. Consistent with the predictions of our 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. Both sets of results hold controlling for a large number of firm-level variables, including location, labour force and owner characteristics. In particular, the results do not appear to be driven by differences in ethnic composition of the labour force across firms, nor by differences in working arrangements at the firm (e.g., percentage of seasonal workers, or fair trade certifications and other social programs). We also find that the main channel through which the violence affected production was through workers' absence, which averaged 50% at the peak of the violence,

[30]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.

rather than transportation problems which seem to have been solved by firms' coordinated action through the industry association. Taken together, the evidence suggests that institutional arrangements developed to export in integrated non-traditional agricultural value chains gave firms higher incentives and lower costs to react and limit the disruptions caused by the violence.

The model calibration suggests that the average firm in the affected areas suffered at least a 16% increase in operating costs due to the violence, in addition to a 30% drop in revenue. Even if 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 associated with the violence.

An interesting question, albeit one that we cannot directly speak to, is whether the presence of flower firms affected the degree of participation in the violence. Despite multi-ethnic labor forces, available evidence shows very limited violence directed towards firms as well as happening on firms premises. In line with the findings in this paper, it is possible that the export oriented nature of the industry contributed to stabilizing the situation, due to a mix of contractual obligations with foreign buyers and pre-existing institutional forums to achieve coordination (e.g., a well-functioning business association). This would suggest a new micro-economic channel on the relationship between electoral violence, local institutions and international trade. Given its policy implications, exploring the relevance of this hypothesis is an important area 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.[31] 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 Π^*, 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,

[31] 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, $D^v > D^*$. 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 $D^v = D^*$. For these firms, the only effect is $q^v < q^*$. For firms for which $D^v > D^*$, however, the quantity of flowers exported in each shipment might increase, since $\Sigma_{i=0}^{D^v} \delta^i q^v \leq \Sigma_{i=0}^{D^*} \delta^i q^*$. 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.[32] 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)[33], during the post election violence DEPHA provided maps with hot spots on where and when the violence had occurred,[34](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,[35] (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

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

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

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

[35]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

Variable	Observations	Mean in No-Violence	SE No-violence	Mean in Violence	SE Violence	*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 Violence, Survey Data

Variable	Observations	Mean in No-Violence	SE No-violence	Mean in Violence	SE Violence	*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*
Violence 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 violence and firms in regions unaffected by the violence 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 violence and firms in regions unaffected by the violence 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 violence 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-Violence Location Winter 1: # of Firms: 85 Winter 0: # of Firms: 85	(b) Violence Location Winter 1: # of Firms: 19 Winter 0: # of Firms: 19	(c) Viol. - No-Viol. Diff. Total # of Firms 104
1	Treatment Period	Winter 1: Days of Violence [29 Dec 2007 - 4 Jan 2008]	6.17 [2.225]	5.476 [2.683]	-0.695 (0.652)
2a	Control Periods	Winter 1: Control Period [4 Nov 2007 - 22 Dec 2007]	6.619 [1.497]	7.185 [1.438]	0.566 (0.363)
2b		Winter 0: Days of Violence [29 Dec 2006 - 4 Jan 2007]	6.363 [1.790]	6.745 [1.256]	0.382 (0.366)
2c		Winter 0: Control Period [4 Nov 2006 - 22 Dec 2006]	6.642 [1.614]	7.066 [1.171]	0.426 (0.319)
3a	First Differences	[1]-[2a]	-0.449*** (0.129)	-1.709*** (0.472)	-1.261*** (0.476)
3b		[1]-[2b]	-0.193 (0.193)	-1.270** (0.559)	-1.077** (0.477)
4	Difference in Difference	([1]-[2a]) - ([2b]-[2c])	-0.171 (0.179)	-1.389*** (0.491)	**Triple Difference** -1.218** (0.508)

