

The Value of Relationships: Evidence from a Supply Shock to Kenyan Flower Exports

Rocco Macchiavello* Ameet Morjaria†

November 2010‡

- Comments Welcome! -

Abstract

When contracts are incomplete firms facilitate trade by developing relationships in which future rents deter short-term opportunism. We study how future rents assure contractual performance in the Kenya flower export sector. Based on revealed preferences we compute a lower bound to the value of the rents for the exporters in each relationship: the value of a relationship must be greater than the revenues foregone by not selling on the spot-market at higher prices. At a time of a large, negative and unanticipated supply shock induced by an intense episode of ethnic violence, exporters prioritize the most valuable relationships. In turn, compliance at the time of the shock positively correlates with relationship survival, future trade volumes, prices and relationship value. Interpreted under the light of models of 1) relational contracts, 2) informal insurance, 3) repeated games with imperfect monitoring and 4) reputation, the evidence is consistent with the latter two classes of models, particularly reputation ones. Policy implications are discussed.

Keywords: Reputation, Relational Contracts, Dynamic Games, Reliability, Rents, Spot Market.

JEL Codes: F14, F23, L14, O13, Q17.

*Warwick, Harvard Kennedy School, BREAD and CEPR. E-mail: r.macchiavello@warwick.ac.uk.

†Harvard Kennedy School.

‡This research would have not been possible without the collaboration of many people in the Kenyan flower industry and the help of staff at the Steadman Group in Nairobi. We thank them all. We are especially grateful to Abhijit Banerjee and Bob Gibbons for inspiring conversations. We also thank Pol Antras, David Atkin, Oriana Bandiera, , Tim Besley, Nick Bloom, Robin Burgess, Lorenzo Casaburi, Arnaud Costinot, Stefan Dercon, Marcel Fafchamps, Raquel Fernandez, Andrew Foster, Greg Fischer, Maitreesh Ghatak, , Asim Khwaja, Beata Javorcik, Clare Leaver, Niko Matoushek, Marc Melitz, Dilip Mookherjee, Kaivan Munshi, Andrew Newman, Imran Rasul, Mark Rosenzweig, Larry Samuelson, Antoinette Schoar, Tavneet Suri, Steve Tadelis, Dan Trefler, Fabian Waldinger, Chris Woodruff and seminar and workshop participants in Barcelona, Bocconi, BREAD, Brown, BU, Cambridge, CSAE, Dublin, Duke, Essex, EUDN, Frankfurt, Harvard, IFPRI, LSE, MIT-Sloan, Munich, Namur, Nottingham, NYU, Oxford, Southampton, Tilburg, UCL, Yale and Warwick for helpful comments and suggestions. Financial support from the iiG research programme, funded by the UK Department for International Development (DFID), and from STICERD is gratefully acknowledged.

1 Introduction

1. *In the absence of enforceable contracts, LT relationships are important.*

The ability to enter binding agreements is recognized as an essential ingredient for the expansion of markets, trade and economic development (see, e.g., Greif (2005)). In many markets, however, formal contract enforcement is not available: this can occur because formal institutions either do not exist or are not effective, or because third-party enforcement is prohibitively costly. Trading parties then, rely on informal enforcement mechanisms to guarantee contractual performance. Among those mechanisms, long-term relationships based on trust or reputation are perhaps the most widely studied and have received enormous theoretical attention.

2. *Theoretical Literature presents a large class of models to study LT Relationships.*

To capture the richness of real-life relationships, the theoretical literature has developed many different models to study how repeated interactions can help deter short-term opportunism. An important distinction emerges between models of *trust* versus models of *reputation*.¹ Models of trust rely on self-enforcing agreements, and include *i*) relational contracting models (e.g., Klein and Laffer (1981), Bull (1987), MacLeod and Malcolmson (1989), Baker, Gibbons, and Murphy (2002) and Levin (2003)), *ii*) models of informal insurance (see, e.g., Thomas and Worrall (1988)), *iii*) repeated games with (see, e.g., Abreu (1988)) and without perfect monitoring (see, e.g., Green and Porter (1984), Abreu et al. (1990), Athey and Bagwell (2001)). To clarify, the notion of trust is based on hidden actions, i.e., trust is formalized as beliefs about what a player is *expected to do*. In trust models, incentives to deter short-term opportunism are created by attaching less favorable continuation outcomes following deviations. Models of reputation (see, e.g., Kreps and Wilson (1982), Diamond (1989), Mailath and Samuelson (2006)), in contrast, are based on hidden types, i.e., reputation is formalized as beliefs about what a player is *expected to be*. The asymmetric information about a player's type introduces the possibility that, by playing frequently enough a certain action, a player can develop a reputation which induces expectations that she will continue play that action in the future. Short-term opportunism, then, is deterred by fear that it will lead to a worsening of the player's reputation.

3. *These approaches share common insights, but differ in important respects.*

¹The literature is large and often different authors refer to similar concepts using different terminology. For reviews, see, e.g., Bar-Isaac and Tadelis (2008), Cabral (2006), and the recent book by Mailath and Samuelson (2006). For the purpose of this paper, the discussion of different "trust" models in Levin (2003) is arguably the most useful.

The different classes of model share the common insight that future rents are necessary to deter short-term opportunism. The models, however, also differ in important respects. In models of trust, for example, the link between past behavior and expectations of future behavior is an equilibrium phenomenon, which holds in some equilibria but not in others. In models with types, instead, the incomplete information introduces an intrinsic, in fact, causal, connection between past behavior and expectations of future behavior. Dynamic games with perfect monitoring and (most) relational contracts models have stationary equilibrium outcomes, while reputation models and repeated games of imperfect monitoring do not, albeit for very different reasons. The models also differ in the (potential) externalities that relationships impose on each other. Alternative trading partners worsen incentives by undermining available punishments in models of trust but can improve incentives in reputation models if a good name is a valuable asset to be leveraged across multiple trading partners.

4. While distinguish models would be desirable, progress has been difficult.

As a consequence of these differences, it seems desirable, not least from a policy perspective, to assess the empirical relevance of the different types of models. Empirical progress in the area, however, has been hindered by several difficulties. Trust and reputation are embedded in beliefs held by contracting parties. These beliefs are typically unobservable by the econometrician. The empirical literature, therefore, has proxied the future rents generated by a relationship with product, firm, or market characteristics, which might affect contractual outcomes in several other ways. Furthermore, dataset containing information on transactions between firms are relatively rare.

5. Why Flowers? Why Exports? Why Kenya? Unique Advantages of our Settings

This paper attempts to make empirical progress in the area by studying relationships between Kenyan exporters of roses and foreign wholesalers. Four unique features make this particular market an ideal laboratory to empirically study long-term relationships between firms. First, a survey we conducted among producers in Kenya reveals that the relationships with foreign buyers are not governed by written contracts enforceable by courts. This has to be expected, since the perishable nature of flowers makes it unpractical to write and enforce contracts on supplier's reliability.² The resulting contractual imperfections, exacerbated by the international nature of the

²Upon receiving the flowers, the buyer could refuse payment and claim that the flowers sent were not of the appropriate variety and/or did not arrive in good conditions while the seller could always claim otherwise.

transaction, imply that firms must rely on repeated transactions to assure contractual performance.

Second, in the flower industry, long-term relationships coexist alongside a well-functioning spot market, the Dutch Auctions.³ Because of the seasonality inherent to the flower industry, prices on the spot market are sometime higher than prices received from direct buyers, which tend to be more stable throughout the season. The spot-market, therefore, provides a reference price that can be used, through a revealed preference argument, to compute a lower bound to the future rents exporters derive from a relationship.

Third, a large, unanticipated, negative supply shock induced by an intense episode of ethnic violence provides a unique opportunity to test competing models of relationships.⁴ Finally, focusing on an export market provides the further advantage that, unlike domestic sales, export sales are administratively recorded by customs. We can, therefore, analyze transaction-level data of all exports of flowers with information on sellers and buyers names, as well as information on units traded, prices and date.⁵

6. The Empirical Analysis

The empirical analysis begins by computing a direct measure of (a lower bound to) the net present value of the future rents associated with each relationship for the sellers. The key idea is that the net present value of the future rents associated with a relationship must be large enough to compensate the exporters for not side-selling to the spot market at higher prices.⁶ Using this revealed preference argument; a lower bound to the net present value of the future rents associated with a relationship can be calculated using only information on quantities transacted, FOB prices in the relationships and auction prices; which are all observable in the data.

7. Summary of Findings

³The “Dutch auction”, also known as “clock auction”, is named after the flower auctions in the Netherlands. A Dutch auction is a type of auction where the auctioneer begins with a high asking price which is lowered until some participant is willing to accept, and pay, the auctioneer’s price. This type of auction is convenient when it is important to auction goods quickly, since a sale never requires more than one bid.

⁴Following heavily contested presidential elections in Kenya at the end of December 2007, several, but not all, regions of the country plunged into intense episodes of ethnic violence. Flower exporters located in regions where conflict occurred suddenly found themselves lacking significant proportions of their labor force and suffered dramatic drop in exports. In Ksoll et al. (2010) we document that at the average firm in the conflict region 50% of the labor force was missing and exports volumes dropped by 38%.at the pick of the violence.

⁵Note that (essentially) all flower production in Kenya is destined to export markets: we, therefore, observe the entire industry sales.

⁶The argument is formally derived within the framework of a stylized model presented in the Appendix.

To distinguish between different models, the empirical analysis focuses on three sets of facts. First, we show that the estimated relationship values positively correlate with the age and past amount of trade in the relationship. These results hold in different samples and under different identification assumptions. In particular, they hold controlling for both relationships and time fixed effects as well as in a balanced sample of relationships that controls for selection effects.⁷

Second, at the time of the violence, exporters located in the region directly affected by the violence could not satisfy the commitments they had with all their buyers. The violence was a large shock and exporters had to choose which buyers to prioritize. We find that exporters prioritized the most valuable relationships. This relationship holds even allowing the effects of the ethnic violence to depend on buyers and sellers effect in a fully flexible way.

Third, we show that the demonstrated reliability at the time of the violence correlates with future outcomes in the relationships: controlling for both buyer and seller fixed effects, we find that reliability in volumes at the time of the violence positively correlates with the likelihood of relationship survival, with higher volumes of trade, higher prices and higher future values of the relationship in the season following the violence. Furthermore, the positive correlation between reliability at the time of the violence and relationship outcomes is robust to controlling for the value of the relationship as estimated before the violence.

8. Interpretation of the Findings

The results described above cannot be interpreted causally: while the negative supply shock was exogenous to the firm, the decision of which relationship to prioritize was not. Nevertheless, the correlation patterns observed in the data provide enough information to distinguish across competing classes of models. In particular, the third set of results is not consistent with models with stationary outcomes, i.e., (most) relational contracting models and dynamic games with perfect monitoring. The second set of results, instead, is not consistent with models that emphasize insurance considerations. The evidence, therefore, is only consistent with dynamic games with imperfect monitoring and reputation models. Since it is hard to characterize optimal equilibria in dynamic games with imperfect monitoring, it is difficult to reject this class of models. Bearing this difficulty in mind, the strong empirical association between

⁷As is well known, it is not possible to separately identify (linear) age effects, time and cohort effects (see, e.g., Deaton (1997)). Since the past volume of trade, however, evolves non-linearly with the age of the relationship, results linking future values and past trade can control for both relationship (which include cohort) and time effects.

the past history and the future value of a relationship and the long-lasting effects of the reliability at the time of the violence on contractual outcomes, however, favour reputation models over dynamic games with imperfect monitoring in our context.

9. Structure of the Paper

The rest of the paper is organized as follows. Section 2 discusses the related empirical literature. Section 3 provides some background on the industry, the contractual practices, and the ethnic violence. Section 4 presents the empirical results. Section 4.1 describes the relationships. Section 4.2 computes the value of each relationship for the seller. Section 4.3 establishes the positive correlation between a relationship history and value. Section 4.4 introduces the measure of reliability at the time of the violence. Section 4.5 studies the relationship between reliability and future relationship outcomes. Section 4.6 provides further evidence. Section 5 interprets the results in light of the different theoretical models. Section 6 offers some concluding remarks. An Appendix formally derives the strategy to compute the value of the relationship in the context of a stylized theoretical framework and provides further information on the data.

2 Related Empirical Literature

This Section relates the findings of the paper to the empirical literature on relationships between firms.⁸ McMillan and Woodruff (1999), Banerjee and Duflo (2000), and Macchiavello (2010) are the most closely related contributions and also share with the current paper a developing country setting. In an environment characterized by the absence of formal contract enforcement, McMillan and Woodruff (1999) find evidence consistent with long term informal relationships facilitating trade credit. Banerjee and Duflo (2000) infer the importance of reputation by showing that a firm’s age strongly correlates with contractual forms in the Indian Software industry. There are two important differences between these papers and ours. First, both McMillan and Woodruff (1999) and Banerjee and Duflo (2000) rely on cross-sectional survey evidence and cannot control for unobserved firm, or client, heterogeneity. In contrast, we exploit an exogenous supply shock and rely on “within relationship” evidence to prove the existence, study the source, and quantify the importance of the future rents necessary to

⁸A discussion of the much larger theoretical literature is postponed until Section 5, where we interpret the main empirical results under the light of different (classes of) models.

enforce the implicit contract. Second, we focus on prices and export volumes as contractual outcomes. Macchiavello (2010) studies learning effects in new markets using a twenty years panel of relationships between Chilean wineries and distributors in the UK. Controlling for relationships fixed effects, he documents that exporters entering a new market capture an increasing fraction of the surplus generated by their relationship with foreign distributors as their reputation improves. While both papers find evidence consistent with reputation and trust being quantitatively important determinants of export performance, they differ with respect to the methodology used as well as the time horizon covered by the analysis.⁹

Alongside a larger literature that studies explicit contract terms between firms (see, e.g., Lafontaine and Slade (2009) for a survey), some studies have focused on the relationship between informal enforcement mechanisms based on reputation, or repeated interaction, and formal contract choice (see, e.g., Corts and Singh (2004), Kalnins and Mayer (2004), and Lyons (2002)). These papers, however, also rely on cross-sectional data and do not attempt to separate the effects of past and previous anticipated interactions. In this respect, Gil and Marion (2009) is most closely related to our paper. In the context of public procurement, they show that a larger stock of prior interactions between contractors and subcontractors normally leads to lower prices and higher likelihood of participation in the auctions but that this relationship does not arise at times and areas with little future contract volume, suggesting the importance of the self-enforcing mechanism. Finally, Brown et al. (2004, 2009) study the role of self-enforcing agreements and reputation in facilitating trade in the context of controlled laboratory experiments.¹⁰

⁹Banerjee and Munshi (2004), Andrabi et al. (2006), Munshi (2010) provide interesting studies of contractual relationships in a development context, but with rather different focus. For example, Munshi (2010) and Banerjee and Munshi (2004) provide evidence on the trade enhancing role of long term relationships based on community ties. Andrabi et al. (2006) provide evidence of how flexible specialization attenuates hold-up problems.

¹⁰The paper is also related to a recent literature on intermediation and international trade (see, e.g., Rauch (1999), Kranton and Swamy (2007), Araujo and Ornelas (2007), Antras and Costinot (2009) for theoretical contributions, and Bernard et al. (2009) and Blum et al. (2009) for empirical ones). This literature has paid little attention to reputational issues in export markets. From a rather different perspective, there is a large literature in development studies and sociology that emphasizes the value of collaborative relationships with foreign buyers (see, e.g., Egan and Mody (1992) and Gereffi (1999)).

