ELECTORAL VIOLENCE AND SUPPLY CHAIN DISRUPTIONS IN KENYA'S FLORICULTURE INDUSTRY

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Abstract—Violent conflicts, particularly at election times in Africa, are a common cause of instability and economic disruption. This paper studies how firms react to electoral violence using the case of Kenyan flower exporters during the 2008 postelection violence as an example. The violence induced a large negative supply shock that reduced exports primarily through workers' absence and had heterogeneous effects: larger firms and those with direct contractual relationships in export markets suffered smaller production and loss of workers. On the demand side, global buyers were not able to shift sourcing to Kenyan exporters located in areas not directly affected by the violence or to neighboring Ethiopian suppliers. Consistent with difficulties in ensuring against supply-chain risk disruptions caused by electoral violence, firms in direct contractual relationships ramp up shipments just before the subsequent 2013 presidential election to mitigate risk.

I.   Introduction

IN many countries, political instability is a potentially major hindrance to firm performance. In the African context, violent conflicts, particularly at election times, are a common cause of instability and disruption (Bates, 2001, 2008). During the period from 1990 to 2018, 23% of the 348 elections that took place in sub-Saharan Africa witnessed postelectoral violence (see figure 1).
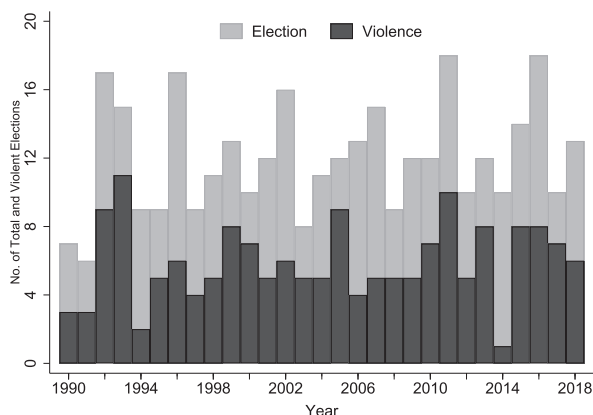
Cross-country studies (e.g., Alesina et al., 1996; Collier, 2007; Glick & Taylor, 2010) show that violent conflicts have negative effects on growth, investment, and trade at the macro-level. Micro-level evidence on the impact of violence on economic activity through firms' operations, necessary to understand the underlying mechanisms and formulate appropriate policies, remains limited. There are two major empirical challenges to providing micro-level evidence: (a) gathering detailed information on the operations of firms before, during, and after the conflict and (b) constructing a valid counterfactual that is, assessing what would have happened in the absence of the violence.

This paper investigates the mechanisms and costs of disruptions induced by the postelectoral violence in 2008 on the Kenyan floriculture industry. Export development is important to promote growth and poverty reduction in low-income countries (Rodrik, 2005). The Kenyan floriculture industry provides an important example: one of the largest earners of foreign currency, the industry is also a major employer of lower-educated women in rural areas. Besides its intrinsic relevance, the setting allows us to overcome the empirical challenges identified above. Kenyan flowers are produced almost exclusively for the export market. Since flowers are perishable, daily data on exports, available from trade transaction 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 so the export data can also be matched with the exact location where flowers are produced.[1] The ethnic violence that followed the elections in Kenya at the end of 2007 did not equally affect all regions of the country where flower firms 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. We also designed and conducted a survey of flower firms in Kenya shortly after

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

FIGURE 1.—ELECTIONS AND VIOLENCE IN SUB-SAHARAN AFRICA

Panel A: Violence anytime during an election year   Panel B: Violence post-election
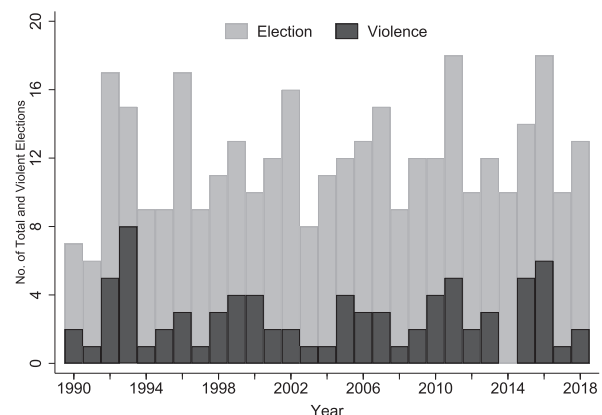
Light gray histogram represents the total number of elections across sub-Saharan Africa in a given year between 1990–2018. The black histogram overlaid on the gray represents the total number of elections that encountered violence. Calendar year is represented on the *x*-axis, and the *y*-axis shows the number of total and violent elections. The figure highlights the frequency of elections in Africa that were associated with violent episodes at any time (panel A) and postelection (panel B) within the calendar year corresponding to the election. Data on elections with and without violence were compiled and calculated from the universe of all country-specific Human Rights Reports published by the U.S. Department of State. A review of available sources and news articles reveals that of the fourteen presidential, parliamentary/legislative elections held in 2019, eight saw violence before, during, or after the vote. Appendix E provides additional details.

the end of the violence. The survey collected information on how firms were affected by and reacted to the violence. Once combined with the administrative data, the survey sheds light on the mechanisms through which the violence affected the firms.

Our core finding is that the electoral violence induced a large, negative, supply shock in the industry. Controlling for firm-specific seasonality and growth patterns, weekly export volumes of firms in the affected regions dropped, on average, by 56% relative to what would have happened had the violence not occurred. With regard to mechanisms, we show two sets of results. First, we find that workers' absence, which across firms averaged 50% of the labor force at the peak of the violence, was an important channel through which the violence affected production. Second, we explore heterogeneity in both firms' exposure and response to the violence. 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. Rather than being less exposed to the violence, we argue that these exporters had stronger incentives to maintain production to preserve valuable reputation in export markets and, accordingly, exerted more effort to retain workers. These results hold even after controlling for characteristics of the labor force (gender, ethnicity), working arrangements (housing programs on the farm, farm certifications), and ownership (foreign, politically connected). After accounting for these characteristics, we find no evidence that foreign-owned firms, politically connected firms, or certified firms suffered differential reductions in exports and worker absence.

Given the large negative supply shock, it is important to understand how the demand side of the market reacted to it. We document that at the time of the violence, global buyers sourcing through direct relationships were not able to shift sourcing of flowers to Kenyan suppliers in unaffected locations or to suppliers in neighboring Ethiopia. Buyers' diffi-

culties in finding alternative sources of supply are consistent with exporters' efforts to maintain deliveries. They also suggest that supply-chain risks induced by electoral violence are hard to insure against. Consistent with this hypothesis, exporters and buyers in direct contractual relationships mitigated the risk of supply-chain disruptions ahead of the subsequent 2013 presidential election by ramping up shipments just before the election.

This work contributes firm-level evidence on the impact of conflict on trade and firms, on the mechanisms that underpin its impact and on the emerging literature on supply-chain disruptions.[2] The literature on the impact of conflict on trade has largely studied disruptions at a more aggregate level (Collier & Hoeffler, 1998; Besley & Persson, 2008; Martin, Mayer, & Thoenig, 2008; Glick and Taylor, 2010). More recently, Korovkin and Makarin (2023) estimate the effects of conflict on trade in nonconflict areas at the micro-level using customs transactions between Russia and Ukraine. Our paper documents the effect of conflict on directly affected firms and the underlying mechanisms.

Recent contributions have greatly expanded our understanding of how conflict affects firms' performance. It may affect firm performance through supply-side shocks such as distortions in markets for material and labor inputs (Amodio & Di Maio, 2017; Klapper, Richmond, & Tran, 2013; Collier & Duponchel, 2013), unreliable transport, or the fear of theft; demand shocks from negative income effects (Montoya, 2016; Rozo, 2018); or effects at the extensive margin that influence firms' entry, exit, and location choices (Blumenstock et al., 2018). Hjort (2014) also studies the Kenyan flower industry in the aftermath of the 2008 presidential elections, although he focuses on the operations of an individual

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[2]Dercon and Gutiérrez-Romero (2012) and Dupas and Robinson (2012) provide survey-based evidence of the violence that followed the Kenyan presidential elections. The large literature on conflict is surveyed in Blattman and Miguel (2010).

flower farm (whereas we provide sector-wide firm-level evidence), and the effects of conflict on firm performance through the channel of ethnic divisions within a firm.[3] Our paper contributes to the literature by characterizing both the supply-side and demand-side responses to a short-lived but intense episode of violence. Our evidence also suggests that the business arrangements developed by firms to participate in global value chains are important in determining the impact of conflict on trade.[4]

Finally, the paper contributes to the emerging literature on supply-chain disruptions. For example, Carvalho et al. (2021) exploit the Great East Japan Earthquake of 2011 to quantify the role of input-output linkages as a mechanism for the propagation of shocks. Barrot and Sauvagnat (2016) also study the extent to which firm-level shocks induced by natural disasters propagate in production networks and find particularly large effects for inputs that require specific investments.[5] Finally, Macchiavello and Morjaria (2015) study relational contracts between exporters and global buyers in the Kenyan floriculture industry.[6] They exploit the same episode of electoral violence to distinguish across competing models of relational contracting. The two papers are notably different. Unlike this paper, they focus on within-exporters differences in behavior across relationships and treat the electoral violence as a reduced form of shock. In contrast, this paper documents the mechanisms through which the violence was a supply shock and explores across-firms heterogeneity in the incidence of, and response to, the violence. Using novel data, this paper also discusses the extent to which global buyers responded by shifting sourcing across regions in Kenya and across the border to Ethiopia and by adjusting ahead of the subsequent presidential election.

