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

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February 2011*

Abstract

Under incomplete contracts firms develop relationships in which future rents deter short-term opportunism. This notion is captured in models of relational contracts, informal insurance, repeated games with perfect and imperfect monitoring and reputation. Can these models be empirically distinguished? The Kenya rose export sector provides an ideal testing ground. The paper shows that 1) the value of future rents for the sellers increases with the age of the relationship; 2) during a negative supply shock induced by an episode of ethnic violence, sellers prioritize the most valuable relationships; and 3) compliance at the time of the shock positively correlates with relationship survival, future trade volumes, prices and relationship value. The evidence is consistent with reputation and some repeated games with imperfect monitoring models.

Keywords: Relational Contracts, Repeated Games, Reputation.

JEL Codes: C73, D23, L14, O12.

*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, Jon Levin, 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, NBER Organizational Workshop, Nottingham, NYU, Oxford, Southampton, Tilburg, UCL, Yale and Warwick for helpful comments and suggestions. This document is an output from research funding by the UK Department for International Development (DFID) as part of the iiG, a research programme to study how to improve institutions for pro-poor growth in Africa and South-Asia. The views expressed are not necessarily those of DFID. E-mail: r.macchiavello@warwick.ac.uk

1 Introduction

When contracts are incomplete trading parties rely on informal enforcement mechanisms to guarantee contractual performance (see, e.g., Greif (2005)). Among those mechanisms, long-term relationships based on trust or reputation are perhaps the most widely studied and have received enormous theoretical attention. To capture the richness of real-life relationships, the theoretical literature has developed several models to study how repeated interactions help deter short-term opportunism.[1] The different models share the common insight that future rents are necessary to deter short-term opportunism.

The models, however, differ in important respects. For example, in models of "trust" incentives to deter short-term opportunism are created by switching to less favorable outcomes following deviations. This intuition is shared by relational contracts models (e.g., MacLeod and Malcomsom (1989), Baker, Gibbons, and Murphy (2002), Levin (2003)), models of informal insurance (see, e.g., Thomas and Worrall (1988)) as well as repeated games with (see, e.g., Abreu (1988)) and without (see, e.g., Green and Porter (1984), Abreu et al. (1990)) perfect monitoring. Relational contracts models, however, assume that parties can transfer resources (in contrast to repeated games) and have no demand for insurance (in contrast to the informal insurance literature). These two assumptions imply a stationary equilibrium outcome, a feature they share with repeated games with perfect monitoring, but that distinguishes them from informal insurance models and repeated games with imperfect monitoring. Models of "reputation" (see, e.g., Kreps and Wilson (1982), Diamond (1989), Mailath and Samuleson (2006)), in contrast, introduce uncertainty over a player's type. The uncertainty allows players to develop a reputation which induces expectations that she will play certain actions in the future. Short-term opportunism, then, is deterred by fear that it will lead to a worsening of the player's reputation. Because of learning, the equilibrium outcome of reputation models is also non-stationary. Learning, moreover, introduces a causal connection between the past history and the future outcomes in the relationship which is absent in models of trust.[2] Finally, different models also predict different responses to negative shocks. If insurance considerations are of first

[1] The 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 in Levin (2003) is extremely useful.

[2] Trust and reputation models also differ in the externalities that relationships impose on each other: alternative trading partners weaken the 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 relationships.

order importance, the rents available in the relationship are used to provide better insurance against negative shocks. In repeated games with imperfect monitoring and reputation models, instead, parties protect the relationships that are most valuable, albeit for different reasons.

This paper is the first study, to the best of our knowledge, to distinguish between the different models. Which kind of data would be necessary to distinguish among them? Three ingredients are necessary. First, a dataset containing longitudinal information on transactions between firms from an environment in which parties do not have access to formal contracts. Second, since trust and reputation are embedded in beliefs that are unobservable by the econometrician, a direct measure of the future rents in the relationship. Finally, an exogenous short-run shock to distinguish models based on the relationships' short- and long-run responses to the shock.

The Kenya rose export sector provides an ideal testing ground.[3] A survey we conducted among producers in Kenya reveals that relationships with foreign buyers are not governed by written contracts enforceable by courts. This has to be expected, since the perishable nature of roses makes it unpractical 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. The resulting contractual imperfections, exacerbated by the international nature of the transaction, imply that firms rely on repeated transactions to assure contractual performance. Unlike domestic sales, export sales are administratively recorded by customs. This paper uses transaction level data of all exports of roses from Kenya, including the names of the domestic sellers and foreign buyers, as well as information on units traded, prices and date. An important advantage of looking at the flower industry is that long-term relationships coexist alongside a well-functioning spot market, the Dutch Auctions.[4] The spot-market 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. Finally, a short-run, negative, supply shock induced by an episode of ethnic violence in January 2008 provides a unique opportunity to distinguish competing models of relationships.[5]

[3] All flowers produced in Kenya are destined to export markets. Kenya is the second largest exporter of flowers in the world.

[4] The "Dutch", or "clock", auction is named after the flower auctions in the Netherlands. In a Dutch auction 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.

[5] Following heavily contested presidential elections in Kenya at the end of December 2007, several,

Accordingly, the paper documents three facts. First, we compute 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 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] The procedure exclusively relies on information on quantities transacted, prices in the relationships and auction prices; which are all observable in the data. The estimated relationship values positively correlate with the age and past amount of trade in the relationship. These results hold controlling for both relationships (which include cohort), time and selection effects.

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 chose which buyers to prioritize. We find that exporters prioritized the most valuable relationships.