3 Background: Contractual Practices in the Flower Industry and the Ethnic Violence in Kenya

This section provides background information on the industry, its contractual practices and the ethnic violence. The Section relies on information collected through a representative survey of the Kenya flower industry conducted by the authors through face-to-face interviews in the summer of 2008.¹¹

The Flower Industry in Kenya

Over the last decade, Kenya has become one of the leading exporters of flowers in the world, overtaking traditional exporters such as Israel, Colombia and Ecuador. The flower industry is nowadays the largest foreign-currency earner for the Kenyan economy alongside tourism and tea. The Kenyan flower industry counts around one hundred and a handful of established exporters located at various clusters in the country.

Flowers are a fragile and highly perishable commodity. In order to ensure the supply of high-quality flowers to distant markets, coordination along the supply chain is crucial. Flowers are hand-picked in the field, kept in cool storage rooms at constant temperature for grading, then packed, transported to Nairobi's international airport in refrigerated trucks owned by firms, inspected and sent to overseas markets. The industry is labor intensive and employs mostly low educated women in rural areas. However, workers receive significant training in harvesting, handling, grading, packing, and acquire skills which are difficult to replace in the short-run. Because of both demand (e.g. particular dates such as Valentines day and Mothers day) and supply factors (it is costly to produce flowers in Europe during winter), floriculture is a business characterized by significant seasonality. The business season begins in mid-august.

Contractual Practices

Flowers are exported in two ways: flowers can be sold in the Netherlands at the Dutch auctions or can be sold to direct buyers located in the Netherlands and elsewhere. The two marketing channels share the same logistic operations associated with exports, but differ with respect to their contractual structure. The Dutch auctions are close to the idealized Walrasian market described in textbooks. There are no contractual obligations to deliver particular volumes or qualities of flowers at any particular date. Upon arrival in the Netherlands, a clearing agent transports the flowers to the

¹¹Note that the empirical analysis only relies on transaction-level data on exports of flowers which are administratively collected by the customs authority. Further information about data sources is provided in Appendix.

auctions where they are inspected, graded and finally put on the auction clock. Buyers bid for the flowers accordingly to the protocol of a standard descending price Dutch auction. The corresponding payment is immediately transferred from the buyer account to the auction houses and then to the exporter, after deduction of a commission for the auctions and the clearing agent. A part from consolidating demand and supply of flowers in the market aggregating over idiosyncratic shocks, the Dutch Auctions act as a platform that provides contract enforcement between buyers and sellers located in different countries: the Auction Houses certify the quality of the flowers sold and enforce payments from buyers to sellers.¹²

Formal contract enforcement, in contrast, is missing in the direct relationships between the flower exporter and the foreign buyer, typically a wholesaler. The perishable nature of flowers makes it impractical to write and enforce contracts on supplier's reliability. Upon receiving the flowers, the buyer could refuse payment and claim that the flowers sent were not of the appropriate variety and/or did not arrive in good conditions while the seller could always claim otherwise. Accordingly, exporters do not write complete contracts with foreign buyers.¹³

Exporters and foreign buyers negotiate a marketing plan at the beginning of the season. With respect to volumes, the parties typically agree on some minimum volume of orders year around to guarantee the seller a certain level of sales. Parties might, however, agree to allow for a relatively large percentage (e.g., 20%) of orders to be managed "ad hoc". With respect to prices, most firms negotiate constant prices with their main buyer throughout the year but some have prices changing two times a year, possibly through a catalogue or price list.¹⁴

Contracts do not specify exclusivity clauses. In particular, contracts do not require firms to sell all, or even a particular share, of their production to a buyer or to not sell on the spot market. In principle, it would seem possible to write enforceable contracts that prevent firms from side-selling flowers at the auctions, at least for those buyers

¹²Each firm has an account at the auctions that allows them to sell flowers at any time. It is common practice in the industry to keep accounts at the auctions houses even for those firms that sell their production almost exclusively through direct relationships. The costs of maintaining an account are small, while the option value can be substantial.

¹³Among the surveyed 74 producers, only 32 had a written contract with their main buyer. When a contract is written, it is highly incomplete. Among the 32 firms with a written contract, less than a third had any written provision on the volumes, quality, and schedule at which flowers have to be delivered. Written contracts often include clauses for automatic renewal. Some firms report to have had a written contract only in the first year of their relationship with a particular buyer.

¹⁴Prices are not indexed on the prices prevailing at the Dutch auctions. Prices at the Dutch auctions are high when demand is high. If at least one party values cash-flow stability or buyers have (unobservable) demand shocks that are not perfectly correlated with prices on the spot market indexed contracts might not be (constrained) optimal.

that have access to the spot market. The ability to sell on the spot market, however, gives producers flexibility to sell excess production as well as some protection against buyers defaults and/or opportunism. It is, therefore, not obvious whether contractual provisions preventing exporters from selling to the spot markets would be desirable.¹⁵

Finally, even when some kind of written agreement exists, parties would not go to a court to enforce it: in the words of one of our respondents, with a written contract “everybody knows what the expectations are so that the (written) contract turns out to be useless”. Written contracts, therefore, are used to set common “reference points”, as in the recent work by Hart and Moore (2008), rather than to set the outside option that would be enforced by a court. The resulting contractual imperfections, exacerbated by the international nature of the transaction, imply that firms rely on repeated transactions to assure good contractual performance.

Why do relationships coexist along-side a well functioning spot-market in this industry? A part from saving the freight and time costs associated with shipping flowers to, e.g., Moscow via Amsterdam, producers and buyers value the stability of prices and orders guaranteed by a well-functioning relationship. A buyer’s commitment to purchase a pre-specified quantity of flowers throughout the season at pre-specified prices allow the producer to better plan production, sales and cash flows. Buyers, on the other hand, value having access to a reliable supply of flowers to guarantee final customers the availability of flower bouquets that combine flowers sourced from different suppliers often located in different countries. Accessing alternative sources of supply at the last-minute can be very costly.

Ethnic Violence as Short-Run Supply Shock

An intense episode of ethnic violence affected several parts of Kenya following contested presidential elections at the end of December 2007 and provides a short-run unanticipated shock to the production function of firms.¹⁶ The ethnic violence had two major spikes lasting for a few days at the beginning and at the end of January 2008. The regions in which flowers producers are clustered were not all equally affected. Only firms located in the Rift Valley and in the Western Provinces were directly affected by the violence (see Figure 1).¹⁷ The main consequence of the violence was that firms

¹⁵ Furthermore, such provisions, could be circumvented by selling on the spot markets through other exporters. In this regard, the interviews we conducted with exporters reveal that i) exporters do not sell, nor purchase, significant volumes of flowers to or from other exporters and ii) exporters perceive that it would be hard for most buyers to monitor a firm sales to other buyers or on the Dutch auctions.

¹⁶ Ksoll et al. (2010) study the overall impact of the ethnic violence on the industry, quantifies profit and welfare losses.

¹⁷ The classification of affected and unaffected regions is strongly supported by the survey conducted in the summer following the crisis and is not controversial. See Appendix for details.

located in the regions affected by the violence found themselves lacking significant numbers of their workers. Because workers in the industry are hired and trained at the beginning of the season, they cannot be replaced in the short run. Among the 74 firms surveyed, 42 were located in regions that were directly affected by the violence. Table A1 shows that while firms located in regions not affected by the violence did not report any significant absence among workers (1%, on average), firms located in regions affected by the violence reported an average of 50% of their labor force missing during the period of the violence. Furthermore, firms were unable to replace workers. On average, firms in areas affected by the violence replaced around 5% of their missing workers with more than half of the firm replacing none. Many firms paid extra-hours to the remaining workers in order to minimize disruption in production.

With so many workers missing, firms suffered large reduction in total output. Figure 2 plots deseasonalized export volumes around the period of the violence for the two separate groups of firms relative to the previous season. The Figure clearly illustrates that the outbreak of the violence was a large and negative shock to the quantity of flowers exported by the firms in the conflict locations.

In the survey, we asked several questions about whether the violence had been anticipated or not. Not a single respondent among the 74 producers interviewed reported to have anticipated the shock (and to have adjusted production or sales plans accordingly): the violence has been a large, unanticipated and relatively short-run negative shock to the production function of firms.

4 Empirical Results

This Section presents the empirical results. After describing summary statistics for the baseline sample of relationships, we present the results in temporal order, as illustrated in Figure A1. We first compute lower bounds to the value of each relationship in the baseline sample combining the customs data with spot-market price information and show that the estimated value correlates with the age of the relationship. We then look at how shipments of flowers were affected by the ethnic violence. We create a measure of “reliability” at the time of the violence and show that exporters had to reduce shipments to their buyers and prioritized the most valuable relationships. Finally, we show that relationships outcomes in the season that followed the violence positively correlate with reliability at the time of the violence.

4.1 Relationships Characteristics

Using the customs data, we build a dataset of relationships. Overall, we focus on the period August 2004 to August 2009, i.e., five entire seasons. The violence happened in January 2008, i.e., in the middle of the fourth season in the data, which runs from August 2007 to August 2008.

We define the baseline sample of relationships as those links between an exporter and a foreign buyer that were active in the period immediately before the violence. A relationship is active if the two parties transacted at least twenty times in the twenty weeks before the eruption of the violence, i.e., at least once a week on average. The data show clear spikes in the distribution of shipments across relationships at one, two, three, four and six shipments per week in the reference period. The cutoff is chosen to distinguish between relationships versus sporadic orders. Results are not sensitive to the choice of cutoff, however.

In total, this leaves us with 189 relationships in the baseline sample. Panel A in Table 1 reports summary statistics for the relationships in the baseline sample. The average relationship had 60 shipments in the period from the beginning of the season until the week preceding the violence, i.e., three shipments per week on average. The average age of the relationship in the sample, measured as the number of days from the first shipment observed in the data, is 860 days, i.e., two years and a half. Immediately before the violence, contracting parties in the average relationship had transacted with each other 298 times. Note, however, that these figures are left-censored, since they are computed from the customs data from August 2004 onward. Since our records begin in April 2004, we are able to distinguish relationships that were new in August 2004 from relationships that were active before. Among the 189 relationships in the baseline sample, 44% are classified as censored, i.e., were already active before August 2004.¹⁸

Panel B in Table 1 shows that relationships are not exclusive. Among the one hundred established exporters, only fifty six have at least a direct relationship with a foreign buyer in our baseline sample. On average, therefore, exporters have three direct relationships. Similarly, there are seventy one buyers with at least a relationship in our baseline. The average buyer, therefore, has about two and a half Kenyan suppliers. This variation allows to study the economics of these relationship by controlling for both buyers and seller fixed effects.

¹⁸This confirms the findings of the survey, in which several respondents reported to have had relationships longer than a decade.

4.2 Estimating the Value of Relationships

The Incentive Constraint

This Section uses the model described in Appendix A to estimate a lower bound on the value of a direct relationship for the seller. The basic set up of the model is as follows. Time is discrete, the buyer and the seller have an infinite horizon and discount the future at a common and constant rate. In each period, the cost of producing q units of flowers is given by $c(q)$, with $c'(\cdot) > 0$ and $c''(\cdot) > 0$, and the buyer always needs q^* units of flowers. Relative to the spot market, where prices oscillate between a “high season” followed by a “low season”, with $p_s \in \{\underline{p}, \bar{p}\}$, a relationship is assumed, for simplicity, to save on transportation and intermediation costs.¹⁹ Denoting with t_s the FOB price in the relationship during season s , a necessary, but not sufficient, condition for the relationship to be self-enforcing is

$$\delta (U_{s+1} - U_{s+1}^o) \geq q^*(p_s - t_s) \quad (1)$$

where U_{s+1} and U_{s+1}^o are the net present values of maintaining a good relationship by supplying q^* and compromising the relationship by side-selling on the spot market respectively. The incentive constraint for the seller (1) provides the foundation for the exercise. Specifically, the constraint says that the net present value of the future rents from the relationship is at least as large as the additional revenues the firm could get by selling on the auctions in the pick season. In general, the condition in (1) will not be sufficient to guarantee that the relationship is self-sustaining because side selling q^* on the market might not be the best deviation available to the seller. The right hand side of the constraint in (1), therefore, only provides a *lower bound* to the value of the relationship. The model in the Appendix formally shows that if the incentive compatibility constraint in the high season, i.e., when $p_s = \bar{p}$, is satisfied, then the corresponding constraint in the low season cannot be binding. In other words, only the maximum temptation to deviate has to be considered to obtain an estimate of a lower bound to the value of the relationship.

Empirical Implementation of the Incentive Constraint

From an empirical point of view, the appeal of the incentive constraint in (1) is that q^* , p_s and t_s are directly observable in the data and, therefore, no estimation is required to compute the lower bound to the value of the relationship during a given

¹⁹A source of relationship surplus is needed for any relational contract to be sustainable at all. To keep the model simple, we abstract from modeling other sources of surplus generated by relationships, such as insurance and reliability, that were discussed in the previous Section.

season. In particular, the proposed method does not rely on information on the cost structure of the firm, nor on expectations of future trade between the parties, which are typically unobservable and/or difficult to estimate.

In bringing the constraint to the data we need to choose a “deviation window”, i.e., the length of the period of time during which the deviation is computed. For each relationship i , therefore, we compute the lower bound to the value of the relationship during season \mathcal{S} , as

$$\mathbf{V}_{i\mathcal{S}} = \max_{t \in \mathcal{S}} \{(p_{i,t} - t_{i,t}) q_{i,t}\}, \quad (2)$$

where $p_{i,t}$ is the price at the auctions in week t during season \mathcal{S} , $t_{i,t}$ is the unit price in relationship i in week t .²⁰ The operator $\max_{\mathcal{S}}$ gives the highest temptation to renege during the season: the model clearly states that only the incentive compatibility constraint in the pick season is binding. In other words, $\mathbf{V}_{i\mathcal{S}}$ is the maximum amount of revenue foregone in any given week of the season by the firm by selling to the buyer at lower prices rather than selling on the spot market at higher prices.²¹

In the empirical specifications below, we normalize the value of the rents by either the yearly revenue generated by the relationship in season \mathcal{S} , i.e., $\mathbf{R}_{i\mathcal{S}} = \sum_{t \in \mathcal{S}} t_{it} q_{it}$, or by the average weekly revenues generated by the relationship during the season, $\mathbf{R}_{i\mathcal{S}_i} = \frac{1}{|S_i|} \sum_{t \in \mathcal{S}} t_{it} q_{it}$, where S_i is the number of weeks the relationship was active during the particular season. Denote by $\mathbf{V}_{i\mathcal{S}}^N$ the normalized measure.

The variation in the estimated values across relationships, therefore, comes from two sources. First, there is the seasonal variation in prices, $t_{i,t}$. Figure 3 shows that FOB Prices in Direct Relationships are more stable than prices at the auctions throughout the season. The Figure shows the weekly variation relative to the season mean of FOB prices in direct relationships and at the auctions. The second source of variation, is the quantity of flowers transacted within the relationship at the time in which the one-shot temptation to renege on the relational contract was highest, $q_{i,t}$.²²

For most relationships, the maximum temptation to deviate arises during the Valentine pick. Figure 4 shows that FOB Prices at the Auctions are highly predictable. A regression of the weekly price at the auction on week and season dummies explains 76% of the variation in prices in the three season preceding the violence period. This

²⁰Information on prices for large and small roses at the auctions allows to index $p_{i,t}$ by relationship i .