The remainder of the paper is organized as follows. Section II provides background information on the Kenyan flower industry and the postelectoral violence and describes the data. Section III presents the estimation strategy and empirical results. Section IV discusses policy implications of our findings and offers concluding remarks. A theoretical framework, additional robustness checks and details about the data are provided in the Appendix.

[3]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. In contrast to stock market reactions, our data allow us to unpack the various channels through which the violence has affected firms' operations.

[4]A complementary strand of the literature studies the impact of trade on conflict. For example, Dube and Vargas (2013) find that an increase in the international price of a labor-intensive (capital-intensive) export commodity reduces (increases) violence in Colombia. Amodio, Baccini, and Di Maio (2021) show that the imposition of trade restrictions contributes to conflict by inducing a deterioration in manufacturing and local labor market outcomes. We find suggestive evidence that at the time of the violence, stable contractual relationships in export markets might have provided incentives to limit the impact of the violence.

[5]Blouin and Macchiavello (2019) show that the risk of delivery failures increases at times of sudden price spikes due to moral hazard.

[6]See also Antić, Morjaria, and Talamas (2023) on contractual relationships and export strategies in the Ethiopian flower industry.

II.   Background and Data

A.   Kenyan Flower Industry

In the the past two decades, Kenya has become one of the leading exporters of flowers in the world. Between 2005 and 2015, Kenya's share of the global floriculture increased from 5% to 11%, with the country overtaking traditional producers such as Israel and Ecuador. Exports of cut flowers are among the largest sources of foreign currency for Kenya alongside tourism and remittances. The Kenyan flower industry counts around 100 established firms located in various clusters in the country.

Coordination along the supply chain is critical to ensure the supply of high-quality fragile and perishable flowers to distant markets. Flowers are handpicked 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 women in rural areas. The perishable nature of the flowers implies that postharvest 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 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, the relationship between the exporter and the foreign buyer is governed through a (nonwritten) relational contract.

B.   Electoral Violence

Kenya's fourth multiparty general elections were held on December 27, 2007, and involved two main candidates: the incumbent, Mwai Kibaki (an ethnic Kikuyu hailing from the Central province representing the Party of National Unity (PNU)), and Raila Odinga (an ethnic 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 (Gibson & 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 challenger led on the first day of counting (December 28), leading to an initial victory declaration by ODM (December 29). However, also on the 29th, the head of the Electoral Commission declared Kibaki the winner by a margin of 2%. The hasty inauguration of Kibaki on the afternoon of the December 30 resulted in

Odinga's accusing the government of fraud.[7] Within minutes of the election results announcement, a political and humanitarian crisis erupted nationwide. Targeted ethnic violence broke out in various parts of the country, especially in Nyanza, Mombasa, Nairobi, and parts of the Rift Valley, where ODM supporters 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 January 25 and 30, 2008. This second phase of violence happened mainly in the areas of Nakuru, Naivasha, and Limuru as a revenge attack on members of ethnic groups perceived to be ODM supporters.[8] Sporadic violence and chaos continued until a power-sharing agreement was reached on February 29, 2008 (a calendar of events is provided in appendix figure A1, which we use as a basis for defining the days of violence). 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.[9]

C. Data

Firm-level data. Daily data on exports of flowers are available from trade transaction records for the period from September 2004 to June 2013. We restrict our sample to established firms that export throughout the majority of the floriculture season. For most of the analysis, we exclude flower traders as they account for a relatively tiny share of exports and we lack information on the location of farms where they source flowers. This leaves us with 118 flower-producing firms. The firms in our sample cover more than 90% of all exports of flowers from Kenya. We complement the Kenyan transaction data with records from neighboring Ethiopia for the 2007–2010 period.

To complement these 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 with the most senior person at the firm, which on most occasions was the owner. A sample of 75 firms, about three-fifths of established exporters, located in all the producing regions of the country, was surveyed (additional details on the data collection are in appendix E). Additional administrative information on location and ownership char-

acteristics was collected for the entire sample of firms (see table 1).[10]

Location and days of violence. We classify whether firms are located in areas that were affected by violence or not.[11] The primary source of information used to classify whether a location suffered from violence is the *Information Bulletin on the Electoral Violence* (Kenya Red Cross Society, 2008). These bulletins contain daily information on which areas suffered violence and what form the violence took (e.g., deaths, riots, burning of property). This information is supplemented by various sources (see appendix E for details). The first spike of violence took place from December 29, 2007, to January 4, 2008, while the second spike took place from January 25 to 30, 2008.

III. Evidence

This section presents the empirical results. Section IIIA summarizes the key predictions of the model in appendix C. Section IIIB discusses the identification strategy and presents reduced form effects of the violence on production. Section IIIC discusses a variety of robustness checks and other outcomes. Section IIID introduces information from the survey to disentangle the main channels through which the violence affected the industry and considers heterogeneous effects for the firms during the violence. Finally, section IIIE considers the extent to which global buyers could react to the violence by shifting sourcing elsewhere and how the supply chain responded to increased risk ahead of the subsequent presidential election in 2013.

A. Conceptual Framework

The appendix presents a theoretical framework to understand how firms were affected by, and reacted to, the violence. The model focuses on the aspects that are the most salient to understand the particular episode we study and is not meant to portray a comprehensive treatment of how firms might be affected by violence. In particular, we take a short-run perspective in which a firm's capital and other input decisions are fixed, assume an exogenous price for output not affected by the violence, and abstract from how the violence might increase uncertainty.

The framework delivers a set of testable predictions on the short-run effects of the violence on the firms:

1. Export volumes decrease due to the violence. Furthermore, the likelihood of exporting on any given day also decreases because of the violence, but export volumes conditional on exporting might either increase or

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[7]According to domestic and international observers, the vote counting was flawed with severe discrepancies between the parliamentary and presidential votes (see, e.g., https://www.iri.org/kenyas-2007-presidential-and-local-elections and https://www.foreign.senate.gov/imo/media/doc/MozerskyTestimony080207a.pdf)

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

[9]The economic effects of the crisis were extensively covered in the international media. See, e.g., *International Herald Tribune* (January 29, 2008), Reuters (January 30, 2008), *China Daily* (February 13, 2008), MSNBC (February 12, 2008), *Economist* (February 7, 2008, and September 4, 2008), *Business Daily* (August 21, 2008), and *East African Standard* (February 14, 2008).

[10]We also gathered qualitative information on firms' behavior in preparation for the 2013 Kenyan presidential election through phone interviews with a few firms.

[11]Appendix table B1 lists the flower-growing clusters according to industry reports in which firms are located. Appendix figure A2 shows the nearest towns where these firms are located in Kenya.

TABLE 1.—DESCRIPTIVE STATISTICS

A: Firms in Areas with and without Violence, Administrative Records

Variable	No violence		Violence		
	Mean	SE	Mean	SE	P-value
Daily Exports in kg (IHS)	11.54	(0.20)	10.95	(0.28)	0.10
Small	0.42	(0.07)	0.47	(0.06)	0.64
Foreign Owner	0.32	(0.06)	0.42	(0.06)	0.22
Indian Owner	0.21	(0.05)	0.21	(0.05)	0.98
Kenyan Owner	0.40	(0.07)	0.30	(0.06)	0.25
Politically Connected Firm	0.28	(0.06)	0.15	(0.04)	0.08*
Exports to Auctions	0.40	(0.07)	0.26	(0.06)	0.10*
Production in Roses	0.56	(0.07)	0.53	(0.06)	0.79

B: Firms in Areas with and without Violence, Survey Data

Variable	No violence		Violence		
	Mean	SE	Mean	SE	P-value
Number of Workers Jan 2008	521.89	(112.59)	441.13	(45.34)	0.44
Female Workers (%)	61.42	(2.18)	64.39	(2.68)	0.42
Temporary Workers (%)	18.56	(4.98)	23.78	(4.37)	0.45
Workers with Primary Education (%)	90.40	(1.57)	91.21	(1.46)	0.71
Workers Housed	0.48	(0.10)	0.30	(0.07)	0.13
Entry Year	1997	(1.06)	1999	(0.72)	0.03**
Association Member	0.67	(0.09)	0.49	(0.08)	0.15
Certification	0.81	(0.08)	0.69	(0.07)	0.25
Number of Insulated Trucks	1.42	(0.24)	1.05	(0.24)	0.29
Sold to Direct Buyers (%)	50.36	(8.73)	38.54	(6.73)	0.28
Workers at Risk (%)	12.38	(2.73)	32.57	(4.89)	0.00***
Affected Operations	0.37	(0.09)	0.87	(0.05)	0.00***
Experienced Worker Absence	0.23	(0.08)	0.87	(0.05)	0.00***
Workers Lost (%)	4.15	(2.72)	49.33	(5.75)	0.00***
Production Loss because of Worker Absence	0.26	(0.17)	2.35	(0.20)	0.00***
Transportation Problems	0.26	(0.09)	0.64	(0.07)	0.00***
Hire Extra Security	0.08	(0.06)	0.38	(0.08)	0.01***