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

			(a) No-Violence Location Winter 1: # of Firms: 50 Winter 0: # of Firms: 50	(b) Violence Location Winter 1: # of Firms: 54 Winter 0: # of Firms: 54	(c) Viol. - No-Viol. Diff. Total # of Firms 104
1	Treatment Period	Winter 1: Days of Violence [25 Jan 2008 - 30 Jan 2008]	7.015 [1.207]	6.09 [2.585]	-0.925** (0.391)
2a	Control Periods	Winter 1: Control Period [4 Nov 2007 - 22 Dec 2007]	6.791 [1.345]	6.659 [1.632]	-0.132 (0.292)
2b		Winter 0: Days of Violence [25 Jan 2007 - 30 Jan 2007]	6.522 [1.910]	6.42 [2.222]	-0.152 (0.411)
2c		Winter 0: Control Period [4 Nov 2006 - 22 Dec 2006]	6.54 [1.700]	6.604 [1.426]	0.104 (0.314)
3a	First Differences	[1]-[2a]	0.224** (0.108)	-0.569** (0.236)	-0.793*** (0.259)
3b		[1]-[2b]	0.493* (0.264)	-0.330 (0.282)	-0.823** (0.385)
4	Difference in Difference	([1]-[2a]) - ([2b]-[2c])	0.242 (0.278)	-0.385** (0.156)	**Triple Difference** -0.627** (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 Violence 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 Violence 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: Violence and No-Violence 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 * Violence 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 * Violence 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)
Violence location (yes=1)	-0.396	-	-	-	-	-
	(0.417)					
	Panel B: Violence 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
Winter	yes	yes	-	-	-	-
Day of year * Violence (yes =1)				yes	yes	yes
Winter * Violence (yes=1)			yes	yes	-	-
Firm * Winter					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 winters from 2004/05 to 2007/08. Violence 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. Winter dummies are separate dummies for the 4 winters. Standard errors, clustered at the firm and winter-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 * Violence 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 * Violence 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 * Violence (yes =1)	yes	yes	yes	yes	yes
Winter * Violence (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 winters from 2004/05 to 2007/08. Violence 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 violence region are the towns of Eldoret, Kitale, Elburgon, Kericho and Nakuru. For the second outbreak of violence the Violence 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 winter-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) * Violence location (yes=1) * Small Firm (yes =1)	-1.101***							-0.504**
	(0.160)							(0.244)
Days of Violence (25 Jan 2008 - 30 Jan 2008) * Violence location (yes=1) * Only Auction (yes =1)		-0.545***						-0.769***
		(0.154)						(0.245)
Days of Violence (25 Jan 2008 - 30 Jan 2008) * Violence location (yes=1) * Only Roses Exported (yes			-0.008					0.192
			(0.115)					(0.290)
Days of Violence (25 Jan 2008 - 30 Jan 2008) * Violence 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; however ,the regressions also include the main effects and interactions with location, period and winter. See Data Appendix for source of variables. The specification allows the intensity of violence to differ across locations. Location specific growth, seasonality (date) and firm fixed effects are also included. Standard errors in ( ) are obtained by multi-way clustering at the firm-winter and location-winter-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?
Violence 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-Violence 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. Violence 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) * Violence 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) * Violence location (yes=1) * Small Firm (yes=1)					0.088	
					(0.518)	
Week of Violence (yes=1) * Violence location (yes=1) * Only Auction (yes=1)						-0.299
						(0.708)
Fixed Effects						
Firm * Winter	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 value equal to 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 location-winter-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 violence 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 violence 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 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 earnings 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: Electoral Violence in Sub-Saharan Africa

Country	Year	Characteristics of Violence (Examples)
Mauritania	1992	
Comoros	1992	
Angola	1992	
Cen. Africa Rep.	1992	
Kenya	1992, 1997, 2007	Election fraud [2 months, 1,113 + dead]
Nigeria	1992, 1993, 1999, 2007	State sponsored violence against opposition [200+ dead]
Senegal	1993	
Togo	1993, 1994, 1998, 2003, 2005	State sponsored violence against opposition [700+ dead, 40,000+ fled to nearby country]
EQ Guinea	1993, 1996, 1999, 2004	
Guinea	1993, 1998, 2010	Opposition protest over military junta [1 day, 156 dead]
DR Congo	1993, 2006	Opposition reject run-off results [3 weeks +, 200+ dead]
South Africa	1994, 1999	
Cote d'Ivoire	1995, 2000, 2010	Postponing of presidential elections [1 day, 5 dead, 10+ wounded]
Sudan	1996, 2000	
Niger	1996	
Lesotho	1998	
Nigeria	1999, 2003, 2007	State sponsored violence against opposition [200+ dead]
Tanzania	2000	
Zimbabwe	2000, 2002, 2005, 2008	State sponsored violence against opposition [180+ dead, 1000+ abductions, tortures etc]
Ethiopia	2000, 2005	Demonstration by opposition against electoral fraud [1 day, 36 dead, 100+ wounded]
Madagascar	2001, 2009	Anti-government protests by opposition [9 months, 135+ dead]
Burundi	2005	

The Tables updates the records in Straus and Taylor (2009). Straus and Taylor (2009) study 213 elections (presidential and parliamentary) in 45 African countries during the period 1990-2007. Electoral violence is defined as those elections that feature repression, a violent campaign, and incidents leading to 20 or more deaths. Sources: Lindberg (2006), Straus and Taylor (2009) and UN General Assembly – *Election-related violence and killings* (2010).