²¹Since we are interested in a lower bound, we chose a relatively conservative deviation window of one week. Different choices lead to larger bounds that are very strongly correlated with the measure used in the text and do not affect the results.

²²Because prices in direct relationships are very stable during the season, when we normalize the estimated value by seasonal or average weekly revenues, this second source of variation greatly drives the estimated values.

implies that the estimated value is not driven by surprises, i.e., by unexpectedly high prices. This is confirmed by Figure 5. The Figure shows that the number of relationships dying in a given week does not correlate with the price at the Auctions in that week during the two season preceding the violence period. This is consistent with the fact that prices at the auctions are highly predictable. Regardless of whether week dummies are controlled for or not, the level of prices at the auctions do not predict the number of relationships dying. A regression of the number of relationships dying in a given week on week and season dummies explain 57% of the variation in relationship deaths. These two facts suggest that parties design the relational contract to “navigate” through the season, i.e., they agree on relatively stable prices and orders that provide enough rents to compensate from the short-run gains of deviating by selling on the spot market at higher prices.

The Estimated Values

For the 189 relationships in the baseline sample, Panel C in Table 1 shows that the estimated values of the relationships in the season that preceded the violence was 10% (respectively, 331%) of the seasonal (respectively, average weekly) revenues in the average relationship. It is hard to provide a benchmark against which assess whether 10% of yearly revenues is a large number or not. From a theoretical point of view, under free-entry in the formation of relationships, initial sunk investments would dissipate the ex-post rents (see, e.g., Klein and Laffer (1981), Shapiro (1983)). Under free-entry, therefore, our estimate yield a lower bound to the fixed costs of starting a relationship and can be compared to estimates from structural models on the importance of fixed costs in export markets. Das et al. (2007) reports that in the Colombian chemicals industry, fixed costs of exports in each year represent 1% of the export revenues of the firm.²³

4.3 Future Value and History of the Relationship

Figure 6 plots the distribution of the estimated lower bounds (in logs) for three different samples of relationships in the season before the violence. The three samples are given

²³The corresponding figure for the initial sunk costs is between 18 to 42%. It is worth stressing, however, that our estimates are a very conservative lower bound. Figures 4 and 5 suggest that the optimal time for the seller to deviate is at the beginning of the period in which prices at the auctions start being above prices in the relationship. The value of the rent should then be given by the (discounted) integral of the temptations to deviate over the corresponding weeks. For reasonable discount factors, this number is significantly larger than, but highly correlated with, the estimates reported above.

by, relationships in the baseline sample that were active at the Valentine peak of the season prior to the violence; relationships in the baseline sample that were not active during the Valentine peak of the season prior to the violence; and relationships that were active during the Valentine peak of the season prior to the violence but that are not in the baseline sample since they did not survive until the violence period. The Figure shows two patterns. First, the relationships that have survived have higher values than the relationships that did not. Second, young relationships had lower values than established relationships.

The latter observation, however, cannot be interpreted as evidence that the value of a relationship increases with age since, mechanically, the estimated value of a relationship that is “too young” to have gone through a seasonal pick is low. Different models, however, have different predictions on the relationship between a relationship’s age and its value. Table 2, therefore, presents regression results between the value of a relationship and various measures of a relationship history under alternative specifications.

Column 1 and 2 report results using the age of the relationship, measured in days since the first shipment observed in the data. Column 1 reports results from the cross-sectional specification

$$V_{fb} = \mu_f + \eta_b + \beta Age_{fb} + \mathbf{C}_{fb} + \varepsilon_{fb}, \quad (3)$$

where V_{fb} is the estimated value of the relationship between exporter f and buyer b in the season before the violence, μ_f and η_b are exporter and buyer fixed effects respectively, \mathbf{C}_{fb} is a dummy that takes value equal to one if the relationship is left censored in the data and ε_{fb} is an error term. The regression is estimated in the sample of relationships that were active in the season before the violence. Column 1 shows that the age of the relationship positively correlates with the estimated value of the relationship for the seller.

The positive correlation between a relationship age and its value has to be interpreted cautiously. In particular, from a cross-section it is not possible to disentangle age and cohort effects. The inclusion of buyer and seller fixed effects controls for cohort effects at the contractual-party level, but cannot control for the fact that more valuable relationships might have started earlier, i.e., for the presence of relationships cohort effects. Column 2, therefore, presents results from an alternative specification that exploits the time variation across seasons. This allow to control for relationship cohort effects by including relationships fixed effects. The specification is then given

by

$$V_{fbs} = \mu_{fb} + \beta Age_{fbs} + \varepsilon_{fbs}, \quad (4)$$

where notation has been modified to consider variation across season s . The specification is estimated on a balanced sample of relationships in order to also take into account the positive selection effects documented in Figure 6. The results confirm a positive correlation between the relationship's age and the value for the seller.

Even with panel data, it is not possible to separately identify age, cohort and time effects since, given a cohort, age and time are collinear. The specification in Column 2, therefore, cannot control for season fixed effects. In order to control for both relationship and season fixed effects, Columns 3 to 6 consider alternative measures of a relationships history, $H_{fbs} \in \{PF_{fbs}, PT_{fbs}\}$. Columns 3 and 4 proxy for the past history of a relationship with the number of previous transactions between the parties, denoted PF_{fbs} ; while Columns 5 and 6 use the cumulative value of past temptations, PT_{fbs} . A part from not being collinear with time and cohort, these two variables capture information that has been revealed during the course of the relationship. For the sake of comparison, Columns 3 and 5 replicate the cross-section specification in Column 1 and confirm a positive association between a relationship history and its value for the seller. Columns 4 and 6, instead, report results from the specification

$$V_{fbs} = \mu_{fb} + \phi_s + \beta H_{fbs} + \varepsilon_{fbs}, \quad (5)$$

in which ϕ_s are season fixed effects. The results confirm the positive association between the past history of a relationships and its value for the seller. In sum, controlling for relationship fixed effects, which include cohort effects, season effects and selection, we find a strong positive association between a relationship's history and the value of the relationship for the seller.²⁴

4.4 Relationships Under Attack: the Violence-Induced Supply Shock

Combining custom records and prices on the spot market, the previous Section estimated a lower bound to the value of a relationship for the seller and showed that it positively correlates with the age of the relationship. To further understand the sources of value in the relationships and discriminate between competing theoretical models, this Section looks at how a large unanticipated supply shock induced by ethnic violence

²⁴Consistently with the positive selection effects documented in Figure 6, we find stronger results on the unbalanced sample of relationships.

affected the relationships. First, we construct a measure of the seller “reliability” at the time of the violence in each relationship. Then we ask whether sellers prioritize more valuable relationships and if these choices correlate with future outcomes in the relationship.

Reliability at the Time of the Violence

We exploit the regularity of shipments within direct relationships to construct a counterfactual measure of the volumes of flowers that should have been exported in a particular relationship during the time of the violence had the violence not occurred. For each relationship in the baseline sample, we separately estimate a model that predicts shipments of flowers in a particular day, as a function of shipments in the same day of the week the previous week, total shipments in the previous week, and week fixed effects. For each relationship, we obtain a predicted shipment of flowers in a particular day. We aggregate these predicted value at the week level. The model predicts more than 80% of both in sample and out of sample variation in weekly shipments for the median relationship in the sample.

Denote by y_{fb} the observed shipments of flowers in relationship between firm f and buyer b during the week of the violence, and by \hat{y}_{fb} the predicted shipments of flowers in the same relationship, obtained using the observed shipments in the week immediately before the violence and the coefficients from the relationship specific model described above. The measure of reliability at the time of the violence is given by

$$R_{fb} = \frac{y_{fb}}{\hat{y}_{fb}}. \tag{6}$$

The measure R_{fb} captures the percentage of predicted shipments of flowers exported by a firm during the violence period to a particular buyer.

The first question we ask is whether the violence reduced “reliability”. To answer this question, Table 3 reports results from the regression

$$R_{fb} = \alpha_b + \beta \mathbf{I}_f(C = 1) + \gamma Z_{fb} + \eta X_f + \varepsilon_{fb}, \tag{7}$$

where $\mathbf{I}_f(C = 1)$ is an indicator function that takes value equal to one if firm f is located in the region directly affected by the violence and zero otherwise; X_f is a vector of firm controls, Z_{fb} is a vector of relationship controls, and α_b are buyer fixed effects. To account for the fact that shocks to relationships that involve one or more common contractual parties might be correlated, the error term, ε_{fb} , is estimated through multi-way clustering at the firm and buyer level (see, Cameron et al. (2009)).

Because the conflict dummy is defined at a firm’s location level, the specification cannot control for exporter fixed effects. Note, however, that the reliability measure R_{fb} is a deviation from a relationships-specific counterfactual that already accounts for relationship-specific average and seasonal fluctuations in exports.²⁵ The controls included in specification (7), then, allow the violence period to have affected export volumes in a particular relationship differentially across buyers, sellers and relationship characteristics.

Table 3 shows that the violence reduced the ability of firms to maintain a regular supply to the foreign buyers. The Table reports results using different empirical specifications that differ in the number of controls included. In particular, in the last Column, which controls for buyer fixed effects as well as firm and relationship controls as in equation (7), we find that the estimated reliability was 15% lower, on average, in relationships involving firms located in the conflict region.

Did Exporters Prioritize More Valuable Relationships?

Because of the violence, firms located in the conflict region could not satisfy the entirety of orders from their buyers. The next question we ask is whether the value of the relationship i between firm f and buyer b , estimated in the season before the violence, i.e., $\mathbf{V}_{i=fb}^N$, correlates with the reliability measure R_{fb} . Table 4 reports results from the regression

$$R_{fb} = \alpha_b + \mu_f + \beta \mathbf{V}_{fb}^N + \gamma Z_{fb} + \varepsilon_{fb}. \quad (8)$$

This specification is very similar to equation (7), but note that it now includes firm fixed effects μ_f . Since we are interested in determining how a particular firm chooses to prioritize among different relationships, given that the firm was under the effects of the violence, we can include firm fixed effects and estimate regression (8) separately on the sample of firms located in the conflict and in the no-conflict regions.

Table 4 shows that exporters prioritized the most valuable relationships. Columns 1 and 2 in the Table report the correlation between the measure of reliability at the time of the violence and the (lower bound to) the relationship value computed from the season before the violence in the sample of relationships of firms located in the conflict region. The two columns differ in so far as Column 2 also controls for buyer fixed effects. Controlling for seller fixed effects and for relationship characteristics, we find that the value of the relationship positively correlate with the observed reliability. Note

²⁵The cross-sectional results derived from specification (7), therefore, are similar to a regression of volumes of exports $\tilde{y}_{fb\tau s}$ at time τ in season s , on relationship-specific seasonality and season fixed effects, $\mu_{fb\tau}$ and $\mu_{fb s}$, in which the effects of the violence are recovered from an interaction between a dummy for the period of the violence, $v_{\tau s}$, and a dummy for the conflict region, c_f .

that we use the value of the relationship normalized by the weekly average revenues and, therefore, the positive correlation is not simply picking up the fact that exporters prioritize larger relationships. Also, note that the value of a relationship is mechanically negatively correlated with the price received by the seller in the relationship. Hence, the correlation is not picking up the fact that exporters prioritize those relationships that pay higher prices at the time of the violence.²⁶

Furthermore, Columns 3 and 4 use an alternative proxy for the value of the relationship which is given by the ratio of the shipment volumes at the time of the maximum temptation to renege over the average weekly shipment volumes. This measure does not rely on prices and captures how much the relationship can be “stretched” at the time of the maximum temptation to deviate. The results confirm the findings in Columns 1 and 2.²⁷

Finally, Columns 5 and 6 repeat the same exercise for the baseline specification on the sample of relationships located in the no conflict region. As expected, the results show that there is no correlation between the value of the relationship and the reliability in the region that was not affected by the violence.

4.5 Reliability and Future Relationship Outcomes

The violence made it difficult for firms to maintain regular shipments across the entire portfolio of direct buyers. Exporters, therefore, had to choose which relationships to prioritize and, as shown in Table 4, they prioritized the most valuable relationships.

We now examine whether the measure of reliability at the time of the violence correlates with subsequent outcomes in the relationships. We focus on the period starting from the beginning of the following season, i.e., after mid august 2008. This is the time in which the contractual parties negotiate the marketing plans and contracts for the new season. We consider a variety of contractual outcomes: relationship’s survival, volume of trade and prices, and estimates of the value of the relationship in the new season.

Reliability and Relationship’s Survival

Figure 7 begins with suggestive evidence on relationship survival. Figure 7 plots the distribution of reliability across the sample of relationships that did survive until

²⁶Unreported results show that the age of the relationship positively correlates with reliability if the value of the relationship is not controlled for. Once the value is controlled for, the correlation between age and reliability is weaker. Also, FOB prices positively correlate with reliability.

²⁷Consistently with these findings, results below show that firms stopped selling to the spot market, where their future value is, by construction, equal to zero.

the following season and those who did not, for relationships in the conflict region and in the no-conflict region separately. The Figure illustrates three facts. First, many more relationships did not survive in the conflict region, 16 out of 94, than in the no-conflict region, where the corresponding figure is 8 out of 95. Second, relationships that survived in the conflict region had higher reliability than those that did not survive. The difference in mean is statistically significant at the 3% level. Third, such a relationship between reliability at the time of the violence and relationship survival does not exist in the sample of relationships that were not directly affected by the violence.

Table 5 confirms these results. The Table shows that across the entire sample of relationships, and controlling for buyer fixed effects and relationship characteristics, reliability at the time of the violence correlates with relationship survival. In particular, higher reliability reduces the likelihood of relationship's death in the conflict region, but does not in the no-conflict region. In other words: the conflict destroyed relationships, but only those towards which exporters have not been reliable. Consistently with this result, Figure 8 shows that, on average, the conflict destroyed relatively less valuable relationships in the conflict region, but not in the no-conflict region.^{28,29}

Reliability and the Evolution of Volumes and Prices

Table 6 reports results on the volume of exports and average prices in the season following the violence on the sample of surviving relationships. The Table reports results from specifications of the form

$$y_{fb}^{sv+1} = \mu_f + \eta_b + \beta R_{fb} + \phi y_{fb}^{sv} + \gamma Z_{fb} + \varepsilon_{fb}; \quad (9)$$

where y_{fb}^{sv+1} can be either average export volumes or prices in the first twenty weeks of the season that followed the violence, y_{fb}^{sv} is the corresponding variable for the same period in the season of the violence, and R_{fb} , Z_{fb} and ε_{fb} are as defined above. In other words, the specification controls for the value of the dependent variable in the corresponding period immediately before the violence. The results, therefore, are best interpreted as correlations between reliability at the time of the violence and growth in the dependent variable.

²⁸Note that in Figure 8 there is a gap of two years, rather than one, between the time at which the survival of the relationship is measured and the time at which the relationship value is estimated. This explain the difference with the findings in Figure 6. Results are reported in this way because the seasonal pick came after the violence and values measured at that time already confound the effects of the violence.

²⁹Note that since reliability R_{fb} is a predicted variable, the Table reports bootstrapped standard errors.