C: Surveyed versus Nonsurveyed Firms, Administrative Records

Variable	No violence		Violence		
	Mean	SE	Mean	SE	P-value
Export, Jan-Feb 2007, in kg '000	10.82	(0.31)	11.50	(0.21)	0.06*
Violence Region	0.40	(0.07)	0.63	(0.06)	0.01**
Small	0.51	(0.07)	0.40	(0.06)	0.26
Foreign Owner	0.34	(0.07)	0.40	(0.06)	0.52
Indian Owner	0.20	(0.06)	0.22	(0.05)	0.80
Kenyan Owner	0.34	(0.07)	0.36	(0.06)	0.85
Politically Connected Firm	0.20	(0.06)	0.22	(0.05)	0.80
Exports to Auctions	0.38	(0.07)	0.28	(0.06)	0.27
Production in Roses	0.45	(0.07)	0.61	(0.06)	0.08*

***, ***, and * denote statistical significance at the 1%, 5%, and 10% levels, 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 firms is the universe of established firms active in the industry at the time of the violence, after excluding the four largest firms, traders and infrequent exporters. Daily Exports in the first two months of 2007 (kgs), Production in Roses, and Exports to Auctions are computed from transaction records. Small, type of firm ownership (Foreign, Indian, and Kenyan) and Politically Connected Firm are all dummy variables. Panel B tests differences in sample-means for firms in the locations affected by the violence and firms in locations unaffected by the violence using information collected through a face-to-face survey designed and conducted by the authors. Workers Housed is a dummy variable taking a value of 1 if the firm offers housing for workers at the premises and 0 otherwise. Entry Year is the year in which the firm starts to export flowers. Association Member is a dummy variable taking a value of 1 if the firm is a member of the Kenya Flower Council and 0 otherwise. Certification is a dummy variable taking a value of 1 if the firm is a participant in any of the standard certification programs during our study period (Fair-Trade, Max Havelaar Switzerland, Milieu Programma Sierteelt, and Kenya Flower Council). Workers at Risk is percentage of the workforce that is at risk of violence. We define being at risk as being a member of an ethnic group that was in the opposite alliance from the majority ethnic group of the district from the 1989 Population Census data. Affected Operations, Experienced Worker Absence, Transportation Problems, and Hire Extra Security are all dummy variables capturing margins of firm disruptions due to electoral violence. Production Loss because of Worker Absence is a categorical variable taking values from 0 (not at all) to 4 (severe). Panel C shows that surveyed and nonsurveyed firms do not differ for the administrative data available for both samples. Violence Region is a dummy taking a value of 1 if the firm is a locality where electoral violence took place, 0 otherwise. Details on data source and variable construction are provided in Appendix E.

decrease as a consequence of the violence depending on the relative importance of the reduction in the number of workers coming to work 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. The mechanism works through the reduction in the number of workers coming to work. Smaller firms and

firms selling mainly to the auctions therefore lose a higher proportion of their workers. Furthermore, if the proportion of workers who do not show up for work is directly controlled for, those firms do not suffer larger reductions in exports.

The model also offers guidance to calibrate the costs of the violence for the firms involved, as described below.

B.   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 were driven by the interaction between political events at the national and local level, and regional ethnic composition (Gibson & 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 in places without flower firms (e.g., slum areas in Nairobi and other major towns). In the baseline analysis, we condition on flower firms' locations and exploit the cross-sectional and temporal variation in the occurrence of violence between "violence" and "no-violence" regions. 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 an intention-to-treat approach in which we classify locations as having suffered violence or not during a prespecified time spell that is kept constant across locations involved during the same spike (see appendix E) for details on the exact dates and location of the violence).

Table 1 reports summary statistics for the industry in the two regions. Panel A reports data from administrative records, while panel B focuses on information from the survey. Both panels show that firms in the regions affected by the violence are broadly 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. Firms in the violence region, however, were oversampled in the survey.

Table 2 investigates the short-run impact of the violence. To do so, it is necessary to control for season (or growth) and seasonality effects. Let $Y(i)^L_{T,W}$ be the exports of flowers by firm i 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 T 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 ten weeks before the end of December. Finally, the indicator W takes a value equal to $W = 1$ in the winter during which the violence occurred (the winter of 2007/2008) and $W = 0$ for the previous winter. With this notation and following our "ITT" approach, a firm was 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 20 firms affected by the violence, while in panel B, 55 firms are located in regions affected by the second spike of violence. In both panels, the sample includes 135 firms.

Under the assumption that the change in exports between $T = 0$ and $T = 1$ is 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:

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

Intuitively, this means 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 across the two seasons. 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, $\Delta^L_{T=0}(i)$, estimates the firm's growth rate comparing the nonviolence 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 and February, the difference-in-difference $\widehat{\gamma}^L(i)$ provides an estimate of the effects of the violence that controls for a firm's growth rate. Appendix table B2 uses data from two seasons preceding the violence to provide support for this identifying assumption. The table shows that seasonality patterns are constant across seasons and similar across regions.[12]

The bottom rows in panels A and B of table 2 report the average $\widehat{\gamma}(i)$ across firms for the two spikes of violence, with columns A and B presenting the results for the no-violence region and the violence regions, respectively. Panel A shows the impact on the twenty firms that were directly affected by the first spike of violence. Rows 3a and 4 in column B show that estimated coefficients for the simple difference and the difference-in-difference estimates for the effects of the first spike of violence are −1.83 and −1.48 (which translate roughly to a 56% drop in exports). Panel B shows that the larger group of 55 firms that were directly affected by the second spike of violence suffered a smaller reduction in exports, a difference that is not statistically significantly different from 0.

The difference between rows 3a and 4 in panel A highlights why accounting for seasonality is so important: the simple

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[12]Later, we provide further support to the identification strategy by reporting parallel trends across regions. The intuition of the identification strategy is also provided graphically in appendix figure A3.

TABLE 2.—EFFECTS OF VIOLENCE: UNCONDITIONAL DIFFERENCE-IN-DIFFERENCE AND TRIPLE DIFFERENCE ESTIMATES

			(A) Non-Violence Region Winter 1: # of Firms: 115 Winter 0: # of Firms: 115	(B) Violence Region Winter 1: # of Firms: 20 Winter 0: # of Firms: 20	(C) Violence - Non-Violence Diff Total # of Firms 135
	A: Locations That Suffered in the First Outbreak of Violence				
1	Treatment Period	Winter −1: Violence Period 29 Dec 2007–4 Jan 2008	6.506 [2.711]	5.477 [3.396]	−1.029 (0.788)
2a	Control Periods	Winter −1: Control Period 4 Nov 2007–22 Dec 2007	7.033 [1.971]	7.303 [2.293]	0.269 (0.536)
2b		Winter −0: Violence Period 29 Dec 2006–4 Jan 2007	6.745 [2.323]	6.988 [2.083]	0.243 (0.524)
2c		Winter −0: Control Period 4 Nov 2006–22 Dec 2006	7.086 [2.164]	7.332 [1.818]	0.245 (0.464)
3a	First Differences	[1]–[2a]	−0.528*** (0.131)	−1.826*** (0.559)	−1.298** (0.558)
3b		[1]–[2b]	−0.239 (0.208)	−1.511** (0.587)	−1.272** (0.607)
4	Difference-in-Difference	([1]–[2a])–([2b]–[2c])	−0.186 (0.163)	−1.482** (0.554)	**−1.296** **(0.559)** **Triple Difference**
			(A) Non-Violence Region Winter 1: # of Firms: 60 Winter 0: # of Firms: 60	(B) Violence Region Winter 1: # of Firms: 75 Winter 0: # of Firms: 75	(C) Violence - Non-Violence Diff Total # of Firms 135
	B: Locations Which Suffered in the Second Outbreak of Violence				
1	Treatment Period	Winter −1: Violence Period 25 Jan 2008–30 Jan 2008	7.27 [1.945]	6.484 [3.037]	−0.786* (0.431)
2a	Control Periods	Winter −1: Control Period 4 Nov 2007–22 Dec 2007	7.151 [1.616]	7.011 [2.294]	−0.139 (0.337)
2b		Winter −0: Violence Period 25 Jan 2007–30 Jan 2007	6.972 [2.422]	6.701 [2.925]	−0.271 (0.492)
2c		Winter −0: Control Period 4 Nov 2006–22 Dec 2006	7.257 [1.81]	7.022 [2.323]	−0.235 (0.38)
3a	First Differences	[1]–[2a]	0.12 (0.126)	−0.527** (0.206)	−0.647*** (0.241)
3b		[1]–[2b]	0.298 (0.304)	−0.216 (0.293)	−0.514 (0.422)
4	Difference-in-Difference	([1]–[2a])–([2b]–[2c])	0.405 (0.255)	−0.205 (0.246)	**−0.61*** **(0.354)** **Triple Difference**

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Columns A and B report means of average daily export weight (kgs, IHS transformation) in rows 1–2c (standard deviations are reported in brackets). Each row in column (C) is a difference-in-difference estimation with standard errors in parentheses clustered at the firm level. Winter is a dummy variable taking a value of 1 if the time period is 2007/2008 and 0 if the time period is 2006/2007. Panel A: Violence location is defined as the localities that suffered violence during the first outbreak of violence. Panel B: Violence location is defined as the localities that suffered violence during the first and second outbreaks. Appendix Table B1 provides further details on the location of firms in flower clusters (as classified by industry practitioners) and where they are located in terms of the first or second outbreak of violence. In panel A there are 20 firms affected by the violence, and in panel B, 75 firms are located in regions affected by the second spike of violence. In both panels the sample included 135 firms.

difference overestimates the effect of violence on firms affected by conflict (as estimated by the difference in difference in row 4) by −0.34, as it does not take into account the lower demand for flowers in the first few weeks of the year relative to the period before the election. This is also a possible explanation for the statistically significant simple difference within the no-violence region of −0.53 (which is also about −0.34 smaller than the estimated effect of this period in the no-violence region).