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, reliability at the time of the violence positively correlates with the likelihood of relationship survival, with higher increases in trade volumes, prices and future values of the relationship in the season following the violence.

The three facts observed in the data provide enough information to distinguish between the models. In particular, the correlation between relationship values and relationship's age is not consistent with models with stationary outcomes, e.g., the relational contract model and games with perfect monitoring. The positive correlation between relationship value and reliability at the time of the shock, instead, is not consistent with models that emphasize insurance considerations. Finally, the positive correlation between reliability during the short-run shock and the long-run outcomes is unlikely to be consistent with the punishment phase of a repeated game with imperfect monitoring. The evidence, therefore, is only consistent with reputation models and (some) dynamic games with imperfect monitoring. In particular, the evidence is consistent with a model in which sellers value acquiring and maintaining a reputation for reliability.

The findings and methodology of the paper contribute to the empirical literature

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.

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

on relationships between firms.[7] 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. 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 enforce the implicit contract. In the context of exports of Chilean wine to the UK, Macchiavello (2010) studies the implications of learning on prices and matching between buyers and sellers in the market.[8]

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 proxy the rents available in the relationship with product, firm, or market characteristics that might affect contractual outcomes in other ways. Typically, these papers do not attempt to separate the effects of past and previous anticipated interactions. An exception is Gil and Marion (2009). 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 except in periods 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.

The rest of the paper is organized as follows. Section 2 distinguishes the testable implications of a variety of theoretical models. Section 3 provides background on the

[7] A discussion of the much larger theoretical literature is postponed until Section 2.

[8] Banerjee 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.

industry, the contractual practices, and the ethnic violence. Section 4 presents the empirical results and interprets them in light of the different theoretical models. Section 5 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 Testable Implications of Different Models

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)). This Section highlights the salient aspects of different models and the differences in their testable implications. We begin by considering models of "trust", which are based on beliefs about hidden actions, and then turn to models of "reputation", which are instead based on beliefs about hidden types.[9]

Relational Contracts

In an important paper, Levin (2003) extends the previous relational contracts literature (see, e.g., MacLeod and Malcomson (1989), Baker et al. (2002)) to consider both adverse selection and moral hazard, two features that are likely to be relevant in the context of rose exports. Levin (2003) 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. A contract is stationary if, on the equilibrium path, effort and compensation are stationary functions of the performance outcome realized in that date. The intuition for this result is as follows: rewards for the seller can come either in the form of immediate payments following good performance, or from moving to a continuation equilibrium that gives higher expected payoff. Because of risk neutrality, these two tools are perfect substitute from the point of view of the trading parties. 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's continuation payoff. The stationarity of the equilibrium outcome also implies that parties "jump" on the equilibrium path from the start of their relationship,

[9] In Section 4 we also discuss some recent theoretical contributions (Chassang (2010), Halac (2010), Fong and Li (2010)) that do not easily fit with the classification used here.

i.e., there is no explicit link between the history of the relationship and continuation payoff.[10]

We summarize the testable implications of relational contracts models as follows: if *i*) parties are risk-neutral and *ii*) have access to monetary transfers, then the contract is stationary, i.e.,:

1. *controlling for relationship, time and selection effects, the past history of trade in the relationship is uncorrelated with future outcomes, and*

2. *controlling for changes in the environment, short-run shocks do not correlate with long-run outcomes in the relationship.*

Informal Insurance Models

A vast literature in dynamic contracting has focused on self-enforcing agreements in the presence of risk aversion (see, e.g., Thomas and Worrall (1988)). The literature studies the implications of the constraints imposed by various "frictions", e.g., limited commitment or asymmetric information, on the amount of insurance that parties can provide to each other. Because of risk aversion, it is in general not optimal to provide rents purely relying on monetary transfers. Parties, instead, rely on a combination of future continuation values and current monetary transfers to provide incentives. In contrast to the predictions of the relational contracts model, the equilibrium outcome is non-stationary, in the sense that past realizations of the shocks influence future continuation values.[11]

The testable implications of insurance models are best highlighted by considering the reaction of the relationship to shocks. In particular, at the time of a large negative shock,

1. *the amount of insurance provided to the party receiving the shock positively correlates with the continuation value promised to that party in the past,*

[10] Levin (2003) also considers the case in which the buyer privately observes outcomes, a feature which is also likely to be relevant in the context of rose exports, given the product's perishability. The extension transforms the setting into a repeated game with private monitoring. Stationary contracts, then, are no longer effective. Levin (2003), however, shows that the optimal contract is a simple termination contract in which 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.

[11] Different models, however, imply different trajectories of the promised value. For instance, with one risk-neutral party and adverse selection, the insured party continuation value decreases over time. In models with two risk averse parties the continuation value for one party might increase or decrease depending on the history of shock realizations.

2. *the insurance is provided by a combination of current transfers and future continuation values.*

No Transfers: Repeated Games Literature

The literature on repeated games considers situations in which trading parties cannot use monetary transfers to share the rents generated by the relationship. As is well known, in repeated games with perfect information optimal equilibria can always be stationary (see, e.g., Abreu (1988)): parties play the best possible equilibrium forever under the threat that a deviation triggers the worst possible punishment. In models with imperfect monitoring (see, e.g., Green and Porter (1984), Abreu et al. (1990), Athey and Bagwell (2001)), instead, optimal equilibria are nonstationary. Because of imperfect monitoring, "punishments", i.e., switching to worse continuation play, occur in equilibrium with positive probability. Trading parties, then, have incentives to find the minimum punishment that deter deviations.