Table A2: Location of Firms and Definition of Violence

Province	Town (No. of Firms)	First Outbreak of Violence: Violence =1, No-conflict=0	Second Outbreak of Violence: Violence =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 A3: 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 A4: Placebos -- No Differential Seasonality Across Regions

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

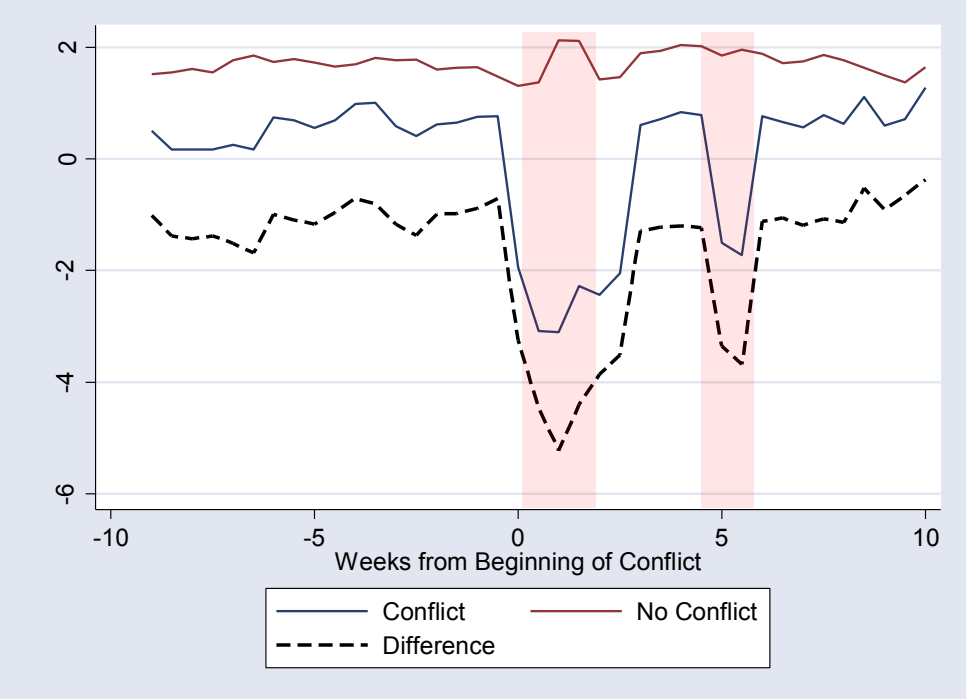
			Non-Violence Region	Violence Region	Violence - Non-Violence Difference
1	Treatment Period	Winter -1:Violence Period [29 Dec 2005 - 4 Jan 2006]	5.844 [2.722]	6.744 [1.986]	0.899 (0.554)
2a	Control Periods	Winter -1: Control Period [4 Nov 2006 - 22 Dec 2006]	6.154 [2.269]	6.81 [2.07]	0.656 (0.544)
2b	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

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

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

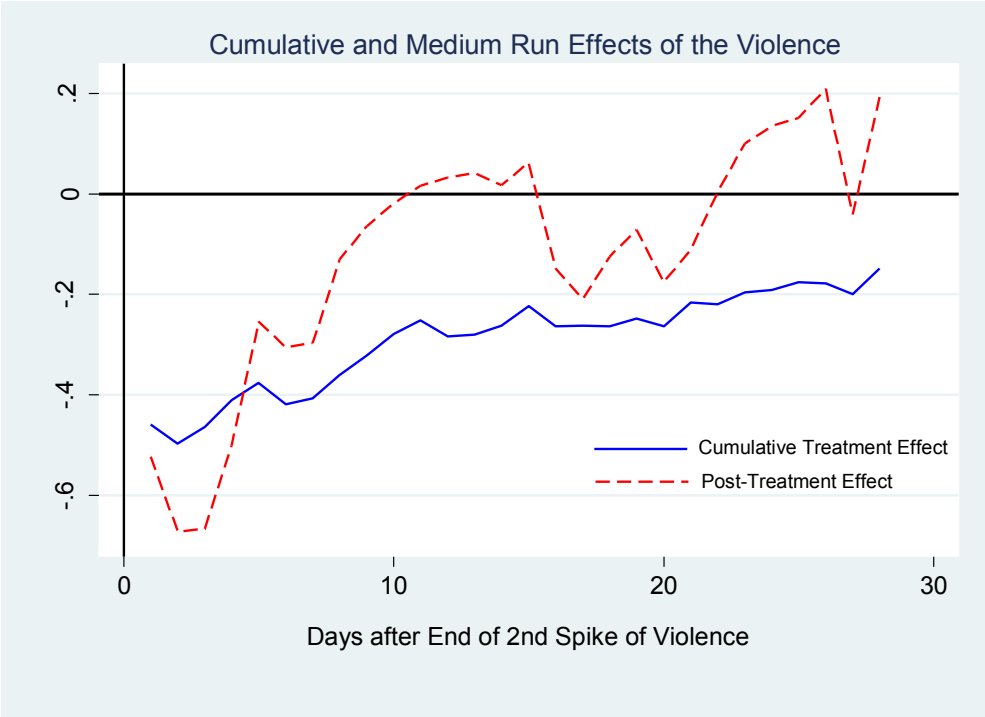
***, **, * denote statistically significance at 1, 5, 10 percent, respectively. Columns (a) and (b) report means of average daily export weight (in log kgs) in rows 1-2(c) (standard deviation are reported in parenthesis). Column (c) reports the corresponding difference, with standard errors in ( ) clustered at the firm level. In Panel A: Violence 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: Violence 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