Panel B shows diverging experiences in the second spike of the violence. The difference-in-difference point estimate in the violence region is negative, while it is positive in the towns not directly involved in the violence. Neither of the two coefficients is statistically significant at conventional levels. The positive point estimate for no-violence regions could arise if firms were trying to make up for losses during the first

spike or if there were positive spillovers. Positive spillover could arise, for example, if buyers who prior to the conflict sourced from violence areas might try to source from non-violence locations to satisfy their unmet demand and hence this could cause an increase in exports. Section IIIE explores this scenario directly but finds no evidence for it.

Cross-regional comparison: Triple differences. One limitation of the difference-in-difference estimates is that they do not account for demand shocks that are specific to a date and winter. This would be the case, for example, if European demand were particularly high for roses for the 2007/2008 new year. A difference-in-differences approach would conflate such demand shocks with the supply shocks induced by the violence. Under the assumption that any change in the

TABLE 3.—EFFECTS OF VIOLENCE: TRIPLE DIFFERENCE ESTIMATES

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
			Daily Exports (kgs, IHS)			
A: Violence and Nonviolence Region, Triple Differences						
Days of Violence First Outbreak	−0.114	−0.144	−0.147	−0.147	−0.216*	−0.080
	(0.146)	(0.118)	(0.118)	(0.127)	(0.117)	(0.125)
Days of Violence First Outbreak × Violence location	−1.471**	−1.267	−1.246	−1.245	−1.106	−1.699
	(0.723)	(1.052)	(1.057)	(1.070)	(0.894)	(1.294)
Days of Violence Second Outbreak	−0.134	−0.045	−0.058	−0.108	−0.156	−0.155
	(0.126)	(0.112)	(0.104)	(0.138)	(0.163)	(0.181)
Days of Violence Second Outbreak × Violence location	−0.442	−0.659***	−0.628***	−0.506**	−0.504	−0.389
	(0.277)	(0.199)	(0.203)	(0.249)	(0.309)	(0.263)
Violence location	−0.215					
	(0.466)					
B: Violence Region Only, Difference in Difference						
Days of Violence Second Outbreak	−0.543***	−0.543***			−0.510**	−0.543***
	(0.093)	(0.193)			(0.243)	(0.211)
C: Nonviolence Region Only, Difference in Difference						
Days of Violence Second Outbreak	−0.028	−0.028			−0.165	−0.028
	(0.125)	(0.157)			(0.205)	(0.165)
Fixed Effects						
Firm	no	yes	yes	yes	yes	—
Day of year	yes	yes	yes	—	yes	yes
Day of week	yes	yes	yes	yes	yes	yes
Winter	yes	yes	yes	—	yes	—
Day of year × Violence location				yes	—	—
Winter × Violence location			yes	yes	—	—
Firm × Week					yes	
Firm × Winter						yes
Adjusted R-squared (Panel A)	0.027	0.453	0.454	0.455	0.472	0.505
Adjusted R-squared (Panel B)	0.025	0.477			0.494	0.521
Adjusted R-squared (Panel C)	0.029	0.422			0.442	0.484
Observations (Panel A)	41,207	41,207	41,207	41,207	41,207	41,207
Observations (Panel B)	23,051	23,051			23,051	23,051
Observations (Panel C)	18,156	18,156			18,156	18,156

***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively. The dependent variable is daily export weights (kgs, IHS transformation). The sample period is the months from November to January for the four winters from 2004/2005 to 2007/2008. Days of Violence First Outbreak is defined as Dec. 29, 2007, to Jan. 4, 2008, and Days of Violence Second Outbreak is defined as Jan. 25, 2008 to Jan. 30, 2008. Violence location is a dummy variable taking a value of 1 if the firm locality suffers from violence and 0 otherwise. Locations are provided in appendix table B1 and additional data details are in appendix E. Panels B and C consider locations affected and unaffected respectively by the violence only. Winter dummies are separate dummies for the four winters. Fixed effects refer to all panels. Standard errors, clustered at the firm and winter-week-location level (see Cameron et al., 2011) are reported in parentheses.

seasonality across winters is the same for the violence and no-violence areas (which also excludes cross-region spillovers), firms in regions not directly affected by the violence can also be used as a control group to estimate the direct effects of the violence and account for such demand shocks. 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

$$\Delta = \overline{\Delta}^{L=1} - \overline{\Delta}^{L=0}. \qquad (2)$$

The triple difference estimates are presented in column C of row 4 in each of the two panels. For the first shock of violence, the tripledifference is −1.30, roughly in line with the difference-in-difference estimates. The triple-difference estimate for the second spike of violence is roughly half in size, at −0.61.

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

$$y_{id} = \alpha_i + \mu^m + \eta^d + \lambda^W + \theta(\mathbf{W} \times \mathbf{T}) \\ + \gamma_{DDD} (\mathbf{W} \times \mathbf{T} \times \mathbf{L})_{id} + \varepsilon_{id}, \qquad (3)$$

where y_{id} denotes exports of firm i on a particular date (e.g., January 20, 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 all available years, with $W = 0$ indicating the three winters predating the violence and $W = 1$ the winter of 2007/2008. Day of the week dummies (i.e., Monday, Tuesday . . .) are denoted by m. The specifications control for firm-specific effects α_i; the day of the year effect η^d; winter-specific effect λ^W (where we allow a different λ^W for each of the four winters); and day of the week effect μ^m. Finally, ε_{id} is an error term.[13]

[13]With regard to statistical inference, there are two main concerns. First, production and, therefore, shipments of flowers of a given firm are likely to be 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

FIGURE 2.—SHORT-RUN EFFECT OF VIOLENCE ON EXPORT VOLUMES
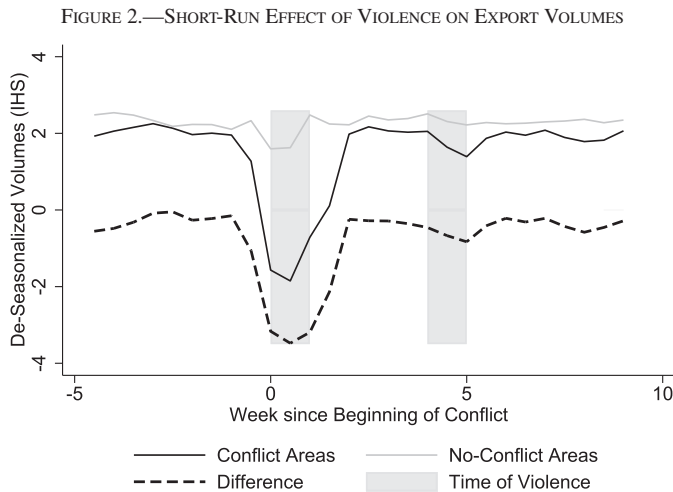
The figure displays the smoothed median biweekly residuals from a regression of export weights (kg, inverse hyperbolic sine transformation) on the following fixed effects: firm, day of week, day of year, and winter with violence location. Residuals are presented separately for conflict and no-conflict areas (see table 3, column 4). Smoothing is through simple moving average. The shaded area indicates times of violence. Conflict areas are defined in appendix table B1.

The indicator functions **W**, **T**, and **L** take values equal to 1 in, respectively, the winter, period, and location in which the violence took place, and 0 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 accounting for seasonality, exports of firms in the violence-affected areas behaved differently from exports in the no-violence areas during the period of the violence. Columns in table 3 include these covariates 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 adds firm fixed effects. Column 3 allows for different winter fixed effects in the violence and no-violence areas (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 and is our primary specification. The coefficients 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.

Parallel trends. The results in column 4 are illustrated by figure 2. The figure plots median residuals of the corresponding baseline regression for firms in the violence and the no-violence regions, when the violence terms V_{WT} and V_{WTL} are not included in the specification. The figure supports the iden-

tification strategy: we do not find any evidence of differences in trends or behavior across regions in the weeks leading up to the violence.

Firm-specific growth and seasonality. Finally, columns 5 and 6 allow for firm-specific seasonality patterns and firm-specific growth between winters and show that the estimates of the impact of the violence are 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 once the extensive set of covariates is used, suggesting that spillovers are of relatively small magnitude. Panel C provides more direct difference-in-difference evidence on a possible effect of the violence on the control locations. This first placebo test shows that there is no overall effect on the control areas, at least not compared with previous seasons and relative to the preelection period, on average.