In general, the set of optimal equilibria in repeated games with incomplete information can be large and hard to characterize and, consequently, it is hard to derive empirically testable implications for this class of models, other than the non-stationarity of the equilibrium outcome. There are, however, two "intuitive" properties that should hold across a variety of models in this class (see the discussion in Mailath and Samuelson (2006)). First, if past trade between parties is taken as a proxy for positive realizations of the performance outcome, then past trade should positively correlate with future outcomes in the relationship. Second, the length of the punishment period should reflect how informative about actions the performance outcome is: if failure most likely stems from adverse circumstances, rather than defection, the length of the punishment period shouldn't be very long.

We summarize the testable implications of repeated games with imperfect monitoring as follows:

1. *controlling for relationship, time and selection effects, the past history of trade in the relationship is positively correlated with future outcomes, and*

2. *controlling for changes in the environment, responses to short-run shocks do not correlate with long-run outcomes in the relationship.*

Reputation

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. By frequently being reliable, the seller develops a reputation which induces expectations that she will be reliable in the future too. This makes buyers more willing to trade with her. Short-term opportunism is deterred by fear of depleting the reputation. Because a seller's stake in her reputation originates from buyer's uncertainty about her type, incentives to maintain a good reputation eventually die out, as uncertainty over a player's type is resolved. Reputation models necessarily have a non-stationary structure since beliefs about a player's type evolve over time: the age and history of the relationship strongly correlate with, in fact "cause", future relationship's outcomes.[12]

In sum, during the reputation building phase, reputation models imply that:

1. *controlling for relationship, time and selection effects, the past history of trade in the relationship is positively correlated with future outcomes, and*

2. *controlling for changes in the environment, responses to short-run shocks that are informative about types positively correlate with long-run outcomes in the relationship.*

Bringing the Models to the Data

The preceding discussion highlights the ingredients necessary to distinguish the different models. First, we need a time varying measure of future outcomes in the relationships. The Appendix describes a stylized model that show how to compute a lower bound to the net present value of the relationship for the seller. The empirical test uses this measure as the summary of the "future outcomes" in the relationships. Second, we need a short-run negative shock to *i*) distinguish insurance models from other models, and *ii*) provide a further test for non-stationarity by looking at the persistent effects of the shock. The empirical tests rely on relationship's short and long-run responses to a negative shock induced by a brief, but intense, episode of ethnic violence.

[12] Beyond this common structure, reputational dynamics are quite sensitive to specific assumptions. For example, in models in which a strategic seller tries to separate herself from a "bad" commitment type, reputational stakes gradually increase over time as buyers become more confident that a cooperative relationship can be sustained. In models in which a strategic seller tries to mimic a "good" type, instead, the temptation to cheat increases as buyers become more optimistic (see, e.g., Mailath and Samuelson (2006) for a discussion).

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.[13]

The Flower Industry in Kenya

Over the last decade, Kenya has become the second largest exporters of flowers in the world. The flower industry, one of the largest foreign-currency earner for the Kenyan economy, 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 auctions where they are inspected, graded and finally put on the auction clock. Buyers

[13] Note 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.

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, the Dutch Auctions act as a platform that provides contract enforcement between buyers and sellers located in different countries: they certify the quality of the flowers sold and enforce payments from buyers to sellers.[14]

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 impossible 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.[15]

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.[16]

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 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

[14] Each 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.

[15] Among 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.

[16] Prices 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.

buyers defaults and/or opportunism. It is, therefore, not obvious whether contractual provisions preventing exporters from selling to the spot markets would be desirable.[17]

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", 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.[18] 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).[19] The main consequence of the violence was that firms 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

[17] 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.

[18] Ksoll et al. (2010) study the overall impact of the ethnic violence on the industry quantifying profit and welfare losses.

[19] 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.

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 combine the customs data with spot-market price information to compute a lower bound to the value of each relationship for the seller in the baseline sample. We then show that the value of the relationship increases with the age and past amount of trade in 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 relationships 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 proceeding 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.[20]

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.

[20] This 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 $p_s \in \{\underline{p}, \overline{p}\}$, a relationship is assumed, for simplicity, to save on transportation and intermediation costs.[21] 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

$$\delta \left(U_{s+1} - U^o_{s+1} \right) \geq q^*(p_s - t_s) \tag{1}$$

where U_{s+1} and U^o_{s+1} 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 $p_s = \overline{p}$, 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

[21] A 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

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

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.[22] 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.[23]

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 $\mathbf{V}^N_{i\mathcal{S}}$ 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, $q_{i,t}$.[24]

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 seasons preceding the violence period. This

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

[23] Since 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.

[24] Because 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 ending 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 ending. 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 their relationship 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 Leffler (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) report that in the Colombian chemicals industry, fixed costs of exports in each year represent 1% of the export revenues of the firm.[25]

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

[25] The 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. 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

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

where V_{fb} is the 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. Adapted to our particular context, this specification replicates the existing studies in the literature.