Column 1 shows that reliability at the time of the violence correlates with an increase in volumes in relationships of firms located in the conflict region. As mentioned above, the coefficient should not be interpreted in a causal way since exporters might have chosen to prioritize those relationships for which they expected larger increases in the volume of trade in the following season. Column 2 controls for the estimated value of the relationship before the violence. The logic of introducing this control is as follows. The value of the relationship is a forward-looking given by the expected net present value of the relationship in the future. The estimated value of the relationship immediately before the violence, therefore, might be able to control for the increase in trade volumes that was expected by the exporter at the time of the violence. The result is robust to the inclusion of the past estimated value. The evidence, therefore, is consistent with reliability at the time of the violence to have led to an increase in the volume of trade in the relationship. Column 3, shows that there is no relationship between reliability and increases in trade volumes in the season following the violence for the sample of relationships that were not directly affected by the violence. Finally, Columns 4 to 6 find the corresponding results with respect to increases in prices. Reliability at the time of the violence strongly correlates with increases in prices, regardless of whether the estimated value of the relationship before the violence is controlled for.³⁰

Reliability and the Evolution of Relationship's Value

Finally, Table 7 explores the correlation between the reliability at the time of the violence and the evolution of future values in the relationship. The Table reports the corresponding results from specification (9), considering two alternative measures of a relationship value. Column 1 reports results using the (normalized) value of the relationship. It finds that reliability at the time of the violence correlates with future relationship value. Column 2 uses an alternative proxy for the value of the relationship which is given by the ratio of the shipment volumes at the time of the maximum temptation to renege over the average weekly shipment volumes. This measure does not rely on prices and captures how much the relationship can be “stretched” at the time of the maximum temptation to deviate. The results confirm the findings in Column 1. Finally, Columns 3 and 4 show that no relationship exists between reliability at the time of the violence and expansion in relationships value.

³⁰Unreported results show that the age of the relationship does not correlate with increases in volumes and prices. However, the interaction between reliability and age is negative and marginally statistically significant, suggesting that the effects of reliability on future outcomes were stronger for newer relationships.

The results in Tables 5, 6 and 7 cannot be interpreted causally. While the negative supply shock was exogenous to the firm, a firm’s reaction to the shock is not: the choice of which relationship to prioritize, if any, is an endogenous choice of the firm. In particular, firms might have chosen to prioritize those relationships in which they expected higher growth rates in either transacted volumes, prices or that they perceived to be more likely to survive.

4.6 Further Evidence

Direct Relationships versus Spot Market

If relationships are valuable, exporters should have exerted effort to maintain supply to their direct buyers during the time of the violence. For instance, exporters could have hired security and organized protection, paid higher wages for remaining workers to work extra-hours, and so on. A particular form of effort that can be detected in the data is whether firms prioritized shipments to direct buyers relative to the spot-market.³¹

For every firm in the industry, we construct the “reliability” towards the spot market, following the construction of the reliability towards direct buyers R_{fb} . Column 1 in Table 8 shows that, for the firms in the conflict region, exports volumes to the spot market drop significantly more than export volumes to direct buyers. Export volumes to the spot market drop by about 80%, while export volumes to direct relationships only drop by 20%. Since firms that only sell to the spot market might have been affected by, and reacted to, the violence differently than firms that also sell to direct buyers, Column 2 includes firm fixed effects. While the effect of the conflict dummy can no longer be identified, the result shows that firms have prioritized shipments to direct buyers over shipments to the spot market.

Column 3 shows that direct relationships of firms that, in normal times, do not sell to the spot market suffer larger declines in shipments during the violence. Consistently with the fact that firms stopped selling on the spot market to maintain supply to direct buyers, those firms that normally do not sell to the spot market did not have access to the buffer, and found it more difficult to maintain supply to their direct buyers.³²

³¹Note that, by definition, the spot market is the “relationship” with zero value.

³²Ksoll et al. (2010) shows that, among the firms located in the regions affected by the violence, those that specialize in selling to direct buyers experienced a significantly smaller loss in *total* volume exported and lost a significantly lower proportion of workers during the conflict. The results control for many potentially confounding factors, including characteristics of a firm’s labor force, such as education, gender, ethnicity, contract type and housing programs, as well as ownership type, certifications and size. The evidence is, therefore, consistent with the idea that firms engaging in direct relationships

Evidence on Prices

The results above show that firms have prioritized shipments to direct buyers over shipments to the spot market during the time of the violence. Figure 9 reports the distribution of FOB prices in direct relationships at the time of the violence. The two vertical bars show the average prices prevailing on the spot market during the time of the violence for both small and large stems. The Figure shows that for a vast majority of relationships FOB prices were lower than prices on the spot market at the time of the violence.

Figure 10 shows that FOB prices during the violence are very similar to prices in the twenty weeks before the violence: prices in direct relationships were not renegotiated upward at the time of the violence. At the time of the violence, therefore, firms have foregone short-run gains to continue supplying direct buyers. Firms must derive future rents from maintaining supply to the direct buyers, and those future rents were sufficient to compensate for the foregone gains and increases in costs.

5 Interpretation

Real-life long-term relationships are complex and multifaceted. Consequently, the theoretical literature on the subject is very large (see, for a recent and comprehensive treatment, Mailath and Samuelson (2006)). No single theoretical model captures all the salient aspects of real-life relationships. The purpose of this Section is to interpret the evidence presented above under the light of the different theoretical frameworks in the literature.

To summarize, we have documented three main facts: *i*) the value of the relationship for the seller increases with the age of the relationship, *ii*) at the time of a large, negative shock, sellers prioritize the most valuable relationships, and *iii*) these choices correlate with future long-term outcomes in the relationship.

To fix ideas, we begin by considering the relational contracts literature as developed in, e.g., Klein and Leffler (1981), Bull (1987) and MacLeod and Malcolmson (1989). In an important paper, Levin (2002) extends the relational contracts literature to consider asymmetric information, both in the form of adverse selection and moral hazard. Both extensions are relevant in our context since, following a failure to deliver flowers of the specified quality, foreign buyers might not be able to tell whether under performance was due to unobservable shock or to low effort. More importantly, Levin have exerted effort to maintain production and keep their workers.

(2002) shows that *i*) if parties are risk-neutral and have access to monetary transfers, and *ii*) the buyer’s actions are perfectly observable, then the (constrained) optimal relational contract is stationary.³³ The intuition for this result is as follows: rewards for the seller can come either as immediate payments following good performance, or from moving to a continuation equilibrium that gives higher expected payoff. Given risk neutrality, these two tools are perfect substitute from the point of view of the agent. Given that the buyer’s behavior is perfectly observable, an optimal contract never destroys surplus along the equilibrium path. Good performance can then be rewarded with monetary transfers without “distorting” future seller continuation payoff.

The evidence discussed above stands in stark contrast with the predictions of the baseline Levin (2002) model: a temporary shock permanently changed future volumes of trades and prices, i.e., the arrangement observed in the data appears to be non-stationary. Levin (2002) considers the case in which the buyer privately observes outcomes, an assumption which is also relevant in the context of flowers, which are highly perishable. This possibility introduces potential for disagreement among parties and Levin (2002) shows that stationary contracts are no longer effective. The extension transforms the setting into a repeated game with private, rather than perfect public, monitoring. Finding optimal equilibria in this class of games is difficult, but Levin (2002) shows that under the assumption that buyers provide a full performance evaluation after each period, the optimal contract is a simple termination contract. In a simple termination contract trade between parties continues in a stationary fashion provided that performance is above a certain threshold. If performance falls below the threshold, parties cease to trade forever. While the assumption that buyers provide a full performance evaluation in each period is likely to apply in our setting, the evidence that, conditional on relationship survival, volumes of trade and prices are permanently affected by the behavior at the time of the shock is not consistent with a simple termination contract.

Interpreted under the light of Levin’s (2002) framework, the evidence implies that the assumption of monetary transfers between risk neutral parties is problematic in our context.³⁴ The theoretical literature provides alternative frameworks in which these assumptions are relaxed. A dynamic contracting literature has focused on self-enforcing

³³A contract is stationary if, on the equilibrium path, effort and compensation are a stationary function of the performance outcome realized in that date.

³⁴Note also that in most relational contracts models parties “jump” on the equilibrium from the start of their relationship, i.e., there is no explicit link between the history of the relationship and continuation payoff. This is in contrast to the strong correlation between the age and value of the relationship for the seller. We return to this issue below.

agreements in the presence of risk aversion (see, e.g., Thomas and Worrall (1988)). Risk aversion introduces a demand for insurance and the literature has focussed on the constraints imposed by, e.g., limited commitment, on the amount of insurance that parties can provide to each other. In these models, future continuation values are used in combination with current monetary transfers to provide incentives. The fact that prices in direct relationships tend to be constant throughout the season suggests that insurance might be an important consideration in the context of the flower market. However, insurance models cannot account for other facts we have documented above. In particular, in insurance models the future value promised by the principal to the agent positively correlate with current insurance. In our context, this suggests that at the time of the violence sellers should have been given more “slack” by buyers with whom they have more valuable relationships. In other words, if insurance is an important source of the value of a relationship, the relationship value should be negatively correlated with reliability at the time of the violence. This is in stark contrast to what documented above. Furthermore, in contrast to the predictions of an insurance model in which a combination of future value and current monetary transfers is used to provide insurance, prices were not renegotiated at the time of the violence. In sum, while possibly important in the context of the flower industry, the evidence suggests that insurance considerations cannot fully account for the evidence discussed above.

These considerations require to consider models in which monetary transfers are not available, e.g., the general literature on repeated games.³⁵ As is well known, in repeated games with perfect information optimal equilibria can always be stationary (see, e.g., Abreu (1988)). In models with imperfect monitoring (see, e.g., Green and Porter (1984), Abreu et al. (1990), Athey and Bagwell (2001)), in contrast, optimal equilibria are nonstationary. The general insight offered by this class of models is that, because of imperfect monitoring, “punishments”, i.e., switching to worse continuation play, occur in equilibrium with positive probability. In contrast to models with perfect information, therefore, parties have incentives to find the minimum punishment that deter deviations. In general, it is hard to characterize optimal equilibria and, consequently, it is hard to empirically reject this class of models. Intuitively, however, the length of the punishment period should be linked to how much the performance outcome is informative of actions taken on the equilibrium path: if failure most likely stems from adverse circumstances, then the length of the punishment period should be

³⁵Spencer (2004) discusses anecdotal evidence for why unconditional transfers, e.g., two-part tariffs, are not used in the context of international transactions.

shorter (see, e.g., Mailath and Samuelson (2006)). In our context, the ethnic violence was arguably a time in which non-performance was not an accurate signal of defection. In contrast to the findings, therefore, we might not expect to find that the punishment period carries through to the following season in the form of lower trade volumes and prices.³⁶

Finally, the theoretical literature has captured the notion of reputation with models that introduce uncertainty over a seller's type (see, e.g., Kreps and Wilson (1982), Diamond (1989), Mailath and Samuelson (2006)). The uncertainty is introduced by assuming that the seller could be a "commitment type", i.e., a player that always plays the same action. Short-term opportunism is deterred by fear of worsening a player's reputation: by frequently being reliable, the seller develops a reputation which induces expectations that she will be reliable in the future too. Reputation models necessarily have a non-recursive structure since beliefs about a player's type evolve over time. Moreover, in reputation models, the age and history of the relationship strongly correlate with, in fact "cause", future relationship's outcomes.

The evidence in the paper is consistent with a reputation model in which sellers try to separate themselves from "unreliable" commitment types. The strong and persistent association between past interactions and future continuation values is consistent with buyers learning about a seller's reliability over time. At the time of the violence, sellers exerted effort to protect their reputation, especially towards the most valuable relationships (e.g., those in which the buyer values reliability more). Finally, seller's higher reputation for reliability is rewarded with future volumes, prices and values at the time of negotiating contracts for the new season.

While a reputation model appears to be consistent with the evidence, reputation models are problematic in many respects. First, reputation results are quite fragile and sensitive to assumptions.³⁷ Second, models often focus on the interaction between one long-lived player and a sequence of short-lived players: with two long-lived players reputation results are even more fragile. Third, incentives to maintain a good reputation eventually die out, as uncertainty over a player's type is resolved. Uncertainty over type can be reintroduced if types are not persistent, reinforcing the feeling that the literature lacks satisfying models of commitment types.³⁸

³⁶Unreported results show that, conditional on survival, trade volumes and prices do not correlate with reliability at the time of the violence in the two months that followed the violence. Some relationships, however, ceased to trade immediately after the violence.

³⁷For example, reputation dynamic are very different in models in which the strategic player tries to separate herself from a "bad" commitment type, versus models in which she tries to pool with a "good" type (see, e.g., Mailath and Samuelson (2006) for a discussion).

³⁸Chassang (2010) studies a repeated game model in which parties learn over time the equilibrium

6 Conclusion

This paper combined transaction level data on flowers exports with spot market prices and a negative supply shock induced by an episode of ethnic violence to study the value of long term relationships in a context with highly incomplete contracts. Consistently with models of trade based on bilateral trust and reputation, the paper shows that future rents assure contractual performance and quantifies those rents for the sellers. Interpreted under the light of relational contracts models, informal insurance models, repeated games with and without perfect monitoring and reputation models with types, sellers reaction to the supply shock suggests that (acquiring and maintaining) a reputation for reliability is an important determinant of sellers rents in our context.

While derived in a special context, the results yield lessons relevant in other contexts. A view that emphasizes trust and reputation as important determinants of trade yields radically different policy implications. The rents associated with long term relationships are consistent with entry costs in export markets: under free entry, initial losses compete away the future rents (see, e.g., Shapiro (1982)). Trust and reputation, then, become assets firms have to build and invest in. Furthermore, if “reputation”, rather than “trust”, is an important determinant of contractual outcomes, prior beliefs about sellers types will initially affect buyer willingness to trade. This might generate positive externalities across sellers and relationships which are different from the negative ones implied by trust models. Also, negative supply shocks such as the ethnic violence considered here, while they might destroy some (of the least valuable) relationships, they also yield an opportunity for sellers to “prove” themselves. Negative shocks can then create surplus by speeding up the process of reputation building.

Policies directed at lowering the costs of starting new relationships, e.g., common marketing, international fairs attendance, have the potential to alleviate barriers to entry while targeting firms that are capable of exporting. In the more specific context of non-traditional agricultural exports from developing countries, the results suggest a positive complementarities between spot markets and direct relationships: while direct relationships provide value in the form of future rents, the spot market allows direct relationships to adjust to supply shocks.

they are playing. The model naturally generates nonstationary dynamics and relationships display path-dependence. Exploring further connections between the model and the evidence discussed in this paper awaits future work.