C. Robustness Checks

We conduct robustness checks that assess possible alternative explanations of the observed patterns. Specifically, we (a) investigate the effect of moving away from using a binary categorization of locations into conflict and no-conflict areas, (b) assess whether infrequent exporters and traders exported additional flowers during this time, (c) investigate location-specific growth and seasonality, and (d) conduct a placebo analysis for the period prior to the conflict. We summarize the results here, while appendix D details the analysis.

Violence intensity and localization. In appendix table D1, we assess the robustness of the binary categorization of firms into violence versus no-violence areas by allowing for the area of influence and the intensity of conflict to vary. We find that conflicts within a 10-km radius (but not a 20-km radius) are correlated with a reduction in exports suggesting relatively localized effects of the violence. When investigating the effects of different levels of intensity of violence, the evidence suggests that rather than the violence itself, the associated disruptions and workers' worries due to the fear of violence and associated insecurity lead to the drop in production.

Traders and infrequent exporters. Appendix figure D2 shows the total exports of firms that are excluded from our analysis because they export too infrequently to be included in the difference specifications. Their overall exports are low, and we do not find any pattern of concern that would suggest that traders may have exported additional amounts of flowers during this period.

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, for instance, roads and transport, are correlated across neighboring firms. Throughout the analysis using transaction records, therefore, standard errors are clustered both at the *firm* and the *season-week-location* level using the Cameron et al. (2011) procedure.

Placebo and further tests. Appendix table D3 shows that there is no differential pattern in exports from the violence area in the weeks leading up to the election violence. To address concerns that there might be location-specific patterns of seasonality and growth, appendix table D4 shows that the results are robust to accounting for location-specific seasonality effects, though less precisely than those in the main table 2.

Effects on other firm outcomes. The negative effects on export volumes in a given day can be decomposed into two effects: a decrease in the likelihood of exporting (the extensive margin) and a decrease in the export volumes conditional on exporting (the intensive margin). Appendix table D5 presents results for these outcomes, as well as for prices and unit weight. Results indicate that the second outbreak of violence had a negative and significant impact on a firm's ability to export, while the negative point estimate is not significant for the first period of violence. During both episodes, the export volumes conditional on exporting decreased as a consequence of the violence, but not significantly so. In terms of prices, the large observed increase in prices is largely the result of a depreciation of the Kenyan shilling. We do not observe any impact on unit weight, which could have indicated compositional changes to exports.

Medium-run effects. Appendix figure D6 reports the cumulative and the medium run effects of the violence throughout February 2008. 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.

D.   The Violence as a Supply Shock: Mechanisms

This section investigates the mechanisms through which the violence affected firms. First, using the survey, we corroborate the violence indicators used in the previous section: firms in locations classified as having suffered from the violence are more likely to report to have worker absence, experienced transportation problems, and hired security. Second, we explore heterogeneity in the response to the violence. We then explore the role of workers' absence and transportation problems in affecting firms' performance during the violence. Finally, we attempt to quantify the short-run losses incurred by firms during the violence.

Incidence of the violence: Survey responses. Before turning to the evidence on production, appendix table B3 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,

firms located in the violence regions are significantly more likely to report that their operations have been directly affected by the violence (column 1), there were days in which members of staff did not come to work because of the violence (column 2), the firm experienced a higher proportion of workers absence due to the violence (column 3), worker absence caused significant losses in production (column 4), the firm experienced transportation problems in delivering flowers to the airport (column 5), and the firm hired extra security personnel during the violence period (column 6).

Heterogeneity in workers and export losses. We now test the model's predictions exploring heterogeneity across firms. Table 4 reports cross-sectional correlations between the firms' characteristics and the percentage of workers absent at the peak of the crisis for firms in the violence location. 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. Since locations also differ in the intensity of the violence, the specification includes location dummies as controls.

Table 4, in particular, shows a correlation between the marketing channels and (in most specifications) the size 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 those exporting through the auctions and smaller firms report a higher fraction of workers missing during the violence period. The correlation between marketing channel and size is robust to the inclusion of a large number of covariates, including (a) location dummies to account for the intensity of the violence, (b) dummies for housing, social programs, and fair-trade-related certifications, (c) the gender composition of the labor force, (d) owners' identity, (e) product variety, and (f) proxies for capital invested in the firm.

The results could, in principle, be driven by systematic differences in the composition of the labor force across firms. For example, firms employing a higher percentage of the minority group in a given locality might suffer higher worker and export losses. In column 7, we include a measure of the proportion of the workforce that is at risk of violence. We define being at risk as being a member of an ethnic group that was in the opposite alliance from the majority ethnic group of the location. While this proportion at risk is positively correlated with a higher proportion of workers lost, the effect is not precisely estimated.

Table 5 reports the heterogeneity results in exports. We focus on the second outbreak of violence (as in panel B of table 2) since the small number of firms affected during the first period of violence (twenty) precludes the estimation of heterogeneous effects. We include the firms' characteristics as in table 4 interacted with the violence period dummy. For ease of exposition, the table only reports the coefficients on the interactions between the shock and the firms' characteristics of interest.

TABLE 4.—HETEROGENEITY IN WORKER ABSENCE

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Workers Absence (%)							
Direct Focus	−17.27	−20.16*	−23.82**	−18.52*	−18.28	−18.39	−21.24*	−24.52*
	(11.20)	(10.38)	(9.584)	(9.531)	(11.43)	(11.77)	(12.16)	(13.95)
Small Firm	28.91**	24.77**	29.42	23.61**	28.00***	32.65**	23.19*	31.33
	(10.85)	(10.28)	(18.09)	(10.77)	(10.02)	(14.25)	(11.60)	(30.59)
Housing Offered		−21.29*	−23.32**	−19.27*	−21.15*	−23.30**	−22.95**	−27.23**
		(11.08)	(11.23)	(11.08)	(11.19)	(10.46)	(10.86)	(10.95)
Association Member			−18.73*					−18.98
			(10.42)					(16.41)
Fair Trade Certification			13.97					15.36
			(20.03)					(26.88)
Politically Connected Firm				−8.221				−2.447
				(15.67)				(17.68)
Foreign Owner				−11.26				−4.704
				(10.30)				(14.64)
Female Workers (%)					−0.326			0.0439
					(0.507)			(0.614)
Only Roses						8.202		3.884
						(13.11)		(19.41)
No Insulated Trucks						−14.78		−7.031
						(13.55)		(21.03)
Workers at Risk (%)							14.52	21.27
							(19.79)	(28.11)
Fixed Effects	location	location	location	location	location	location	location	location
R-squared	0.280	0.352	0.397	0.372	0.360	0.388	0.366	0.444
Observations	41	41	41	41	41	41	41	41

***, **, and * denote statistical significance at 1, 5 and 10 percent levels, respectively. The dependent variable across all columns is the highest percentage of worker absence 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. Direct Focus is a dummy variable taking a value of 1 if the firm exports more than 90% of its production to direct buyers (as opposed to the auction). Small Firm is a dummy variable taking a value of 1 if the firm is smaller than the median firm in the industry. Housing Offered is a dummy variable taking a value of 1 if the firm provides housing for more than 20% of the permanent labor force at its premises. Only Roses is a dummy variable taking a value of 1 if roses are more than 90% of a firms' export volumes. No Insulated Trucks is a dummy variable taking a value of 1 for those firms that do not own insulated trucks. Association Member is a dummy variable taking a value of 1 if the firm is a member of the Kenya Flower Council, a business association. Politically Connected Firm is a dummy variable taking a value of 1 when the firm is politically connected. Foreign Owner is a dummy taking a value of 1 if the owner is a foreign entity. Workers at Risk is percentage of the workforce that is at risk of violence. We define being at risk as being a members of an ethnic group that was in the opposite alliance from the majority ethnic group of the district from the 1989 Population Census data. Fixed effects account for the following locations: Kiambu, Mt Elgon, Naivasha and Nakuru in the first six weeks of January 2008. Robust standard errors are reported in parentheses. Additional details on data source are provided in Appendix E.

The evidence supports the predictions of the model with respect to firm size and marketing channels: on average, smaller firms and firms exporting through the auctions suffered a greater reduction in export volumes during the violence.[14] The last column in the table shows that these correlations are robust to controlling for several other firms' characteristics. Similar to the results in table 4, we find that the proportion of workers at risk is not significantly correlated with the size of the effect of the violence.

In sum, the results of the heterogeneity analysis appear to be broadly consistent with the predictions of the model. The results must, of course, be interpreted cautiously, and, in particular, care should be taken before interpreting the estimates in tables 4 and 5 as causal effects of firm size or marketing channel on exports and worker retention during the violence. Unobservable characteristics might correlate with a firm's exposure, or capacity to react, to the violence as well as with the firm's size and marketing channels. The extensive set of firms' characteristics we can control for assuages, to some extent, these concerns.

Mechanisms: Worker absence and transport. In the firm interviews, we asked, on a week-by-week basis for the period covering January and February 2008, how many workers were absent and whether the firm suffered transportation problems. We now use these measures to provide suggestive evidence on the relevance of these two mechanisms.

Before describing the results, it is worth pointing out certain limitations of this exercise. The retrospective nature of the survey might introduce measurement error in the form of imperfect recall or even bias. For example, respondents may be more likely to recall worker absence as a problem if they were located in the violence region and have more salient memories of worrying about worker absenteeism. Furthermore, the extent of measurement error could be different between reported worker absence and transportation problems.