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

$$V_{fbs} = \mu_{fb} + \beta Age_{fbs} + \varepsilon_{fbs}, \tag{4}$$

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

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

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:

Fact 1: *Controlling for relationship, time and selection effects the past history positively correlates with the future outcomes in the relationship.*

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 affected the relationships. First, we construct a measure of the seller "reliability" at the time of the violence in each relationship. Them 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 $\widehat{y}_{fb}$ 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

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

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.[26] 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., $\mathbf{V}^N_{i=fb}$, correlates with the reliability measure R_{fb}. Table 4 reports results from the regression

$$R_{fb} = \alpha_b + \mu_f + \beta \mathbf{V}^N_{fb} + \gamma Z_{fb} + \varepsilon_{fb}. \tag{8}$$

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 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

[26] The cross-sectional results derived from specification (7), therefore, are similar to a regression of volumes of exports $\widetilde{y}_{fb\tau s}$ at time τ in season s, on relationship-specific seasonality and season fixed effects, $\mu_{fb\tau}$ and μ_{fbs}, 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.

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.[27]

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.[28]

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. In sum:

Fact 2: *At the time of a large, negative, shocks, sellers prioritized the most valuable relationships.*

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 chose 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

[27] Unreported 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.

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

Figures 7 begins with suggestive evidence on relationship survival. Figure 7 plots the distribution of reliability across the sample of relationships that did survive until 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.[29,30]

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

$$y_{fb}^{s_v+1} = \mu_f + \eta_b + \beta R_{fb} + \phi y_{fb}^{s_v} + \gamma Z_{fb} + \varepsilon_{fb}; \tag{9}$$

where $y_{fb}^{s_v+1}$ can be either average export volumes or prices in the first twenty weeks of the season that followed the violence, $y_{fb}^{s_v}$ 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

[29] Note 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.

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

interpreted as correlations between reliability at the time of the violence and growth in the dependent variable.

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 lead 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.[31]

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

[31] Unreported 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.

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.

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. Nevertheless, we have

Fact 3: *Long-run outcomes in the relationship positively correlate with seller's reaction to the short-run negative shock.*

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.[32]

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

[32] Note that, by definition, the spot market is the "relationship" with zero value.

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.[33]

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.

4.7 Discussion of Empirical Results

This Section interprets the evidence under the light of the different theoretical frameworks discussed in Section 2. 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.

How Do Different Models Fit the Evidence?

As noted in Section 2, relational contracts models assume that parties are risk neutral and can transfer rents in the relationship. Under these assumptions, if buyer's actions are perfectly observable, then the (constrained) optimal relational contract is stationary and the relationship immediately "jumps" on the equilibrium. These predictions are not consistent with the evidence discussed above.

[33] Ksoll 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 have exerted effort to mantain production and keep their workers.

First, the strong relationship found between the past history and the value of the relationship for the seller is not consistent with a stationary equilibrium outcome. Since the positive correlation is not driven by (time invariant) relationship characteristics, changes in the environment (time effects) or selection effects, it must be driven by features of the relationship that evolve over time. Second, (the relationship specific reaction to) a temporary shock is associated with permanent changes in future volumes of trade, prices and relationship's value. Controlling for changes in the environment by including buyer, seller and time effects, the observed patterns in the data is also inconsistent with a stationary equilibrium outcome.[34]

The assumption of monetary transfers between risk neutral parties must, therefore, be relaxed in order to rationalize the evidence. The dynamic contracts literature on informal insurance (see, for a model particularly relevant to our context, Thomas and Worrall (1988)) introduces risk aversion. The fact that prices and trade volumes in direct relationships tend to be relatively stable throughout the season suggests that insurance considerations play an important role in the context of the flower market. Insurance models, however, cannot account for other facts documented above. In particular, as noted in Section 2, an insurance model would predict 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 value for the relationship, relationship's value should negatively correlate with reliability at the time of the violence. 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.

The general literature on repeated games considers settings in which monetary transfers are not available. As noted in Section 2, repeated games with perfect information imply stationary equilibrium outcomes and are, therefore, inconsistent with the evidence. In contrast, models with imperfect information have non-stationary outcomes and, as noted in Section 2, are consistent with a positive relationship between

[34] Levin (2003) also considers the case in which the buyer privately observes outcomes. The extension transforms the setting into a repeated game with private, rather than perfect public, monitoring and Levin (2003) shows that the optimal contract is a simple termination contract in which, conditional on survival, parties continues in a stationary fashion. Since the positive correlation between the past history and the value of the relationship is robust to controlling for selection effects, the data also reject this extension of the baseline model.

the past history and the value of the relationship.

Because of the difficulties in characterizing equilibria in these models, it is hard to reject them. At an intuitive level, however, if failure most likely stems from adverse circumstances, rather than defection, the length of the punishment period should be relatively short. The ethnic violence was arguably a time in which non-performance was not an accurate signal of defection and, therefore, we might not expect to find the punishment phase to persist until the following season, in the form of lower trade volumes, prices and relationship's value.[35]

The evidence in the paper is consistent with a reputation model (see, e.g., Kreps and Wilson (1982), Diamond (1989), Mailath and Samuelson (2006)) 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.

Remarks on Reputation and Other Models

A model in which sellers value acquiring and maintaining a reputation for reliability is the most consistent with the evidence. When studying relationships between firms, however, the assumption of exogenous commitment types on which reputation models rely is not fully satisfactory. In particular, the assumption might prevent progress towards the understanding of the origin and evolution of firm's capabilities, of which inter-firm relationships constitute an important part.