References

- [1] Andrabati, T., M. Ghatak and A. Kwhaja (2006) “Subcontractors for Tractors: Theory and Evidence on Flexible Specialization, Supplier Selection, and Contracting”, *Journal of Development Economics*, April 79 (2): 273-302.
- [2] Antras, P. and A. Costinot (2009) “Intermediated Trade”, mimeo MIT
- [3] Araujo, L. and E. Ornelas (2007) “Trust Based Trade”, mimeo LSE
- [4] Banerjee, A. and E. Duflo (2000) “Reputation Effects and the Limits of Contracting: A Study of the Indian Software Industry”, *Quarterly Journal of Economics* 115: 989-1017.
- [5] Banerjee, A. and K. Munshi (2004) “How efficiently is capital allocated? Evidence from the knitted garment industry in Tirupur”. *Review of Economic Studies* 71(1): 19-42.
- [6] Bar-Isaac, H. and S. Tadelis (2008) “Seller Reputation”, *Foundations and Trends in Microeconomics*, 4: 273-351.
- [7] Bernard, B., B. Jensen, S. Redding and P. Schott (2009) Wholesalers and Retailers in U.S. Trade, mimeo Dartmouth
- [8] Blum, B., S. Claro, and I. Horstmann (2009) “Facts and Figures on Intermediated Trade”, mimeo Toronto
- [9] Board, S. (2008) “The Value of Loyalty”, UCLA mimeo.
- [10] Brown, M., A. Falk, E. Fehr (2004) “Relational Contracts and the Nature of Market Interactions”, *Econometrica*, 72-3: 747–780.
- [11] Brown, M., A. Falk, E. Fehr (2009) “On Reputation: a Microfoundation of Contract Enforcement and Price Rigidity”, *Economic Journal*, 119-3, 333–353.
- [12] Cabral, L. (2006) “The Economics of Trust and Reputation: a Primer”, mimeo NYU
- [13] Cameron, C., J. Gelbach and D. Miller (2008) “Robust Inference with Multi-way Clustering”, mimeo, University of California-Davis.
- [14] Corts, K. and J. Singh (2004) “The Effect of Repeated Interaction on Contract Choice: Evidence from Offshore Drilling,” *Journal of Law, Economics, and Organization*, 20: 230-60.

- [15] Das, M., M. Roberts and J. Tybout (2007) “Market Entry Costs, Producer Heterogeneity and Export Dynamics”, *Econometrica*, vol. 75(3), pages 837-873.
- [16] Diamond, D. (1989) “Reputation Acquisition in Debt Markets”, *Journal of Political Economy*, 97: 828-862.
- [17] Eaton, J., S. Kortum and F. Kramarz (2008) “An Anatomy of International Trade: Evidence from French Firms”, *NBER WP* 14610.
- [18] Egan, M.L. and Mody, A. (1992) “Buyer-Seller Links in Export Development”, *World Development*, 20, 321-34.
- [19] Gereffi, G. (1999) “International trade and industrial upgrading in the apparel commodity chain”, *Journal of International Economics*, 48, 37–70.
- [20] Greif, A. (2005) “Commitment, Coercion, and Markets: The Nature and Dynamics of Institutions Supporting Exchange.” In *Handbook of New Institutional Economics*, ed. C. Menard and M. M. Shirley. New York: Springer.
- [21] Holmstrom, B. (1999) “Managerial Incentives Problems - a Dynamic Perspective”, *Review of Economic Studies*, 66: 169-182.
- [22] Kalnins, A. and K. Mayer (2004) “Relationships and Hybrid Contracts: An Analysis of Contract Choice in Information Technology,” *Journal of Law, Economics, and Organization*, 20: 207-29.
- [23] Kellogg, R. (2009) “Learning by Drilling: Inter-Firm Learning and Relationship Persistence in the Texas Oilpatch,” mimeo, University of Michigan
- [24] Klein, B. and K. Leffler (1981) “The Role of Market Forces in Assuring Contractual Performance”, *Journal of Political Economy*, 89(4): 615–41.
- [25] Kranton, R. (1996) “Reciprocal Exchange: A Self-Sustaining System.” *American Economic Review*, 86(4): 830–51.
- [26] Kranton, R. and Swamy, A. (2007) “Contracts, Hold-Up and Exports: Textiles and Opium in Colonial India”, *American Economic Review*, forthcoming.
- [27] Kreps, D. and R. Wilson (1982) “Reputation and Imperfect Information”, *Journal of Economic Theory*, 27: 253-279
- [28] Ksoll, C., R. Macchiavello and A. Morjaria (2009) “*Guns N’ Roses*: an Anatomy of the Effects of Ethnic Violence on Kenya Flower Exports”, mimeo Oxford.

- [29] Lafontaine, F. and M. Slade (2009) "Inter-Firm Contracts: Evidence", forthcoming in R. Gibbons and J. Roberts (Eds.), *Handbook of Organizational Economics*, Elsevier.
- [30] Lyons, B. (2002) "Are Contracts Used Strategically To Frame Renegotiation? An Empirical Study of Inter-Firm Contracts," mimeo, University of East Anglia.
- [31] Macchiavello, R. (2010) "Development Uncorked: Reputation Acquisition in the New Market for Chilean Wines in the UK", CEPR DP7698
- [32] Mailath, G. and L. Samuelson (2006) *Repeated Games and Reputations: Long-Term Relationships*, Oxford University Press.
- [33] McMillan, J. and C. Woodruff (1999) "Inter firm Relationships and Informal Credit in Vietnam", *Quarterly Journal of Economics*, 114: 1285-1320.
- [34] MacLeod, W. B. (2007) "Reputations, Relationships, and Contract Enforcement," *Journal of Economic Literature*, 45: 595-628.
- [35] MacLeod, W. and J. Malcomson (1989) "Implicit Contracts, Incentive Compatibility, and Involuntary Unemployment." *Econometrica*, 57(2): 447-80.
- [36] Munshi, K. (2008) "The Birth of a Business Community: Historical Disadvantage and Contemporary Mobility in India", mimeo Brown Univ.
- [37] Newbery, D. and J. Stiglitz (1982) "Risk Aversion, Supply Response, and the Optimality of Random Prices: A Diagrammatic Analysis", *Quarterly Journal of Economics*, vol. 97(1), pages 1-26.
- [38] Rauch, J. E. (1999) "Business and Social Networks in International Trade", *Journal of Economic Literature*, 39(4), 1177-1203.
- [39] Shapiro, C. (1983) "Premiums for High Quality Products as Returns to Reputations" *Quarterly Journal of Economics*, 98(4): 659-79.
- [40] The Economist (2008), "Kenya's flower industry: Roses are red", February 7th, 2008, Nairobi.

7 Appendix A: Theoretical Framework

We introduce a stylized theoretical framework to guide the use of observable prices and volumes to derive a lower bound on the value of the relationship for the seller. The role of the relational contract is highlighted more clearly when a single supplier deals with a single buyer and courts can not enforce standard sales contracts. This last assumption is reasonable in the case of flowers since the high perishability of flowers makes it impractical to enforce contracts on the quantities and qualities to be delivered.

Set Up: Revenues, Costs and Markets

Time is discrete, the buyer and the seller have an infinite horizon and discount the future at a common and constant rate $\delta < 1$. In each period, the cost of producing q units of flowers is given by $c(q) = \frac{cq^2}{2}$.³⁹ The buyer derives revenues $R(q) = vq - \frac{(q-q^*)^2}{2} - k\mathbf{I}_{q \neq q^*}$ from procuring q units of flowers, where $\mathbf{I}_{q \neq q^*}$ is an indicator taking value equal to one if the buyer sources $q \neq q^*$ units of flowers in a given period. To capture the importance that buyers place on reliability, we assume that q^* is fixed and k is large enough so that it is always optimal for the buyer to source a constant amount of flowers q^* in each period.

Alongside the relationship between the buyer and the seller, there is a market, where the supplier can sell and the buyer can purchase unlimited quantities of flowers at given prices. For simplicity, let us assume that prices on this market oscillate across periods with a “high season” followed by a “low season” and so on. The supplier can sell flowers on the market at a price $p = \underline{p}$ in the low season and at a price $p = \bar{p}$ in the high season. The buyer can purchase flowers on the market at an additional intermediation cost τ , so that the price the buyer faces when the price on the market is $p' \in \{\underline{p}, \bar{p}\}$ is given by $p_b = p' + \tau$. To simplify, let $\underline{p} = 0 < \tau < \bar{p} = p < v$. It is easy to generalize the results to an arbitrary number of seasons and prices.

First Best Contracts

In the first best contracts are perfectly enforceable and the two parties maximize period by period the joint profits. Denote by q_s the quantity supplied by the seller to the buyer, q_a the quantity that the buyer procures on the market and by q_A the quantity sold on the market by the seller. We make the following parametric assumption:

Assumption 1: $k > \frac{1}{2} \frac{(v-cq^*)^2}{1+c}$, and $q^* < \frac{\tau}{c}$.

³⁹This cost function can be derived from a model in which the firm trains L workers at the beginning of the season and, for a given amount of workers L , extra production can be obtained by increasing hours per worker. Under increasing marginal cost of hours worked, the marginal cost c is a decreasing function of the labor force L .

The first assumption implies that, in equilibrium, $q^* = q_a + q_s$, i.e., the buyer sources a quantity q^* of flowers in each period. When this is the case, the optimal sourcing and production decisions when the price on the spot market is p solve the following problem

$$\max_{q \equiv [q_s, q_A]} vq^* - (p + \tau)(q^* - q_s) + pq_A - \frac{c(q_s + q_A)^2}{2}.$$

Denoting by \underline{q} and \bar{q} the solution vector in the high and low season respectively, we have the following Lemma,

Lemma 1 *Under Assumption 1 the optimal sourcing policy is given by*

$$\underline{q} = \begin{cases} q_s = q^* \\ q_a = 0 \\ q_A = 0 \end{cases} \quad \text{and} \quad \bar{q} = \begin{cases} q_s = q^* \\ q_a = 0 \\ q_A = \frac{p}{c} - q^* \end{cases}$$

in the low and high season respectively.

Proof of Lemma 1

When $p = \underline{p}$, then obviously $q_A = 0$. Under Assumption 1, the interior solution is given by the first order conditions

$$\begin{aligned} v &= (q_a + q_s) - q^* + cq_s, \\ v &= (q_a + q_s) - q^* + \tau. \end{aligned}$$

This gives $q_s = \frac{\tau}{c}$, and $q_a = v - \tau + q^* - \frac{\tau}{c}$. Denote the associated joint profits by $\Pi_{p=0}^q$. This sourcing policy needs to be compared with sourcing q^* directly from the buyer and setting $q_a = q_A = 0$, which gives joint profits $\Pi(\underline{p}) = vq^* - \frac{c(q^*)^2}{2}$. By Assumption 1, we have $\frac{\tau}{c} < q^*$, which implies $\Pi(\underline{p}) > \Pi_{p=0}^q$ if $k > \frac{(v-\tau)^2}{2}$.

When, instead, the price at the auction is $p = \bar{p}$, the optimal strategy is to set $q_a = 0$, $q_s = q^*$ and $q_A = \frac{p}{c} - q^*$, which gives profits equal to $\Pi(\bar{p}) = (v - p)q^* + \frac{p^2}{2c}$. The alternative interior solution gives $q_s = v - p + q^*$, and $q_A = \frac{p}{c} - (q^* - (v - p))$. This implies profits $\Pi_{p=\bar{p}}^q = \frac{(v-p)^2}{2} + \frac{p^2}{2c} + q^*(v - p)$, which are smaller than the assumed optimum if $k > \frac{(v-p)^2}{2}$. This is guaranteed by Assumption 1 combined with $p > \tau$. ■

Assumption 1 guarantees that the model captures well established practices in the industry. Since $\tau > 0$, the marginal benefit of selling to the auction is always smaller

than the marginal cost of procuring on the auction. So, if $q_A > 0$, it must be that $q_a = 0$ (and viceversa). The optimal sourcing policy, therefore, entails a constant order flow q^* from the buyer to the seller throughout the season. This is because k is large enough so that it is never optimal for the buyer to source a quantity different from q^* . Sales to the spot market, instead, fluctuate through the season. In the low season, the assumption $q^* < \frac{\tau}{c}$ guarantees that the marginal cost of producing q^* is smaller than the marginal cost of sourcing on the spot market. In the high season, it is instead profitable to sell quantity in excess of q^* on the spot market. The assumption also implies that the total surplus generated by the relationship is higher in the high season than in the low season.

Second Best Relational Contract and Seller Incentive Compatibility

When contracts cannot be written and enforced, parties resume to a relational contract to manage the procurement of flowers. In general, a (stationary) relational contract specifies quantities and payments between the parties in the high and low season. We are interested in determining the conditions under which the first best contract can be implemented, so that a constant level of trade $q_s = q^*$ can be sustained between the parties throughout the relationship. The relational contract is therefore described by unit prices \underline{t} and \bar{t} that the buyer pays to the seller upon successful delivery of quantity q^* in the low and high season respectively.

In this environment, both the buyer and the seller might have incentives to renege on the implicit contract. The buyer might be tempted to avoid paying the price tq^* once the flowers have been received. The seller, instead, might prefer to produce and sell to the buyer a quantity different from the agreed one, q^* . Critically, in evaluating the relative merit of adhering or reneging on the contract, the parties take into account what will happen to the relationship following a failure to deliver q^* or to pay the corresponding price. We assume that, shall any of the two parties renege on the implicit contract, the relationship ends and parties revert to the spot market forever.

Given the focus of the empirical analysis, we consider the incentive constraints for the seller. Denote by $U \in \{\underline{U}, \bar{U}\}$ the value of the relational contract for the buyer and by $U^o \in \{\underline{U}^o, \bar{U}^o\}$ the value of sourcing flowers from the spot market forever, which is assumed to be the punishment for reneging on the relational contract. Intuitively, when the prices on the spot market are high, the relational contract must prevent the supplier from selling the flowers on the spot market deriving an associated gain $(p - \bar{t})q^*$ and loosing the future rents derived from the relationship, $\delta(\bar{U}^o - \bar{U})$. When, instead, prices on the spot market are low, the relational contract must give incentives to the

supplier to produce the specified quantity q^* .

The following Proposition shows that the only relevant constraint for the seller is the one in the high season. The Proposition, therefore, formally establishes the use of the maximum temptation to deviate throughout the season as the correct proxy for the value of the relationship:

Proposition *Assume that, as observed in the data, $p > \bar{t}$. Then, the seller's incentive compatibility constraint in the low season is never binding. The temptation to renege in the high season, given by $q^*(p - \bar{t})$, therefore provides a correct lower bound to the value of the relationship for the seller.*

Proof:

We first establish that the relevant set of incentive constraints for the seller is given by:

$$\begin{aligned} \overline{IC}^S &: \bar{t}q^* + \delta\underline{U} \geq pq^* + \delta\underline{U}^o, \\ \underline{IC}^S &: \underline{t}q^* - C(q^*) + \delta\overline{U} \geq \delta\overline{U}^o \end{aligned} \tag{10}$$

Intuitively, the seller might decide to change production plans when prices at the spot market are low, or she might decide to change sales plans when the prices on the spot market are high. Therefore, both sets of constraints need to be derived. The set of constraints associated with changing production plans, IC_P , is derived as follows. Taking into account the fact that $q_{A^*} = 0$ in the low season, the set of incentive constraints in the high and low season respectively is given by:

$$\begin{aligned} \overline{IC}_P &: \bar{t}q^* + pq_A - C(q^* + q_A) + \delta\underline{U} \geq pq_{A^*} - C(q_{A^*}) + \delta\underline{U}^o, \\ \underline{IC}_P &: \underline{t}q^* - C(q^*) + \delta\overline{U} \geq \delta\overline{U}^o. \end{aligned}$$

The best possible deviation satisfies $C'(q_{A^*}) = p$. Since $q_A > 0$, however, the same holds true for $q^* + q_A$, hence $q_{A^*} = q^* + q_A$. Therefore, this set of incentive constraints can be rewritten as

$$\begin{aligned} \delta(U - U^o) &\geq (p - \bar{t})q^*, \\ \underline{t}q^* - C(q^*) + \delta\overline{U} &\geq \delta\overline{U}^o. \end{aligned}$$

Second, once the seller has produced the agreed quantity of flowers $q^* + q_A$, she must prefer to sell those flowers according to the specified relational contract (rather than

selling a larger part of the produce on the spot market). The corresponding set of incentive constraints is given by:

$$\begin{aligned}\overline{IC}_2^S & : \bar{t}q^* + pq_A + \delta\underline{U} \geq p(q^* + q_A) + \delta\underline{U}^o, \\ \underline{IC}_2^S & : \underline{t}q^* + \delta\bar{U} \geq \delta\bar{U}^o.\end{aligned}$$

It is obvious that the relevant set of incentive constraint is as stated in (10).