Although we cannot provide any evidence to assuage such concerns, the interviews we conducted in person left us with reassuring impressions. The events we asked about took place six months before the survey but were still very salient to the respondents. Responses on transportation difficulties appear to correlate well across respondents within narrowly defined localities, as expected. With respect to workers' absence, we asked respondents to check payroll records.[15]

[14]Although firms that export directly suffer lower reductions in exports than firms exporting through the auctions, the estimates imply an overall reduction in exports for both types of firms. In a sample of well-established relationships, Macchiavello and Morjaria (2015) estimate a 17% drop in exports in the average relationship. Section IIIE explores how global buyers in direct relationships react to the shortfall.

[15]We could not access the payroll records directly and, unfortunately, we did not take note during the interviews about whether the respondent

TABLE 5.—EXPLORING HETEROGENEITY IN EXPORTS

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Daily Exports (kgs, IHS)				
Direct Focus	1.194**	1.140**	1.102**	1.055**	0.903**	1.024**	1.063**	0.824*
	(0.490)	(0.462)	(0.462)	(0.477)	(0.454)	(0.464)	(0.485)	(0.457)
Small Firm	−5.043***	−5.052***	−4.453***	−5.043***	−5.025***	−5.064***	−5.048***	−4.342***
	(0.345)	(0.343)	(0.444)	(0.334)	(0.351)	(0.385)	(0.335)	(0.543)
Housing Offered		−0.144	0.175	−0.232	0.398	−0.289	−0.129	−0.0413
		(0.360)	(0.399)	(0.366)	(0.371)	(0.480)	(0.349)	(0.480)
Association Member			0.469					0.704
			(0.448)					(0.481)
Fair Trade Certification			−0.014					−0.322
			(0.500)					(0.483)
Politically Connected Firm				1.254***				0.493
				(0.425)				(0.456)
Foreign Owner				1.044***				0.767*
				(0.405)				(0.419)
Female Workers (%)					0.0077			0.009
					(0.0121)			(0.0128)
Only Roses						−0.555		−0.317
						(0.465)		(0.476)
No Insulated Trucks						−0.817		−1.147*
						(0.626)		(0.646)
Workers at Risk (%)							0.944	0.256
							(0.884)	(0.840)
Fixed Effects								
Location	yes	yes	yes	yes	yes	yes	yes	yes
Day of year	yes	yes	yes	yes	yes	yes	yes	yes
Day of week	yes	yes	yes	yes	yes	yes	yes	yes
Winter	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.063	0.063	0.093	0.065	0.069	0.066	0.064	0.105
Observations	22,250	22,250	22,250	22,250	22,250	22,250	22,250	22,250

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. The dependent variable across all columns (1 to 8) is daily exports (kgs, IHS transformation). The heterogeneity dummy variables are as described in the footnote of table 4. Only the triple interactions are reported for each specification. Note the triple interaction is a dummy variable taking a value of 1 for the first six weeks of 2008 interacted with the heterogeneity measure. The specification includes day-of-year, day-of-week and season fixed effects. Sample period for the analysis is the four winter periods—Nov. 3 to Jan. 30 for the years 2004/2005, 2005/2006, 2006/2007 and 2007/2008. Standard errors are obtained by two-way clustering at the firm and winter-week-location level (see Cameron et al., 2011) and reported in parentheses.

A second caveat to this analysis is that both the percentage of workers absent and, possibly to a lesser extent, transportation problems experienced by the firm are likely to be, at least in part, the result of an endogenous response by firms to the violence and insecurity.

Notwithstanding these caveats, appendix table B4 reports the results. Specifications are analogous to those in previous tables, but note that the regressions are estimated on the sample of interviewed firms only and the unit of observation is at the firm-week level since the survey variables were asked on weekly basis. Column 1 simply recovers an average reduced-form effect of the violence at the week level. The estimated coefficient is similar to the estimates obtained in previous specifications. Columns 2 and 3 show that the time-varying self-reported measures of worker losses and transportation problems correlate with lower exports. In all cases, estimated coefficients are negative, economically sizable, and statistically significant at conventional level.

Column 4 considers the three variables together to quantify the relative importance of workers' absence, transportation

consulted payroll records. According to the survey, some respondents provided precise numbers for workers' absence, while other responses do suggest that the interviewee used focal categories, suggesting measurement error. Whether the measurement error is exacerbated by recall bias would be an open question.

problems, and the general situation related to the violence in the location of the firm. All estimated coefficients drop by about half and are no longer statistically significant at the conventional level. The results thus suggest that it is difficult to statistically attribute the overall effects on exports to specific channels. In the survey, however, only 50% of firms in the conflict areas report transportation difficulties, while almost 90% report worker absenteeism due to the violence. To gauge the extent to which worker absence affected exports, column 5 restricts the sample in the violence regions to firms that did not experience transportation problems. Interestingly, the point estimate is indistinguishable from the one estimated using the full survey sample in column 2. Although the change in sample warrants caution in interpreting the results, the evidence is consistent with worker losses having been a very important mechanisms through which the violence affected exports.

Quantifying losses during the violence. We now attempt to quantify firms' losses during the violence. The model in appendix C provides guidance on how firm-specific reduced-form estimates of the effects of the violence on production, Δ^v, can be combined with knowledge of the firm's revenues per worker during normal times, R^*, and estimates of key underlying parameters to provide a back-of-the-envelope

calculation of the effects of the violence on firms' profits.[16]

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-week control period that preceded the violence (which are available from trade transaction records), by the number of workers employed by the firm (which is available, for the same period, from the survey). There are two key parameters to be estimated: the elasticity of output to the number of workers (η) and the elasticity of workers, effort costs to hour worked (γ). We assume that these are identical across firms. 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 $\widehat{y^*} \simeq 1,250$ Kenyan shillings for workers at the median firm (or 14 euro at previolence exchange rates).[17]

With knowledge of γ, η can be recovered from a regression analogue to the specification in table 4, with the log of the share of retained workers replacing the share of missing workers. Unreported results reveal an estimated $\widehat{\eta} = 0.56$ when $\gamma = 4$.

Finally, the reduced-form effect of the violence on production Δ^v is given by the firm-level difference-in-difference estimates computed in table 2, which corresponds to equation (1). Because 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. 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 for the median firm (out of the 37 surveyed in the conflict regions with complete information) are as follows. The drop in production was 56%. Prices in export markets were not affected by the violence, but the Kenyan shilling depreciated by about 10%. The calibration reveals that labor costs in Kenyan shillings increased by 83% on average but, given the low share of the wage bill in total costs, this translates into a 19% increase in costs.[18] The median firm would thus have incurred losses during the violence unless operating

profit margins were at least 22%, quite a large number. The estimates thus suggest that the median firm in the violence region likely operated at a loss during the violence.

E. Demand-Side Reaction to the Violence

The violence was thus a large, negative, *supply* shock to the firms that were affected. Given this negative supply shock, how did the *demand* side of the market adjust?

Despite the large shock in Kenya, prices at the auction markets in the Netherlands, which consolidate demand and supply across the globe, were not hugely affected by the violence. At the time of the violence, Kenya accounted for about 10% of the world's exports of flowers. The violence hit half of Kenya's industry, reducing exports by about 30%. This implies that the violence caused a relatively small drop in the aggregate supply at the auction. We thus focus on the response of global buyers sourcing through direct relationships. These buyers suffered an average reduction in deliveries of about 17% (Macchiavello & Morjaria, 2015). We now consider their ability to cope with this shock by shifting sourcing to other suppliers in Kenya and elsewhere that were not directly affected by the violence.

Sourcing from no-conflict areas in Kenya. For a global buyer regularly sourcing flowers from firms hit by the violence in Kenya, a first-response margin would have been to try to increase sourcing from Kenyan suppliers not directly affected by the violence. Besides its intrinsic interest, exploring this channel also allows us to discuss potential spillover across regions. Table 2, column 1, and table 3, panel C, document that on average, firms in the conflict areas did not export more flowers relative to prior seasons and prior years. This suggests that spillovers, if any, do not pose a severe threat to the identification of the reduced-form average treatment effect of the violence. The average finding, however, could be hiding two opposing effects. First, there might be negative spillovers on firms due to a countrywide effect of the insecurity. Second, there might be a positive spillover if some firms in the no-conflict area benefited from additional demand for their flowers.

To explore this hypothesis, we focus on buyer-firm relationships in which the global buyer sourced from firms in both the conflict and no-conflict areas. We test for whether buyers who were sourcing from exporters located in the conflict area were able to source additional flowers from firms in the no-conflict area. Table 6 presents the results focusing on buyer-seller pairs that had relationships before the onset of the violence. Increases along the intensive margin of trade provide the best path to find evidence of positive spillover since the data reveal that none of the 64 buyers who exclusively sourced from the conflict region before the violence were able to start sourcing from the no-conflict region during

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[16]In the survey, we also tried to elicit revenue losses and increases in costs, but the reported figures appear to be noisy. Besides sources of measurement error described above, a concern is that some respondents might have inflated losses to influence the business association (with which we would have shared a report on our findings) to lobby the government for compensation and additional support.