A theoretical literature is rapidly emerging that studies the dynamics of relational contracts (see, e.g., Chassang (2010), Halac (2010), Fong and Li (2010) as well as the second part of Levin (2003) already discussed above). By extending the baseline relational contracts framework, the literature generates interesting dynamics implications for the evolution of relationships. Chassang (2010) and Halac (2010) introduce learning about specific elements of the relationships and are, therefore, particularly relevant for the empirical evidence presented above. In Chassang (2010) parties learn

[35] In a similar vein, unreported 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. Note however that, in principle, parties might be playing an equilibrium in which they agreed to start the punishment phase only months after the violence has occurred, when they negotiate the implicit contracts for the new season.

over time the efficient production function and, by implication, the amount of cooperation they can sustain in equilibrium. The model naturally generates nonstationary dynamics and relationships display path-dependence. Halac (2010), instead, assumes that the buyer privately knows her outside option, i.e., a party's commitment to the relationship is not commonly observed. In the case in which the buyer has the bargaining power, which seems to be the relevant one in our setting, relationships build slowly and, conditional on survival, eventually settle in a stationary outcome. Beside predicting non-stationary outcomes, both models capture the intuition that the violence gave an opportunity to parties to learn how much cooperation can be sustained in their relationship and, therefore, provide a framework consistent with the long-run results described above.

5 Conclusion

When contracts are incomplete, trading parties rely on the future rents associated with long term relationships to deter short-term opportunism and facilitate trade. This paper is the first to empirically distinguish between different models of long term relationships. The Kenya rose export sector was identified as an ideal testing ground since i) the perishable nature of flowers and the international nature of the export transaction imply buyers and sellers cannot rely on enforceable contracts, ii) longitudinal transaction level data with names of buyers and seller are available from customs records, iii) the existence of a spot market provides a reference price that can be used to compute a direct measure of the future rents, and iv) a short-run negative supply shock induced by an episode of ethnic violence allows to distinguish between different models.

The evidence is consistent with models in which learning and reputation matter. In particular, the evidence is consistent with a model in which sellers value acquiring and maintaining a reputation for reliability. From a policy perspective, it is important to know whether learning and reputation are important determinants of firms capabilities to succeed in export markets. Both trust and reputation are assets and firms might have to operate at initial losses in order to penetrate into new markets. But, if reputation, rather than trust, is an important determinant of contractual outcomes, prior beliefs about sellers affect buyers willingness to trade for a while. This generates externalities across sellers, justifying commonly observed institutions such as common certifications, business associations and subsidies to common marketing.

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6 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 $c(q) = \frac{cq^2}{2}$.[36] 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 $p = \overline{p}$ 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 $p' \in \{\underline{p}, \overline{p}\}$ is given by $p_b = p' + \tau$. To simplify, let $\underline{p} = 0 < \tau < \overline{p} = p < v$. 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 $q^* < \frac{\tau}{c}$.

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

[36] This 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.

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 $\overline{q}$ 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*

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

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 $\Pi^q_{p=0}$. 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 $\Pi(\underline{p}) > \Pi^q_{p=0}$ if $k > \frac{(v-\tau)^2}{2}$.

When, instead, the price at the auction is $p = \overline{p}$, the optimal strategy is to set $q_a = 0$, $q_s = q^*$ and $q_A = \frac{p}{c} - q^*$, which gives profits equal to $\Pi(\overline{p}) = (v-p)\,q^* + \frac{p^2}{2c}$. The alternative interior solution gives $q_s = v - p + q^*$, and $q_A = \frac{p}{c} - (q^* - (p-v))$. This implies profits $\Pi^q_{p=\overline{p}} = \frac{(v-p)^2}{2} + \frac{p^2}{2c} + q^*(v-p)$, 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 $\overline{t}$ 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 $U \in \{\underline{U}, \overline{U}\}$ the value of the relational contract for the buyer and by $U^o \in \{\underline{U}^o, \overline{U}^o\}$ the value of sourcing flowers from the spot market forever, which is assumed to be the punishment for renaging 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 $\left(p - \overline{t}\right) q^*$ and loosing the future rents derived from the relationship, $\delta\left(\overline{U}^o - \overline{U}\right)$. 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 renage 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

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

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:

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

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

To derive the corresponding value functions, denote by $\overline{\Pi}(q^*) = \left(\bar{t} - p\right)q^* + \frac{p^2}{2c}$ 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:

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

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:

$$\overline{U}^o = \frac{1}{1-\delta^2}\frac{p^2}{2c} \text{ and } \underline{U}^o = \frac{\delta}{1-\delta^2}\frac{p^2}{2c}. \tag{12}$$

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

$$\overline{IC}^S : \delta\left(\underline{t}q^* - C(q^*)\right) \geq \left(p - \bar{t}\right)q^*, \tag{13}$$

$$\underline{IC}^S : \frac{\left(\underline{t}q^* - C(q^*)\right)}{\delta} \geq \left(p - \bar{t}\right)q^*.$$

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.■

7 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 reg-

ulates 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 administrated 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.[37] The first information bulletin (No. 1 of 3^{rd} January 2008) also contained a map which outlined locations where unrest had occurred. We further obtain access to various sources to supplement our understanding on both whether the location suffered conflict and when this took place. These are (i) *Disaster Desk* of the Data Exchange Platform for the Horn of Africa (DEPHA)[38], during the post election violence DEPHA provided maps with hot spots on where and when the violence had occurred,[39] (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,[40] (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 29^{th} December 2007 which lasted until the 4^{th} Jan 2008, locations which were suffered from violence then were Eldoret, Kitale and Nakuru. The second outbreak occurred between the 25^{th} January 2007 and 30^{th} January 2008, the town of Naivasha suffered during this outbreak.

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

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

[39] We obtain all the DEPHA maps from: `http://www.depha.org/Post_election_Violence.asp` (Accessed on 23 September 2008). Similiar information is also available from `http://www.reliefweb.int` which is also under the UN's OCHA.