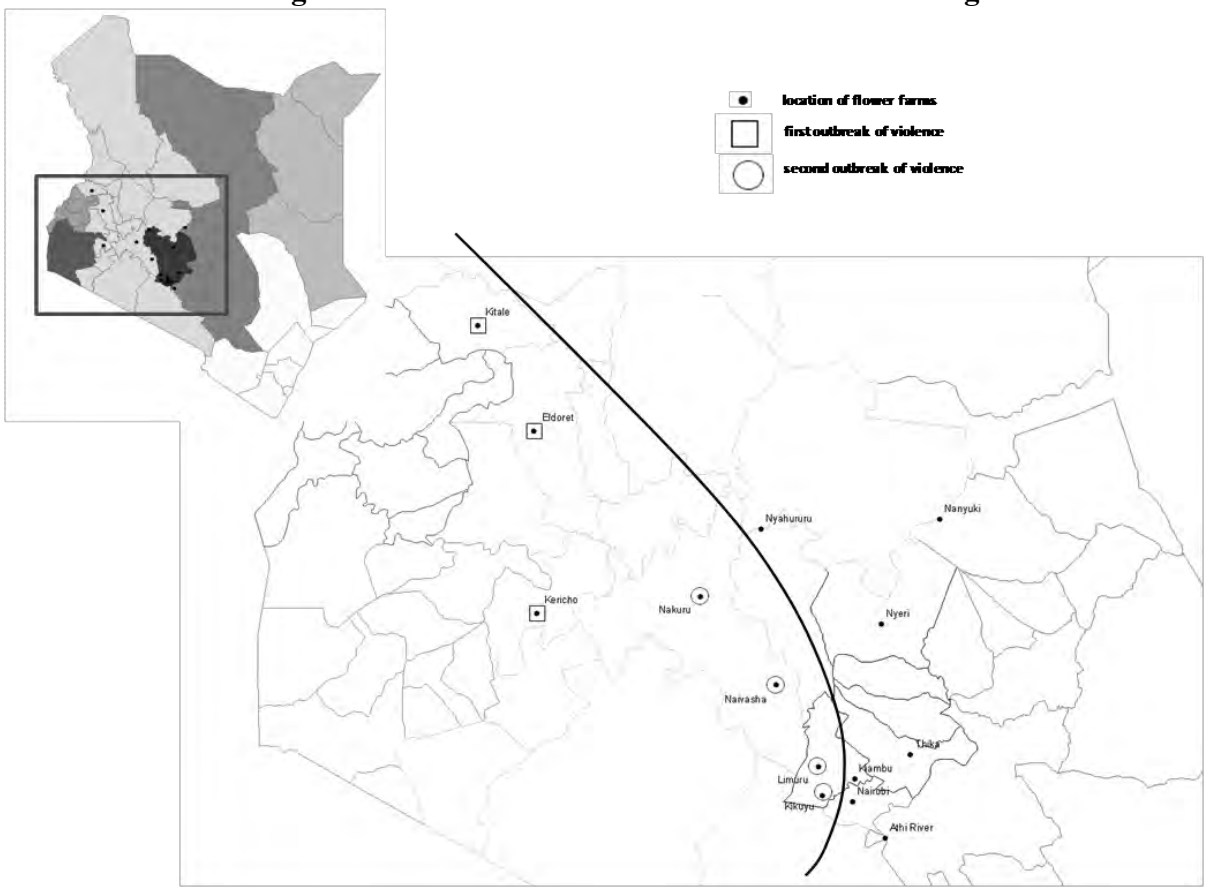
Notes: The figure shows the median biweekly residual of a regression that controls for firm specific seasonality and growth patterns in *violence* and in *no-violence* locations for the 10 weeks before and 10 weeks after the first outbreak of violence.

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.