[17]This estimate nicely matches prevailing wage rates in the flower industry at the time of the survey. These were circa 200 Kenyan shillings per day immediately before the violence, implying a weekly earning of around 1,200 Kenyan shillings. For this reason, we take $\gamma = 4$ as our preferred estimate. Results are robust using alternative choices of ψ in the range $\psi \in [0.1, 0.25]$.

[18]The figure includes both the wages paid for the extra hours worked at the farm for the remaining workers, as well as costs incurred to get workers

to come to work but does not include other fixed costs (e.g., hiring of extra security). The interviews, however, revealed that those costs were small.

TABLE 6.—BUYER-DRIVEN SPILLOVERS ACROSS REGIONS WITHIN KENYA

Dependent Variable	(1)	(2)	(3)	(4)
	Total Daily Exports (kgs, IHS) in Firm-Buyer pair			
Days of Violence	−0.037	−0.037	−0.012	−0.012
	(0.058)	(0.043)	(0.055)	(0.045)
Days of Violence × Proportion Purchased from Violence Location	0.066	0.066		
in the Months Preceding Violence	(0.174)	(0.131)		
Days of Violence × Any Purchase from Violence Location			−0.012	−0.012
in the Months Preceding Violence			(0.081)	(0.067)
Fixed Effects				
Buyer	yes	no	yes	no
Firm - Buyer	no	yes	no	yes
Day of year	yes	yes	yes	yes
Day of week	yes	yes	yes	yes
Winter	yes	yes	yes	yes
Adjusted R-squared	0.094	0.305	0.094	0.305
Observations	218,811	218,811	218,811	218,811

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. The dependent variable across all columns (1 to 4) is total daily exports (kgs, IHS transformation) in a firm-buyer relationship. Days of violence is a dummy variable taking a value of 1 if the date in the sample is between and including Dec. 29, 2007, to Jan. 4, 2008, and Jan. 25, 2008, to Jan. 30, 2008; and 0 otherwise. Proportion purchased from violence location in the months preceding violence is the proportion of flower purchases the buyer of this exporter-buyer pair (i.e., a direct relationship) made from a violence location as a proportion of all of the buyer's purchases in the months prior to the occurrence of violence. Any purchase from violence location in the months preceding violence is a dummy variable that takes the value of 1 if there are any purchases the buyer in this exporter-buyer pair (i.e., direct relationship) made from any exporter located in a violence location. Violence location is localities that suffered violence during the first or second outbreak. Appendix table B1 provides further details on the location of firms in flower clusters (as classified by industry practitioners) and where they are located in terms of the first or second outbreak of violence. Preceding violence refers to the period Nov. 1, 2007 to Dec. 21, 2007. Sample period for the analysis is Nov. 3 to Jan. 30 for the years 2004 to 2010 (i.e. six winters). Standard errors are obtained by two-way clustering (see Cameron et al., 2011) at buyer and season-week level (columns 1 and 3) and buyer-firm relationship and season-week level (columns 2 and 4) and reported in parentheses.

the shock. In total, 48 buyers were sourcing in both regions before the violence.

The table explores both specifications with firm and buyer fixed effects (columns 1 and 3), as well as specifications in which we condition for buyer-seller pair fixed effects (columns 2 and 4). Columns 1 and 2 consider a continuous measure of exposure, defined as the share of flowers imported from Kenya that the buyer sourced in the conflict region. Columns 3 and 4 instead consider a simple indicator for whether the buyer was sourcing any flower at all from the violence region. All specifications include day-of-year, day-of-week, and winter fixed effects. Across the specifications, we find that buyers who were sourcing from the conflict region were not able to shift their sourcing to exporters located in the no-conflict region. Although the estimated coefficient is positive, it is small and far from being statistically significant in all the specifications.

Sourcing from Ethiopia. Global buyers sourcing in Kenya at the time of the violence had a second potential margin of adjustment: increase imports from other origins. The closest substitutes for Kenyan flowers are nearby Ethiopia, a country with a burgeoning flower export industry of its own and that has consciously supported the development of the sector through an active industrial policy. Using detailed custom records from Ethiopia, we analyze whether global buyers who were exposed to the violence in Kenya were able to increase sourcing from the country. Besides its usefulness for understanding buyers' response, the analysis also has potentially important welfare implications. Globally, the negative welfare impacts of the violence may well be less if other countries are able to compensate for reduced Kenyan exports by exporting more.

Table 7 reports the results. Among the 99 global buyers sourcing from Ethiopia just before the violence, only 16 were

also sourcing from Kenya and 9 specifically from the regions affected by the violence.[19] We consider both separately. Note that, consistent with the evidence from Kenya in table 6, none of the buyers sourcing flowers in Kenya but not Ethiopia just before the violence were able to start sourcing in Ethiopia.

The empirical specifications are similar to those in table 6, and consider both the continuous and discrete definition of exposure to Kenya in general, and to the regions with the violence in particular. For simplicity, we focus on specifications that include buyer-seller pair fixed effects, but results are qualitatively identical when considering the two sets of fixed effects separately. Across the board, we find no evidence that global buyers were able to relocate supplies from Kenya to Ethiopia on short notice.[20]

Medium-term effects of the violence. In sum, the available evidence suggests that to a large extent, global buyers were unable to easily shift sourcing to respond to supply-chain disruptions caused by the violence. This evidence is consistent with Macchiavello and Morjaria (2015), who establish that exporters value maintaining a reputation for reliable deliveries to existing buyers and that it takes time to establish new relationships.

The violence might have had additional medium-term impacts. In the flower industry, contracts with direct buyers are renegotiated at the end of the summer. Within firms, relationships that were not prioritized by the firm during the violence are more likely to break down and not survive to the next

[19]These figures suggest that relatively few buyers diversify their sourcing origins in the industry. Similar patterns are observed in the Ethiopian floriculture industry; see Antić et al. (2021) for additional details on the Ethiopian context and data.

[20]The estimated coefficients using the continuous definition of exposure appear large (although indistinguishable from 0) but simply because the average exposure measure is low. They thus imply very small economic magnitudes.

TABLE 7.—BUYER-DRIVEN SPILLOVERS INTO ETHIOPIA

Dependent Variable	(1)	(2)	(3)	(4)	(5)
	Total Daily Exports (kgs, IHS) in Firm-Buyer pair				
Days of Violence	−0.080	−0.082	−0.082	−0.082	−0.082
	(0.188)	(0.179)	(0.170)	(0.173)	(0.171)
Days of Violence × Proportion Purchased from Violence Location in the Months Preceding Violence		−0.684			
		(0.357)			
Days of Violence × Any Flowers Purchased from Violence Location in the Months Preceding Violence			−0.397		
			(0.275)		
Days of Violence × Proportion Purchased from Kenya in the Months Preceding Violence				0.386	
				(0.315)	
Days of Violence × Any Flowers Purchased from Kenya in the Months Preceding Violence					0.084
					(0.238)
Fixed Effects					
Firm	yes	—	—	—	—
Firm - Buyer	—	yes	yes	yes	yes
Day of year	yes	yes	yes	yes	yes
Day of week	yes	yes	yes	yes	yes
Winter	yes	yes	yes	yes	yes
Adjusted R-squared	0.199	0.360	0.360	0.360	0.360
Observations	90,478	83,997	83,997	83,997	83,997

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. The dependent variable across all columns (1 to 5) is total daily exports (kgs, IHS transformation) in a firm-buyer relationship. Days of Violence is dummy variable taking a value of 1 if the date in the sample is between and including Dec. 29, 2007 to Jan. 4, 2008, and Jan. 25, 2008, to Jan. 30, 2008. Proportion Purchased from Violence Location in the Months Preceding Violence is the proportion of flower purchases the buyer of this exporter-buyer pair (i.e., a direct relationship) made from a violence location in Kenya as a proportion of the buyer's purchases from either Kenya or Ethiopia in the months prior to the occurrence of violence. Any Flowers Purchase from Violence Location in the Months Preceding Violence, is a dummy variable that takes the value of 1 if this proportion is bigger than 0. The two variables Proportion Purchased from Kenya and Any Flowers Purchased from Kenya are defined in the same manner, except with reference to exports from Kenya as a whole. Violence Location are localities that suffered violence during the first and second outbreaks. Appendix table B1 provides further details on the location of firms in flower clusters (as classified by industry practitioners) and where they are located in terms of the first or second outbreak of violence. Preceding violence refers to Nov. 1, 2007, to Dec. 21, 2007. Sample period for the analysis is Nov. 1 to Mar. 9 for the years 2007 to 2010 (three winters), so that seasonality patterns are estimated with post-violence data. Standard errors are obtained through two-way clustering (see Cameron et al., 2011) at the buyer and season-week level (column 1) and firm-buyer relationship and season-week level (columns 2–5).

season relative to relationships that were prioritized by the firm. From the firm perspective, however, the overall impact was modest. This is likely due to the possibility of selling to the auctions and forming new relationships. In particular, we check survival rates in the industry one year and two years after the violence. We consider firms located in the conflict region and those located in the no-conflict region. We further split the groups between firms that at the time of the violence, were predominantly selling through direct relationships versus those that predominantly sold to the auctions. We find no statistically significant difference in survival rate and export performance across the four groups two years after the violence.

Mitigating supply-chain risk: Evidence from Kenya's 2013 election. The evidence thus suggests that it is difficult for global buyers to cope with supply-chain disruptions when they occur. If this is the case, we might expect firms to take precautionary measures when the risk of supply-chain disruptions increases.