[40] For 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**	0.223***				
	[0.181]	[0.069]				
Number of Previous Shipments			0.440***	0.229***		
			[0.099]	[0.058]		
Past Temptations to Deviate (Cumulative)					0.257***	0.285***
					[0.057]	[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]	-0.151* [0.081]
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

	Conflict Region				**No Conflict Region**	
Dependent Variable: Reliability at Time of Violence	[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	0.041	0.213*	0.168*
	[0.051]	[0.061]	[0.117]	[0.094]
Reliability at Time of Violence			0.007	-0.007
			[0.032]	[0.032]
Conflict Region X Reliability at Time of Violence			-0.130*	-0.113*
			[0.069]	[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 Variableand 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**	0.307*	0.046	0.149**	0.148**	0.018
	[0.170]	[0.168]	[0.100]	[0.069]	[0.070]	[0.042]
Past Estimated Value		0.081			0.011	
		[0.056]			[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):	**Estimated Value**	**Max. Temptation to Deviate**	**Estimated Value**	**Max. Temptation to Deviate**
	Conflict Region		No Conflict Region	
	[1]	[2]	[3]	[4]
Reliability at Time of Violence	0.672***	0.847**	0.084	0.022
	[0.277]	[0.391]	[0.196]	[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

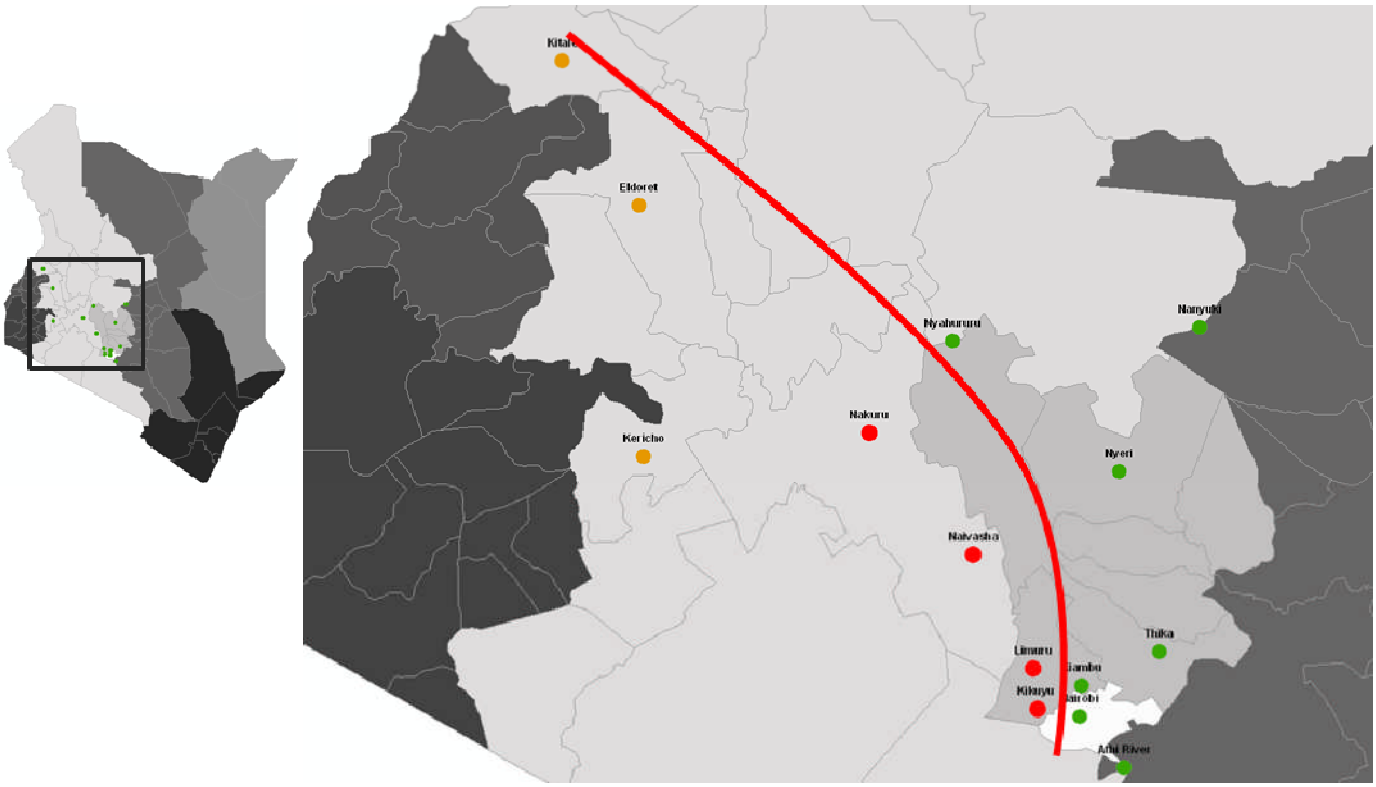
Dependent Variable: Reliability at Time of Violence	[1]		[2]
Conflict Region	-0.865***		-0.175*
	[0.082]		[0.096]
Direct Relationship	-0.088	0.023	
	[0.103]	[0.095]	
Direct Relationship X Conflict Region	0.650**	0.512*	
	[0.312]	[0.271]	
Only Direct Relationships [yes = 1]			0.008
			[0.113]
Only Direct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