To derive the corresponding value functions, denote by $\bar{\Pi}(q^*) = (\bar{t} - p)q^* + \frac{p^2}{2c}$ and $\underline{\Pi}(q^*) = \underline{t}q^* - c(q^*)$ the per period profits from the relationships in the high and low season. The value of the relationship in the high and low seasons are respectively given by:

$$\bar{U} = \frac{\bar{\Pi}(q^*) + \delta\underline{\Pi}(q^*)}{1 - \delta^2} \text{ and } \underline{U} = \frac{\underline{\Pi}(q^*) + \delta\bar{\Pi}(q^*)}{1 - \delta^2}. \quad (11)$$

Assuming that upon the breakdown of the relationship the supplier sells forever on the spot market, the value of the outside option in the high and low season respectively is given by:

$$\bar{U}^o = \frac{1}{1 - \delta^2} \frac{p^2}{2c} \text{ and } \underline{U}^o = \frac{\delta}{1 - \delta^2} \frac{p^2}{2c}. \quad (12)$$

The incentive compatibility can be derived, after some manipulation, by substituting (11) and (12) in 10. This gives

$$\begin{aligned}\overline{IC}^S & : \delta(\underline{t}q^* - C(q^*)) \geq (p - \bar{t})q^*, \\ \underline{IC}^S & : \frac{(\underline{t}q^* - C(q^*))}{\delta} \geq (p - \bar{t})q^*.\end{aligned} \quad (13)$$

Since $\delta < 1$, the constraint in the high season, \overline{IC}^S , implies the constraint in the low season, \underline{IC}^S , and therefore the only constraint that could be binding is the one in the high season. Note that this assumes that $p > \bar{t}$, which will be proven to hold below. ■

8 Appendix B

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

Firm Transactional level Export Data

We analyze data on exports of flowers from Kenya. The data cover all exports of flowers during the period from April 2004 to August 2009. These data are collected by Horticultural Crops Development Authority (HCDA), a parastatal body established

under the Agricultural Act, Cap 318, which develops, promotes, coordinates and regulates the horticultural industry in Kenya. Records of each export transaction are entered in close collaboration with customs services as well as KEPHIS, the agency responsible for phytosanitary inspection of export produce, which are compulsory and strictly enforced. The invoice for each transaction is directly entered into the database at HCDA before the flowers are exported out of the country. Each transaction invoice contains the following information: the name of the Kenyan exporter, the foreign consignee/client, the type of produce, the weight (kgs), the units, the unit value, the total value, the date, the destination, the currency and the agreement on freight (C&F, FOB). Because seasonal patterns are important, we restrict our sample to established exporters that export throughout most of the season in the year preceding the violence. There are approximately 120 producers satisfying those requirements and they cover more than ninety five percent of the exports recorded in the data.

Survey and Administrative Data

The empirical analysis in this paper exclusively relies on the export records. Information provided in the background section, however, was collected through a firm-level survey. The survey was designed in collaboration with Chris Ksoll and was implemented by the authors in July to September 2008. The survey covered i) general questions about the firm (history, farm certification, ownership structure, level of vertical integration, location of farms etc.), ii) contractual relationships in export markets and marketing channels (direct wholesaler and/or auction houses), iii) firm production (covering detailed information on labor force, input use and assets), iv) retrospective post-election violence period (effect on operations, loss of workers by week, issues on transportation and air-freight, financial losses and extra-costs incurred). The survey was administered to the most senior person at the firm, which on most occasions was the owner himself/herself. Upon previous appointment, face-to-face interviews of one to two hours were conducted by the authors with the respondent.

Further administrative data on firms location, ownership, buyer's activity and auction prices was collected from various sources. HCDA, Kenya Flower Council (KFC) and several field visits during the survey, gave the location of all regular exporters in the sample. The names of the directors of the firms are obtained from the Registrar of Companies at the Attorney General's Office. This provides information on the owner's nationality. Internet search and interviews with people in the industry guided the classification of foreign buyers into different marketing channels. Finally, data on prices and volumes at the auctions is obtained at the weekly level from the International

Trade Centre, UNCTAD/WTO, Geneva.

Days of Violence and Conflict location

To classify whether a location suffered conflict or not we rely on the Kenya Red Cross Society's (KRCS) *Information Bulletin on the Electoral Violence*. The KRCS issued the bulletins in the early stages of the crisis daily and later on they were issued every 3/4 days till the end of the crisis.⁴⁰ The first information bulletin (No. 1 of 3rd January 2008) also contained a map which outlined locations where unrest had occurred. We further obtain access to various sources to supplement our understanding on both whether the location suffered conflict and when this took place. These are (i) *Disaster Desk* of the Data Exchange Platform for the Horn of Africa (DEPHA)⁴¹, during the post election violence DEPHA provided maps with hot spots on where and when the violence had occurred,⁴² (ii) the open source project known as *Ushahidi*, was launched to gather information from the general public on events occurring in near-real time. The general public could on a map of Kenya pin up a town/area where conflict had erupted and when,⁴³ (iii) the Kenya National Commission on Human Rights Report (2008) which was initiated by the Human Rights organization itself (iv) Independent Review Commission Report (2008) which was initiated by the Government of Kenya to set up a commission into the post election violence. These sources are useful to make sure we are exhaustive and that smaller towns are not missed out. We use these reports to aid our understanding but are aware that there could be measurement error inherent due to their purpose. As mentioned there were two outbreaks of violence. The first one occurred as soon as the election results were announced on the 29th December 2007 which lasted until the 4th Jan 2008, locations which were suffered from violence then were Eldoret, Kitale and Nakuru. The second outbreak occurred between the 25th January 2007 and 30th January 2008, the town of Naivasha suffered during this outbreak.

⁴⁰See Kenya Red Cross Society (2008) for details.

⁴¹DEPHA's goal is to provide geographic information data and services to the region under the UN's OCHA.

⁴²We obtain all the DEPHA maps from: http://www.depha.org/Post_election_Violence.asp (Accessed on 23 September 2008). Similar information is also available from <http://www.reliefweb.int> which is also under the UN's OCHA.

⁴³For details about *Ushahidi* see <http://www.ushahidi.com/about>. For the Kenya project see <http://legacy.ushahidi.com/> (accessed on 30 September 2008).

Table 1: Direct Relationships, Descriptive Statistics

Variable	Observations	Mean	St. Dev.	Min	Max
Panel A: Relationships Characteristics					
Number of Shipments	189	60.60	35.69	20	140
Number of Stems per Week (in 1000s)	189	102.39	165.14	1.53	971.72
Av. FOB Price (Euro Cents per stem)	189	12.11	11.65	1.25	25.75
Age (in Days)	189	860.12	449.45	33	1352
Number of Previous Transactions	189	298.23	288.80	20	1128
Left Censored (Yes = 1, No =0)	189	0.44	0.49	0	1
Panel B: Number of Relationships per Buyer and Seller					
Number of Relationships per Seller	56	3.38	2.88	1	14
Number of Relationships per Buyer	71	2.66	2.82	1	14
Panel C: Estimated Relationships Values (Season Before the Violence)					
Estimated Value (Relative to Week)	189	3.31	4.23	0.00	26.90
Estimated Value (Relative to Season)	189	0.10	0.19	0.00	1.78
Highest Volume (Relative to Week)	189	2.45	3.11	1.04	6.51

Source: Authors calculations from HCDA Transaction level data on all flower exports. The sample is given by all relationships active immediately before the violence, i.e., only relationships that had more than 20 transactions from the beginning of the season. Left censored refers to relationships that were already active before the beginning of the period covered in the data, i.e., relationships that were active before September 2004.

Table 2: History and Future Value of Relationships

Dependent Variable: Relationship Value	[1]	[2]	[3]	[4]	[5]	[6]
Relationship Age (in Days)	0.381** [0.181]	0.223*** [0.069]				
Number of Previous Shipments			0.440*** [0.099]	0.229*** [0.058]		
Past Temptations to Deviate (Cumulative)					0.257*** [0.057]	0.285*** [0.045]
Firm and Buyer Fixed Effects	yes	--	yes	--	yes	--
Relationship Fixed effects	no	yes	no	yes	no	yes
Season Fixed Effects	no	no	no	yes	no	yes
Number of observations	146	444	146	444	146	444

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table reports correlation between the estimated value of a relationship and different measures of the past history of the relationship. The value is computed for the season before the violence and the sample refers to relationships that were active during the period. The sample excludes relationships that are in the baseline sample but were not active in the season preceding the violence and includes relationships that did not survive until the violence season. A dummy for whether the relationship is left-censored is included as control. Robust standard errors, two-way clustered at the firm and buyer level are reported in parenthesis.

Table 3: The Violence Reduced Exports in Direct Relationships

Dependent Variable: Reliability at Time of Violence	[1]	[2]	[3]	[4]
	Conflict Region	-0.414** [0.206]	-0.392* [0.205]	-0.302* [0.157]
Relationship Controls	no	yes	yes	yes
Exporter Controls	no	no	yes	yes
Buyer Controls	no	no	no	yes
Number of observations	189	189	189	189

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table reports the difference in mean in estimated reliability between direct relationships of firms located in regions directly affected by the violence against direct relationships of firms located in regions not directly affected. Reliability is computed as the ratio of realized exports over predicted exports during the second spike of the violence. The predicted values are obtained by fitting a relationships specific regression of shipments in any given day of the week with shipments in the corresponding day for the previous week, taking into account seasonality patterns. For the median relationship in the sample, this regression has an R-square equal to 0.85. Robust standard errors, two-way clustered at the firm and buyer level, are reported in parenthesis.

Table 4: Relationship Value and Reliability

Dependent Variable: Reliability at Time of Violence	Conflict Region				No Conflict Region	
	[1]	[2]	[3]	[4]	[5]	[6]
Relationship Value	0.066*** [0.023]	0.077* [0.048]			-0.011 [0.040]	
Maximum Sustainable Quantity			0.182** [0.085]	0.128* [0.070]		-0.089 [0.170]
Firms Fixed Effects	yes	yes	yes	yes	yes	yes
Relationship Controls	yes	yes	yes	yes	yes	yes
Buyer Fixed Effects	no	yes	no	yes	no	no
Number of observations	94	94	95	94	94	95

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table reports within firms correlations between estimates of the value of the relationships before the violence and reliability at the time of the violence. Reliability is computed as the ratio of realized exports over predicted exports during the second spike of the violence. The predicted values are obtained by fitting a relationships specific regression of shipments in any given day of the week with shipments in the corresponding day for the previous week, taking into account seasonality patterns. For the median relationship in the sample, this regression has an R-square equal to 0.85. Relationship controls include buyer location and size, relationship age, estimated value and export volumes before the violence. Robust standard errors, two-way clustered at the firm and buyer level, are reported in parenthesis.

Table 5: Conflict and No-Conflict Regions

Dependent Variable: Relationship Death (Season Following the Violence)	[1]	[2]	[3]	[4]
Conflict Region	0.057 [0.051]	0.041 [0.061]	0.213* [0.117]	0.168* [0.094]
Reliability at Time of Violence			0.007 [0.032]	-0.007 [0.032]
Conflict Region X Reliability at Time of Violence			-0.130* [0.069]	-0.113* [0.059]
Relationship Controls	yes	yes	yes	yes
Firm Controls	no	yes	no	yes
Buyer Fixed Effects	no	yes	no	yes
Number of observations	189	189	189	189

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table shows that the violence has destroyed relationships for which reliability at the time of the violence was sufficiently low. No relationship exists between reliability and relationship survival in regions not affected by the violence. The sample is given by all relationships active immediately before the violence. Reliability is computed as the ratio of realized exports over predicted exports during the second spike of the violence. The predicted values are obtained by fitting a relationships specific regression of shipments in any given day of the week with shipments in the corresponding day for the previous week, taking into account seasonality patterns. For the median relationship in the sample, this regression has an R-square equal to 0.85. Relationship controls include buyer location and size, relationship age, estimated value and export volumes before the violence. Firm controls include size, number of relationships, and share of exports to direct relationships. Bootstrapped standard errors are reported in parenthesis.

Figure 6: Reliability and Future Relationship Outcomes

Dependent Variable and Sample (Beginning of Season Following Violence):	Average Weekly Volumes			Average FOB Prices		
	Conflict Region		No-Conflict Region	Conflict Region		No-Conflict Region
	[1]	[2]	[3]	[4]	[5]	[6]
Reliability	0.356** [0.170]	0.307* [0.168]	0.046 [0.100]	0.149** [0.069]	0.148** [0.070]	0.018 [0.042]
Past Estimated Value		0.081 [0.056]			0.011 [0.026]	
Relationship Controls	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes	yes	yes
Buyer Fixed Effects	yes	yes	yes	yes	yes	yes
Number of observations	78	78	87	78	78	87

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table shows that reliability at the time of the violence correlates with volumes and unit prices of exports at the beginning of the season following the violence in the region directly affected by the violence but not in regions not directly affected. The sample is given by the set of surviving relationships. Reliability is computed as the ratio of realized exports over predicted exports during the second spike of the violence. The predicted values are obtained by fitting a relationships specific regression of shipments in any given day of the week with shipments in the corresponding day for the previous week, taking into account seasonality patterns. For the median relationship in the sample, this regression has an R-square equal to 0.85. Past estimated value corresponds to estimated values before the violence. Regressions controls include buyer location and size, relationship age, estimated value as well as the corresponding dependent variable before the violence. Bootstrapped standard errors are reported in parenthesis.

Table 7: Reliability and Future Values

Dependent Variable and Sample (Season Following Violence):	Max. Temptation to Deviate		Max. Temptation to Deviate	
	Estimated Value		Estimated Value	
	Conflict Region		No Conflict Region	
	[1]	[2]	[3]	[4]
Reliability at Time of Violence	0.672*** [0.277]	0.847** [0.391]	0.084 [0.196]	0.022 [0.187]
Relationship Controls	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes
Number of observations	78	78	87	87

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table shows that reliability at the time of the violence correlates with estimates of the value of the relationship in the season following the violence in the region directly affected by the violence but not in regions not directly affected. Reliability is computed as the ratio of realized exports over predicted exports during the second spike of the violence. The predicted values are obtained by fitting a relationships specific regression of shipments in any given day of the week with shipments in the corresponding day for the previous week, taking into account seasonality patterns. For the median relationship in the sample, this regression has an R-square equal to 0.85. Regressions controls include buyer location and size, relationship age, estimated value and shipments before the violence. Bootstrapped standard errors are reported in parenthesis.