Although the industry fully recovered from the short-lived violence in 2008, the violence might have cast a long shadow into the future. Specifically, it is possible that the violence changed firms' expectations of postelection violence. We analyze whether Kenyan flower firms (and their buyers) changed the schedule and volume of exports in possible anticipation of violence around the next presidential elections that took place on March 4, 2013. This would also document whether buyers and firms expected violence or disruptions.

We begin by estimating a countrywide difference-in-differences specification similar to columns 1 and 2 in table 2 but for the entire country. We define the potential period of

violence as the period after March 4, 2013.[21] Figure 3 visually suggests that there is a change in behavior of exporters taking place, and columns 1, 3, and 5 of table 8 show that these changes are statistically significant.

We also investigated whether these expectations of violence reacted to the patterns of violence in 2008—that is, whether firms located in areas in which there was violence in 2008 changed their behavior. We do not find any evidence of a location-specific effect. This may be explained by the fact that the ethnic compositions of the two coalitions changed across the two elections, so the fault lines would not have been the same as in 2008.

Because firms have a much stronger incentive to maintain relationships we observed differences in exporting behavior by marketing channel in 2008, we also analyze whether such differences can be observed in 2013. Panel B of figure 3 shows the share of a firm's exports going to direct buyers versus the auction. We find that firms did prioritize exports to direct buyers in the days before the election, while there is a visible dip in the share of exports to firms just after the election.

While this pattern is precisely measured (see columns 2, 4, and 6 of table 8), the overall effect is statistically significant but relatively small. We conducted phone interviews with a few exporters before the election to gather qualitative information about their behavior. The phone interviews suggest that many firms did not perceive the risk of a repeat of the 2008 postelection violence to be particularly high in 2013. Those who reported that flowers are perishable and have a limited shelf life, and thus adjustments in the schedule of

[21]The 2013 presidential elections occurred just over five years, three months after the previous election at the end of 2007.

FIGURE 3.—EXPORT PATTERNS AROUND THE 2013 PRESIDENTIAL ELECTION
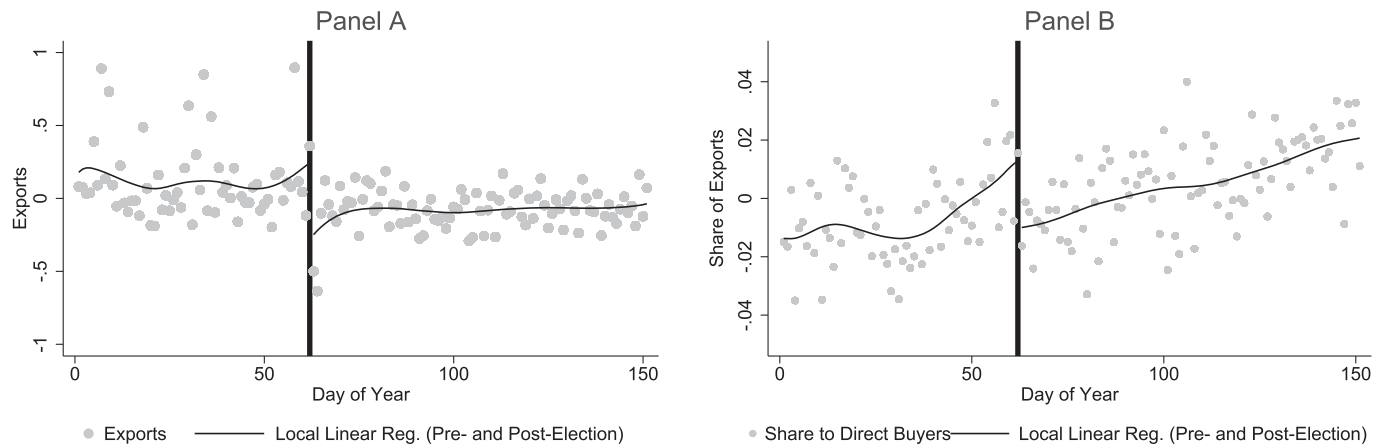
Panel A displays daily exports (kg, inverse hyperbolic sine transformation) of flower firms around the time of the presidential election in 2013 election (March 4, 2013), after accounting for day-of-week, day-of-year, winter, and firm fixed effects. Panel B depicts the share of exports of flower firms that go to direct buyers, after accounting for seasonality effects, day of week, winter, and firm fixed effects. Share of exports to direct buyers is defined as total nonauction exports as a proportion of auction and nonauction exports. Each panel shows the predicted residuals.

TABLE 8.—ANTICIPATION EFFECTS IN THE 2013 ELECTION

Dependent Variable	(1) Total Exports	(2) Share to Direct Buyers	(3) Total Exports	(4) Share to Direct Buyers	(5) Total Exports	(6) Share to Direct Buyers
Days before the 2013 election	0.168** (0.070)	0.032*** (0.010)			0.319*** (0.072)	0.015* (0.009)
Days after the 2013 election			−0.208*** (0.074)	−0.027** (0.010)	−0.307*** (0.069)	−0.015* (0.009)
Fixed Effects						
Firm	yes	yes	yes	yes	yes	yes
Day of year	yes	yes	yes	yes	yes	yes
Day of week	yes	yes	yes	yes	yes	yes
Winter	yes	yes	yes	yes	yes	yes
Adjusted R-squared	0.604	0.777	0.634	0.772	0.616	0.770
Observations	46,314	18,237	66,732	26,478	113,046	44,715

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. The dependent variable in columns 1, 3, and 5 is total daily exports (kgs, IHS transformation) and in columns 2, 4 and 6 is the share of exports to direct buyers, defined as total nonauction exports as a proportion of exports to the auction or direct buyers. The 2013 election took place on Mar. 4, 2013. Days before the 2013 election is a dummy variable taking a value of 1 if the date falls between Feb. 24 and Mar. 4, 2013, and 0 otherwise. Days after the 2013 election is a dummy variable taking a value of 1 if the date is including and after Mar. 4 and before Mar. 11, 2013, and 0 otherwise. Sample period in columns 1 and 2 is the following: Jan. 1–Mar. 3, 2011, Jan. 1–Mar. 2, 2012, and Jan. 1–Mar. 3, 2013; in columns 3 and 4 the following periods: Mar. 4–May 31, 2011; March 3–May 31, 2012, and Mar. 4–May 31, 2013; and columns 5 and 6 the days from Jan. 1–May 31 in the years 2011 to 2013. Number of observations reduces from the odd-numbered columns to the even-numbered columns because the odd-numbered columns include zero exports to both auction and nonauction, whereas the even columns are conditional on exporting (since the share to buyers is not defined when no exports were done). Standard errors are clustered at the firm level and reported in parentheses. Additional data details are provided in appendix E.

shipments, were limited and restricted to buyers with adequate facilities to store flowers.

IV.   Conclusion

This paper combined detailed administrative records on production, an original firm survey, and several other data sources to understand how postelectoral violence in 2008 affected the Kenyan flower industry.

On the supply side, the results show that the violence induced a large negative shock. After controlling for firm-specific seasonality patterns and growth, weekly export volumes of firms in the affected regions dropped, on average, by 56% relative to what would have happened had the violence not occurred. 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.

On the demand side, global buyers were not able to compensate the reduction in deliveries by increasing sourcing from either Kenyan exporters located in areas not directly affected by the violence or from neighboring Ethiopian suppliers. Consistent with difficulties in insuring against supply-chain risk disruptions caused by electoral violence, exporters and buyers in direct contractual relationships mitigated risk by ramping up shipments just before the subsequent presidential election.

Taken together, the results have implications for policy-makers and business executives alike. From a policy perspective, the findings from this study are relevant to countries interested in fostering nontraditional agricultural value chains. For example, the success of floriculture in Kenya has led several sub-Saharan countries, most notably Ethiopia, but also Tanzania, Uganda, Zambia, and Rwanda among others, to promote the development of the industry. Our results suggest that incentives associated with stable relationships in

nontraditional agriculture encouraged firms to quickly respond to the violence.[22] Stable relationships might be associated with higher exporters' margins (Cajal-Grossi, Macchiavello, & Noguera, 2019) but can also lead to foreclosure and less competitive conduct (see Boehm & Sonntag, 2020). While this study does not provide a comprehensive evaluation of the social benefits of such export arrangements, it provides a novel rationale for why policymakers in countries prone to instability might promote the adoption of such arrangements among exporters.[23] The results also have implications for business executives organizing sourcing from politically unstable environments. In particular, the same market frictions, such as search costs and limited contract enforcement, that make stable relationships with suppliers valuable can also hinder global buyers' ability to cope with disruptions by swiftly shifting sourcing to alternative suppliers. Diversifying sourcing origins and planning precautionary measures when risks of disruptions increase become essential tools of the trade.

[22]This suggests that the negative effects of the violence might be even larger in traditional agriculture value chains in which domestic traders and processors market the fresh produce of smaller farmers, often for the local market.

[23]From a broader perspective, Hernandez (2015) finds that the growth of the flower sector was associated with lower rates of unorganized violent crime but no change in guerrilla warfare in Colombia. In the African context, the development of the flower industry has created job opportunities in rural areas but might have exacerbated tensions over land and water.

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