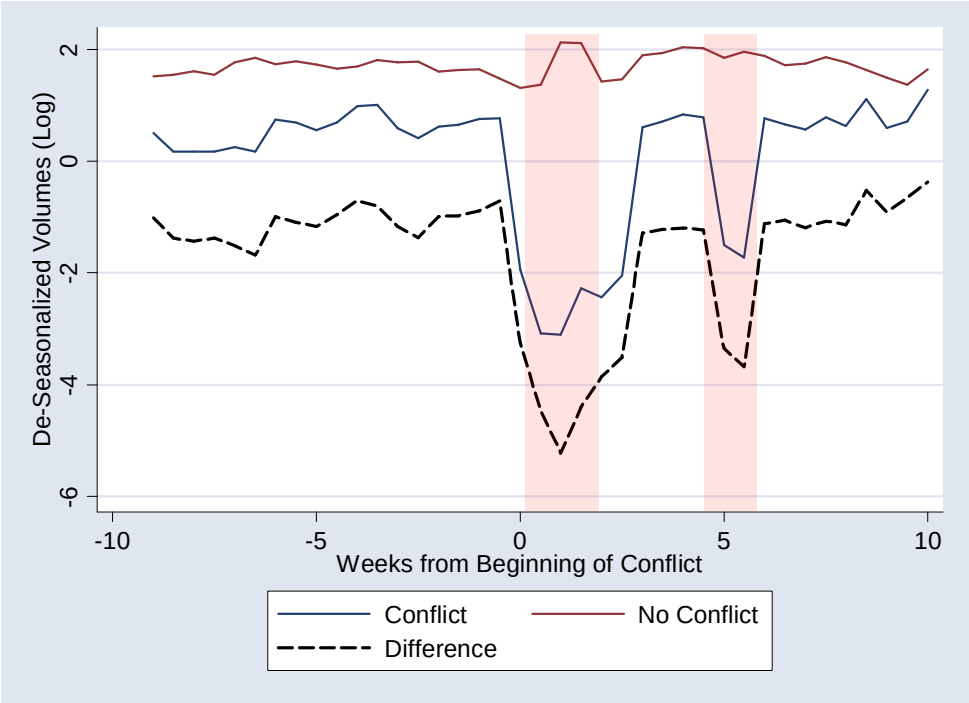
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent Variable:	Did Violence Affect at all the Operations of Your Firm?	Were there any days in which members of your staff did not come to work because of the Violence?	What was the highest proportion of Workers Absent due to the Violence?	To What Extent did Worker Absence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

Figure 1: Conflict and No-Conflict Regions



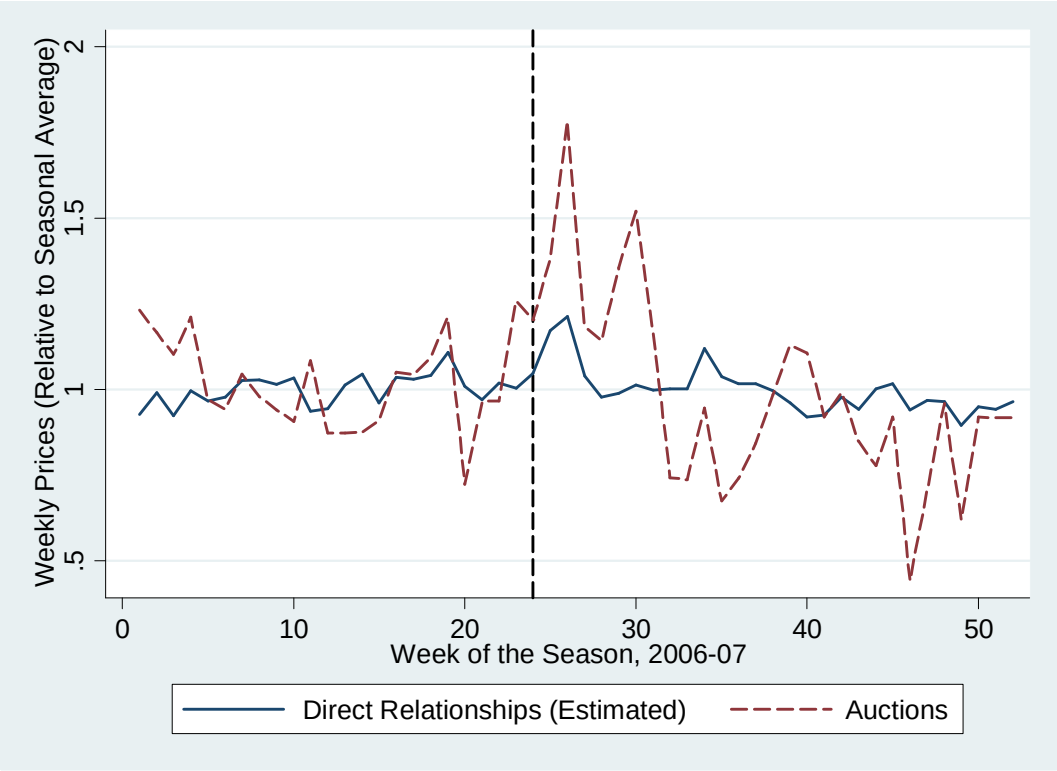
Among the towns around which flower firms are located, the Figure illustrates those locations that were directly affected by the violence to the left of the red line and those locations that were not affected by the violence to the right.