Table 8: Reliability: Direct Relationships vs. Auctions

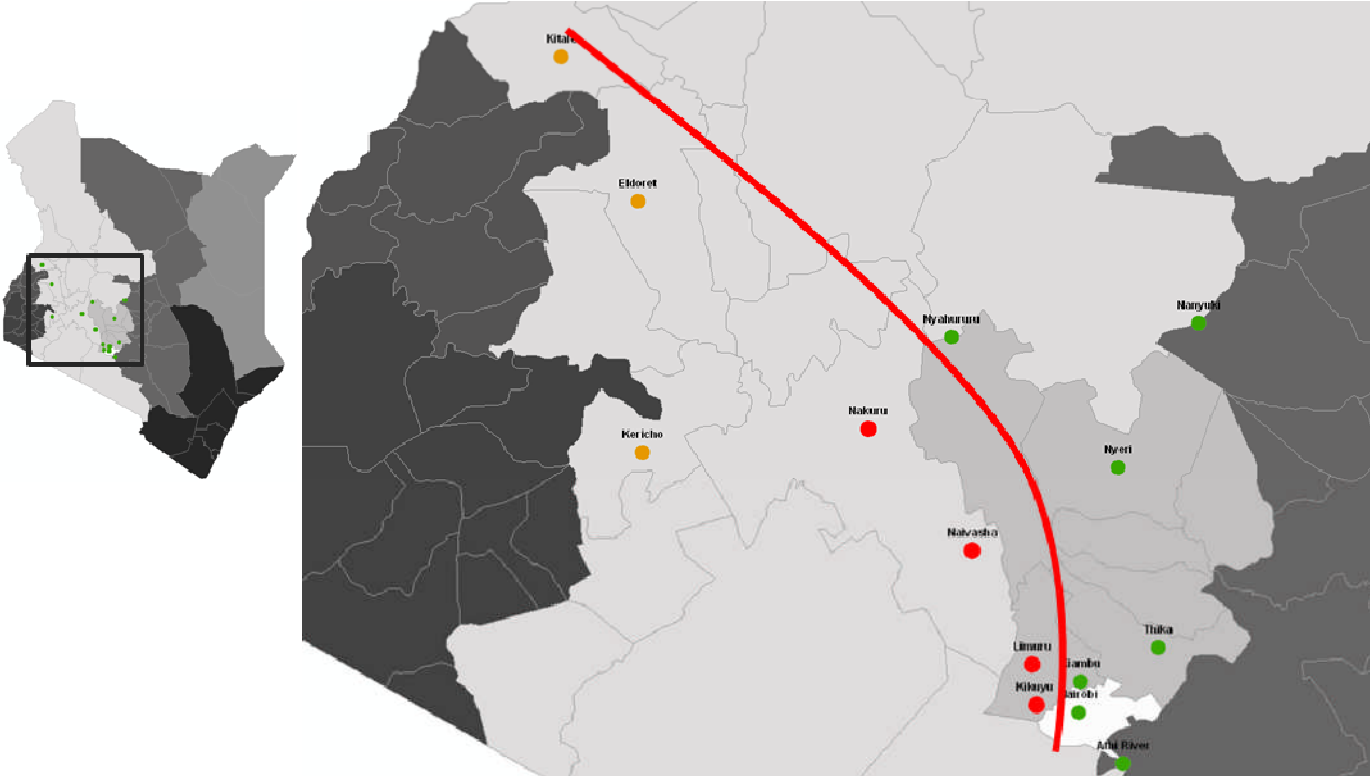
Dependent Variable: Reliability at Time of Violence	[1]	[2]
Conflict Region	-0.865*** [0.082]	-0.175* [0.096]
Direct Relationship	-0.088 [0.103]	0.023 [0.095]
Direct Relationship X Conflict Region	0.650** [0.312]	0.512* [0.271]
Only Direct Relationships [yes = 1]		0.008 [0.113]
Only Direct Relationships [yes = 1] X Conflict Region		-0.473** [0.239]
Relationship Controls	no	no
Firm Fixed Effects	no	yes
Direct Relationships Only	no	no
Number of observations	274	274

***, **, * denote statistical significance at the 1%, 5% and 10% level respectively. The Table reports the difference in mean in estimated reliability between direct relationships and auctions for firms located in regions directly affected by the violence and firms located in regions not directly affected by the violence respectively. Only direct relationship takes value equal to one if the firm exports more than ninety percent of its produce to direct relationships. Robust standard errors, two-way clustered at the firm and buyer level, are reported in parenthesis.

Table A1: The Violence, Self-Reported Records

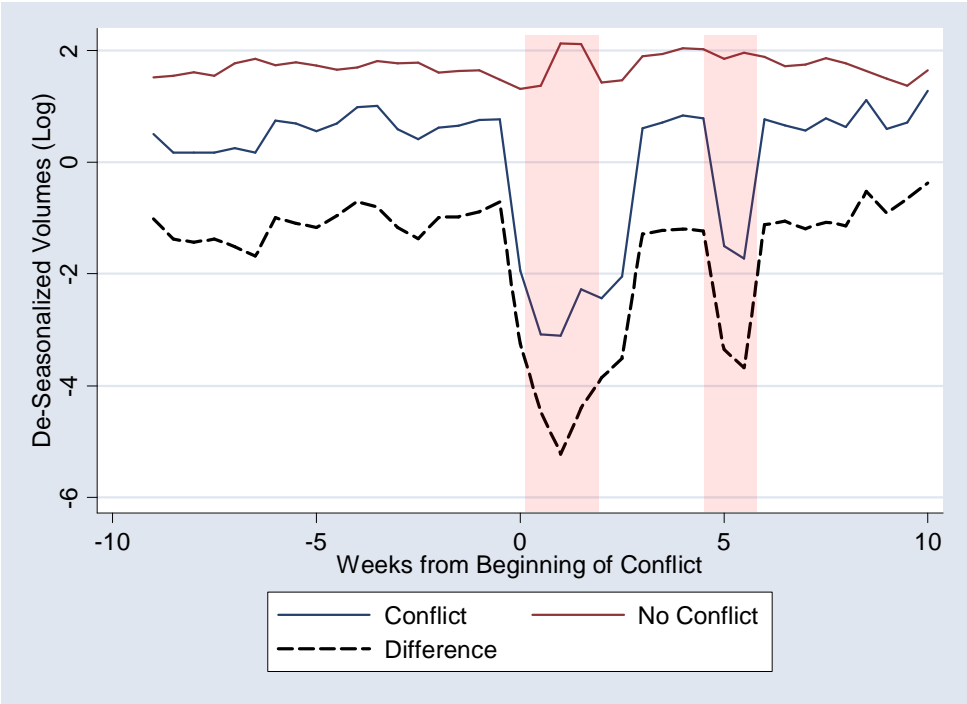
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent Variable:	Did Violence Affect at all the Operations of Your Firm?	Were there any days in which members of your staff did not come to work because of the Violence?	What was the highest proportion of Workers Absent due to the Violence?	To What Extent did Worker Absence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

Figure 1: Conflict and No-Conflict Regions



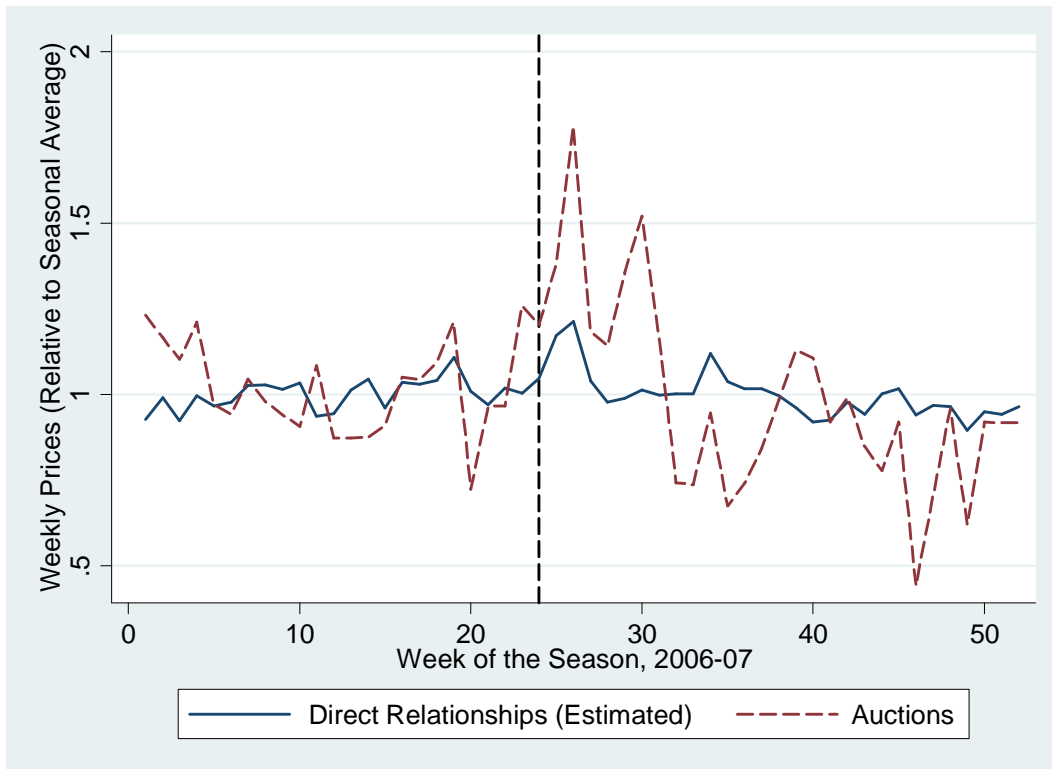
Among the towns around which flower firms are located, the Figure illustrates those locations that were directly affected by the violence to the left of the red line and those locations that were not affected by the violence to the right.

Figure 2: Effect of Violence on Export Volumes



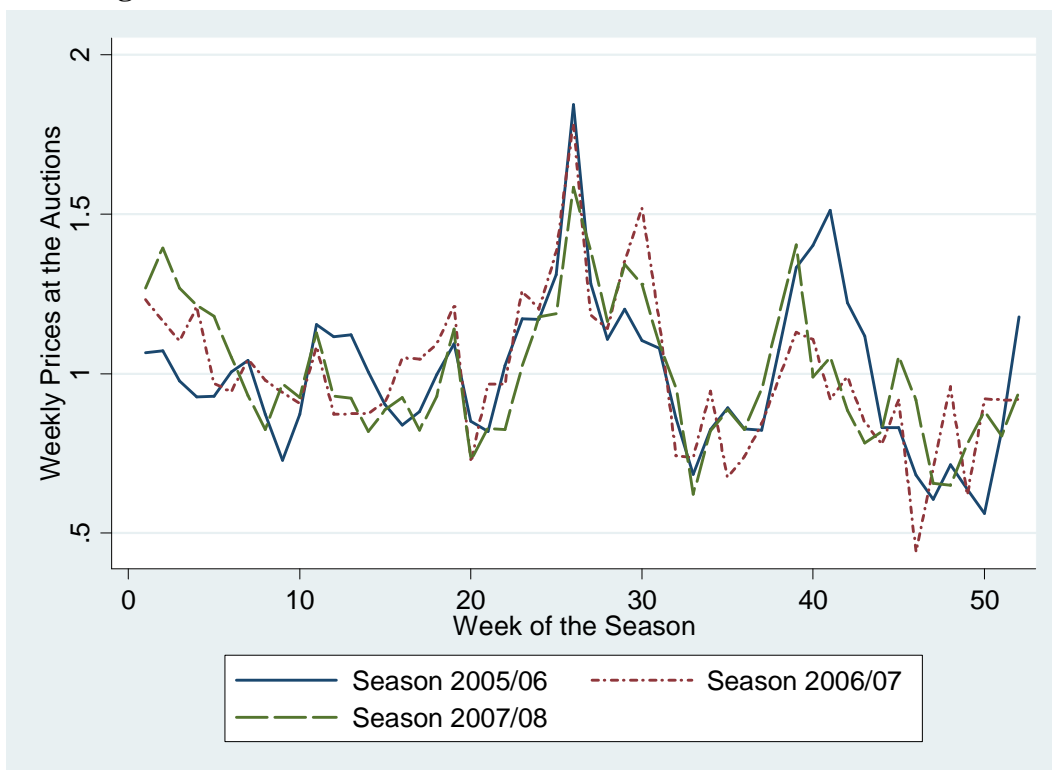
The figure shows the median biweekly residual of a regression that controls for firm specific seasonality and growth patterns in *conflict* and in *non-conflict* locations for the 10 weeks before and 10 weeks after the first outbreak of violence.

Figure 3: Fluctuations in Prices, Direct Relationships vs. Auction



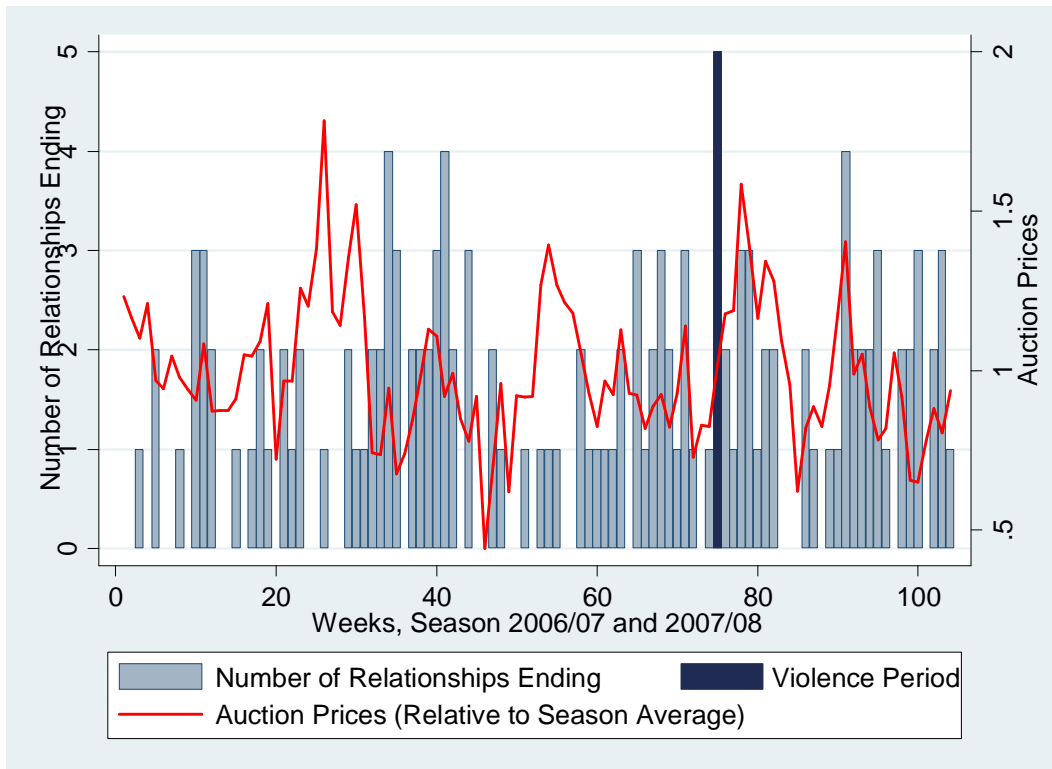
The Figure shows that FOB Prices in Direct Relationships are more stable than prices at the auctions throughout the season. The Figure shows the weekly variation relative to the season mean of FOB prices in direct relationships and at the Auctions. The FOB prices in direct relationships are obtained as week dummies in a regression of FOB prices on relationship fixed effects on the corresponding season. A season begins in mid august.

Figure 4: Seasonal Fluctuations in Auction Prices are Predictable



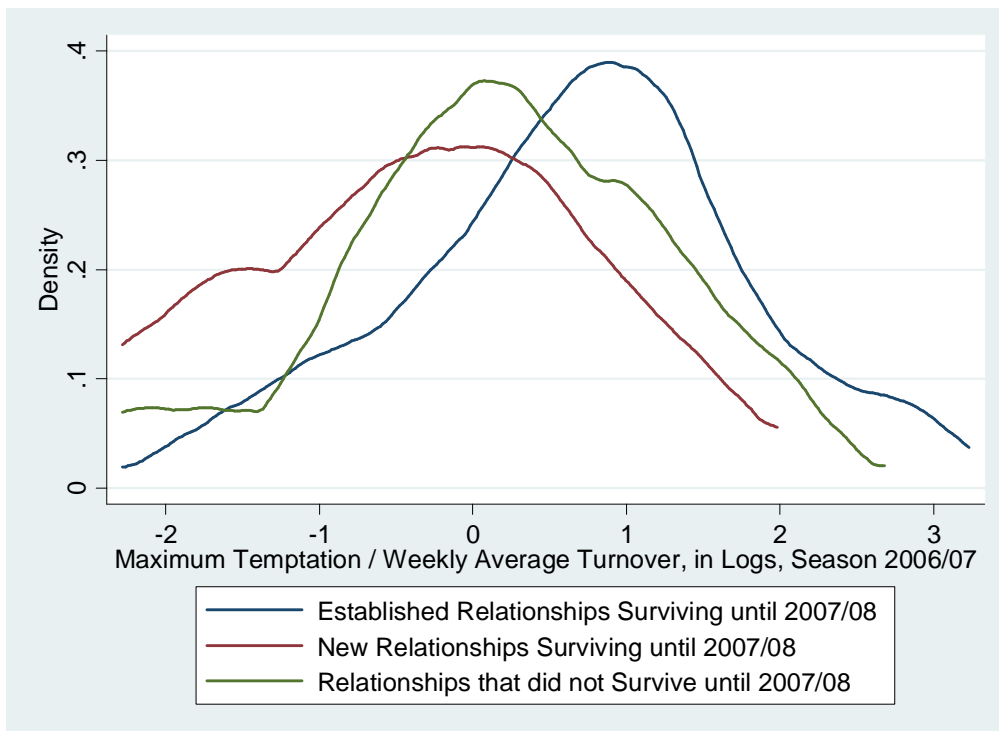
The Figure shows that FOB Prices at the Auctions are highly predictable. A regression of the weekly price at the auction on week and season dummies explains 76% of the variation in prices in the three season preceding the violence period. A season begins in mid august.

Figure 5: Separations Do Not Occur when Auction Prices are High



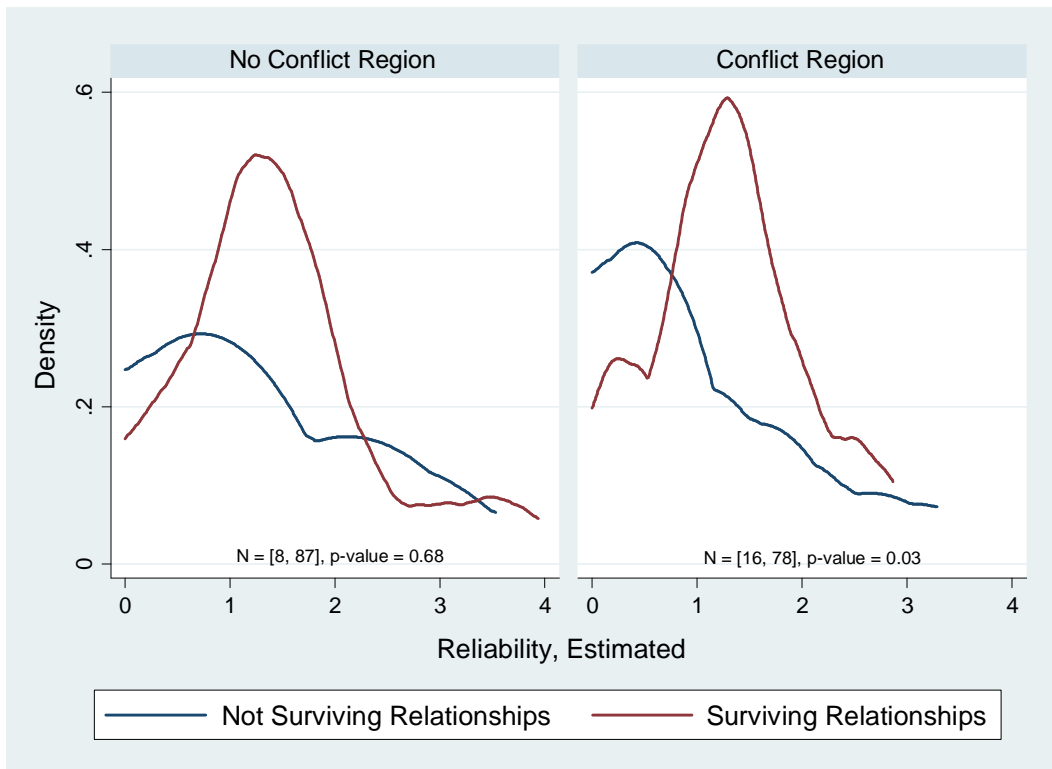
The Figure shows that the number of relationships dying in a given week does not correlate with the price at the Auctions in that week during the two season preceding the violence period. This is consistent with the fact that prices at the auctions are highly predictable. In a regression of the number of relationships dying in a given week that controls for week and season dummies, the coefficient on the violence period is positive and significant. The R-square for the same regression is 0.57. Regardless of whether week dummies are controlled for or not, the level of prices at the auctions do not predict the number of relationships dying.

Figure 6: Surviving Relationships Afford Higher Temptations



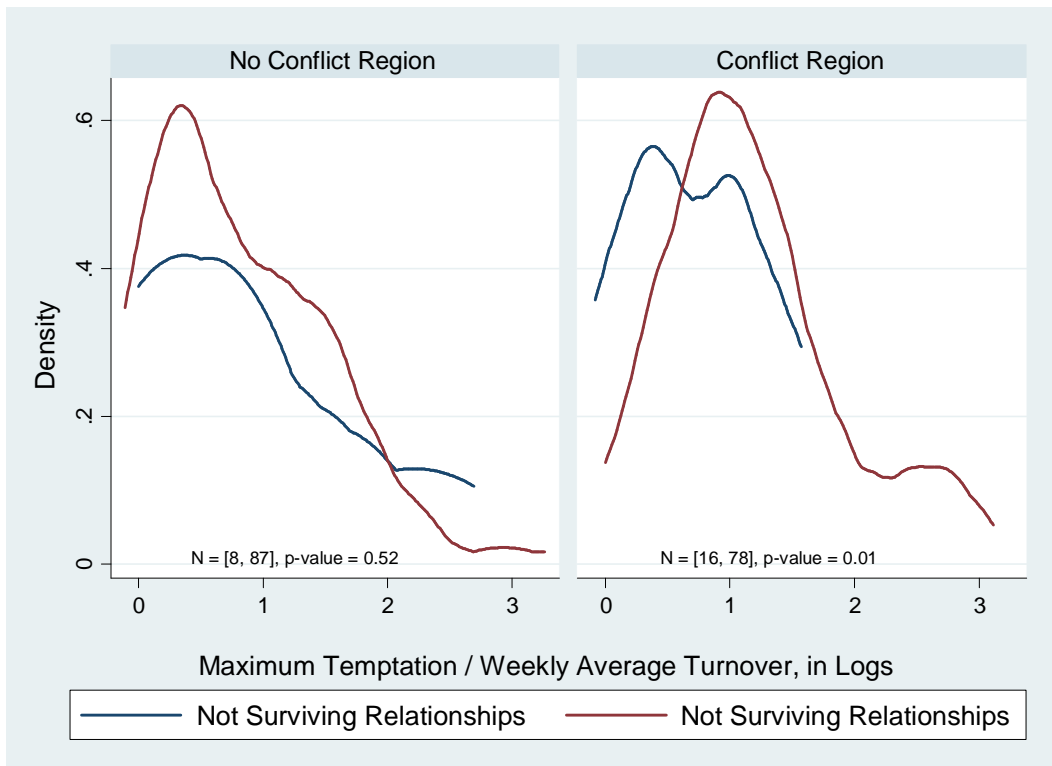
The Figure shows the distribution of the (log of the) value of relationships in the season 2006/07. The value is given by the ratio of the maximum temptation to deviate in any given week of the season, divided by the average weekly value of transactions in the relationship during the season. The maximum temptation to deviate is given by the maximum revenues foregone by the exporter for not selling on the auctions at higher prices during any particular week. Among the relationships in our baseline sample, i.e., those active immediately before the violence period, relationships that were already active before 2006/07 are in blue, new relationships are in red, and relationships that were active in 2006/07 but did not survive are in green. The Figure shows that most valuable relationships, i.e., those that are robust to the higher temptations, are more likely to survive. The equality of mean (and distribution) between surviving and dying relationships is rejected with 1% confidence interval.

Figure 7: Reliability and Survival, Conflict vs. No-Conflict Region



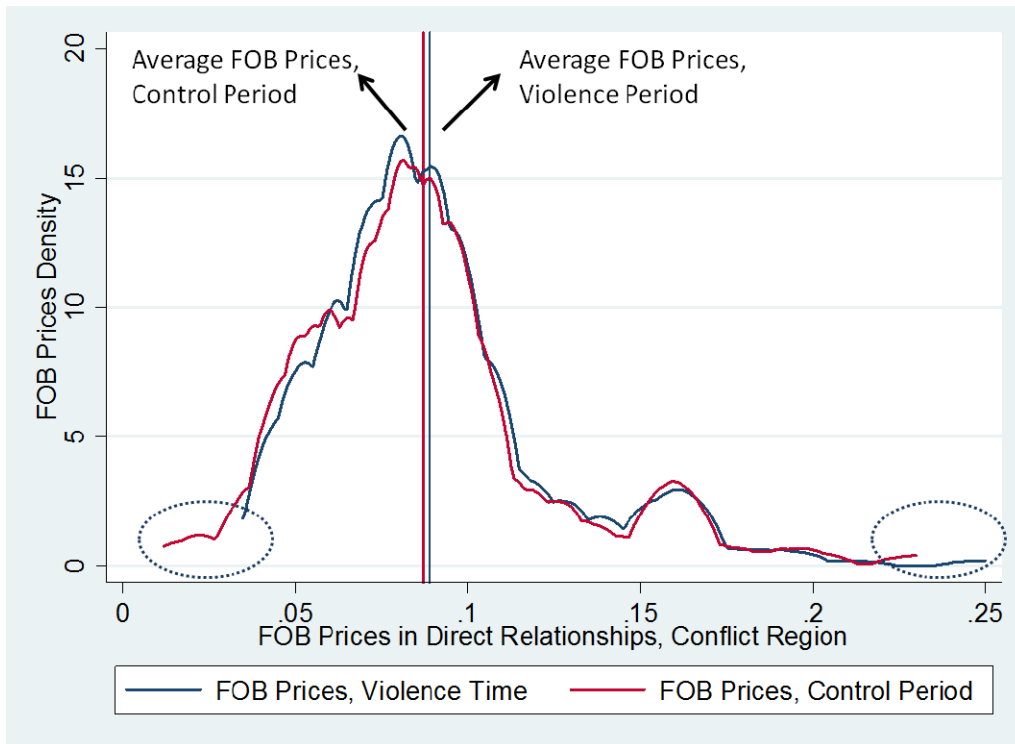
The Figure shows the distribution of the estimated reliability at the time of the violence in the two regions depending on whether the relationship survived until the following season. The Figure shows that the estimated reliability is higher for relationships that survived relative to relationships that did not survive in the conflict region (p-value = 0.03) but not in the no-conflict region (p-value = 0.68).

Figure 8: The Value of Destroyed Relationships: Conflict vs. No-Conflict



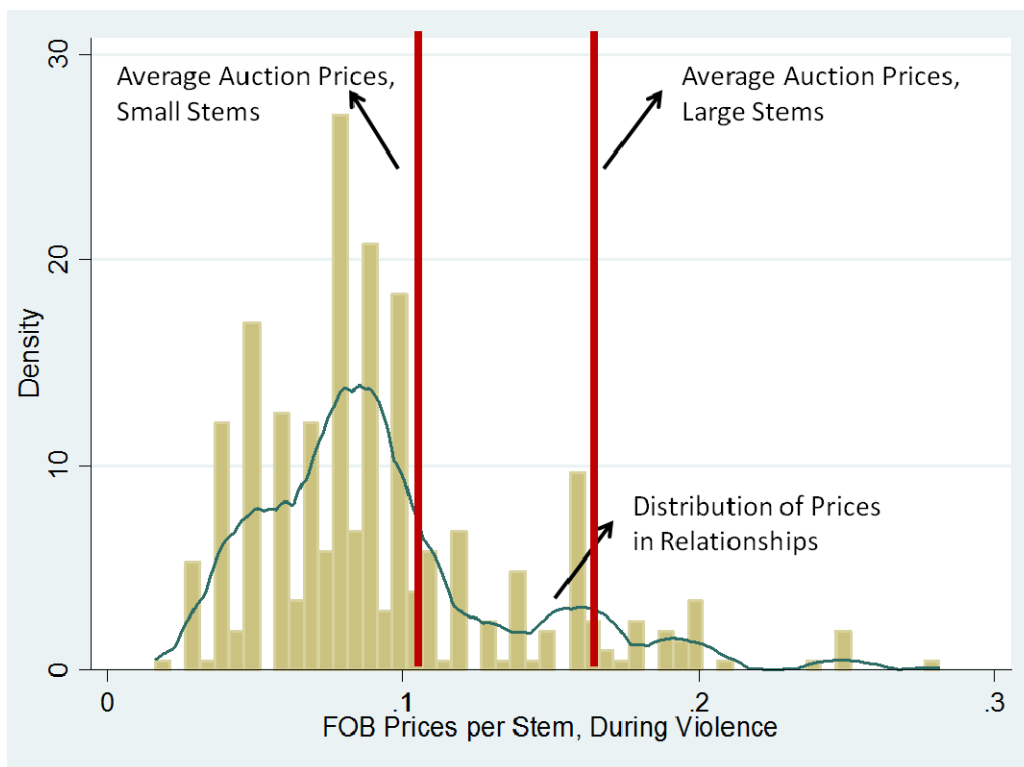
The Figure shows the distribution of the (log of the) value of relationships in the season 2006/07 for relationships in the conflict and no-conflict regions depending on whether the relationship survived until the following season. The value is given by the ratio of the maximum temptation to deviate in any given week of the season, divided by the average weekly value of transactions in the relationship during the season. The maximum temptation to deviate is given by the maximum revenues foregone by the exporter for not selling on the auctions at higher prices during any particular week. The Figure shows that in the conflict region the violence destroyed relationships that were the least valuable (p-value = 0.001).

Figure 9: No Renegotiation of FOB Prices at the Time of the Violence



The Figure shows the distribution of average FOB prices per stem in direct relationships at the time of the violence and in the control period, i.e., the ten weeks prior to the violence. The two vertical lines show average FOB prices at the time of the violence and in the control period. The figure shows that prices were not renegotiated upward at the time of the violence. (Source: authors calculations from HCDA Data).

Figure 10: FOB Prices at the Time of the Violence: Auctions vs. Direct Relationships



The Figure shows the distribution of average FOB prices per stem in direct relationships at the time of the violence. The two vertical lines show the average prices of small and large stems of roses at the Dutch auctions at the time of the violence. The figure shows that most relationships paid prices lower than at the spot market. (Source: authors calculations from HCDA Data and Auctions Data).

Figure A1: Temporal Structure of the Study