Figure 2: Effect of Violence on Export Volumes



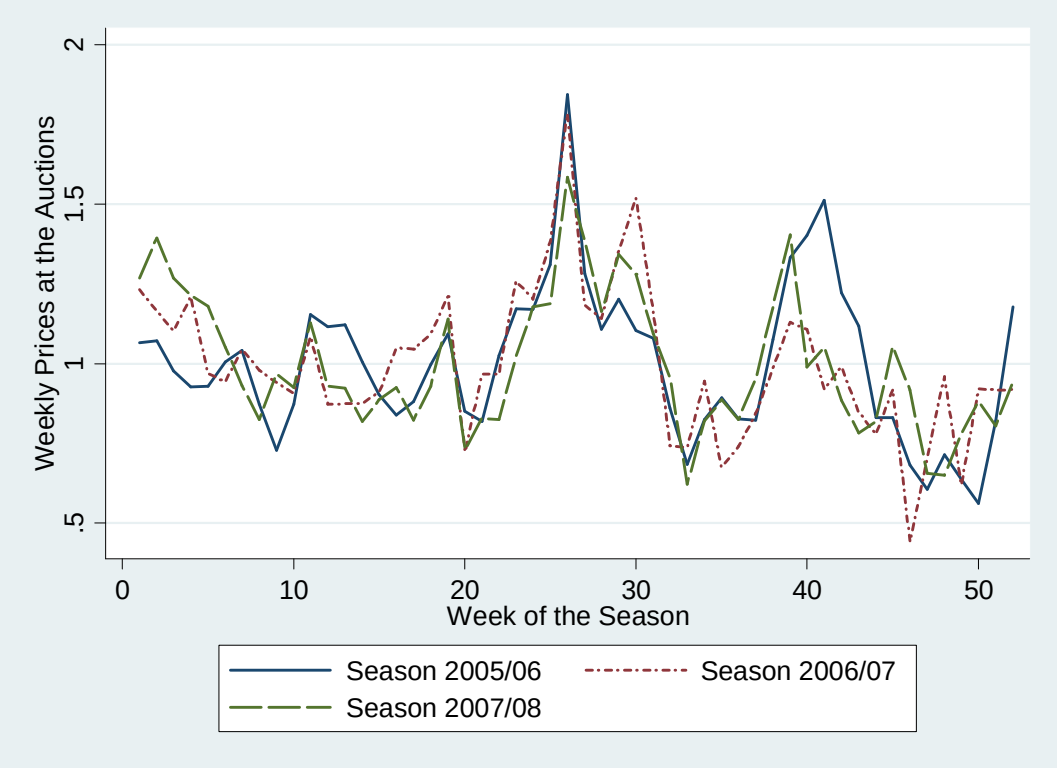
The figure shows the median biweekly residual of a regression that controls for firm specific seasonality and growth patterns in *conflict* and in *non-conflict* locations for the 10 weeks before and 10 weeks after the first outbreak of violence.

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



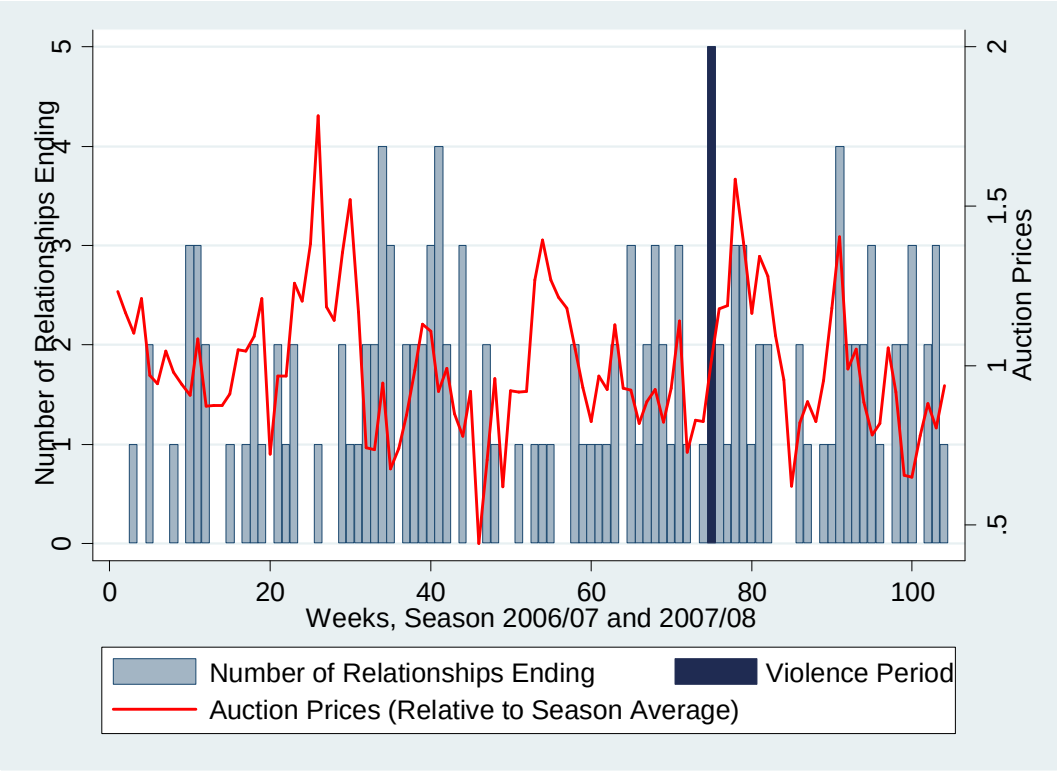
The Figure shows that FOB Prices in Direct Relationships are more stable than prices at the auctions throughout the season. The Figure shows the weekly variation relative to the season mean of FOB prices in direct relationships and at the Auctions. The FOB prices in direct relationships are obtained 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



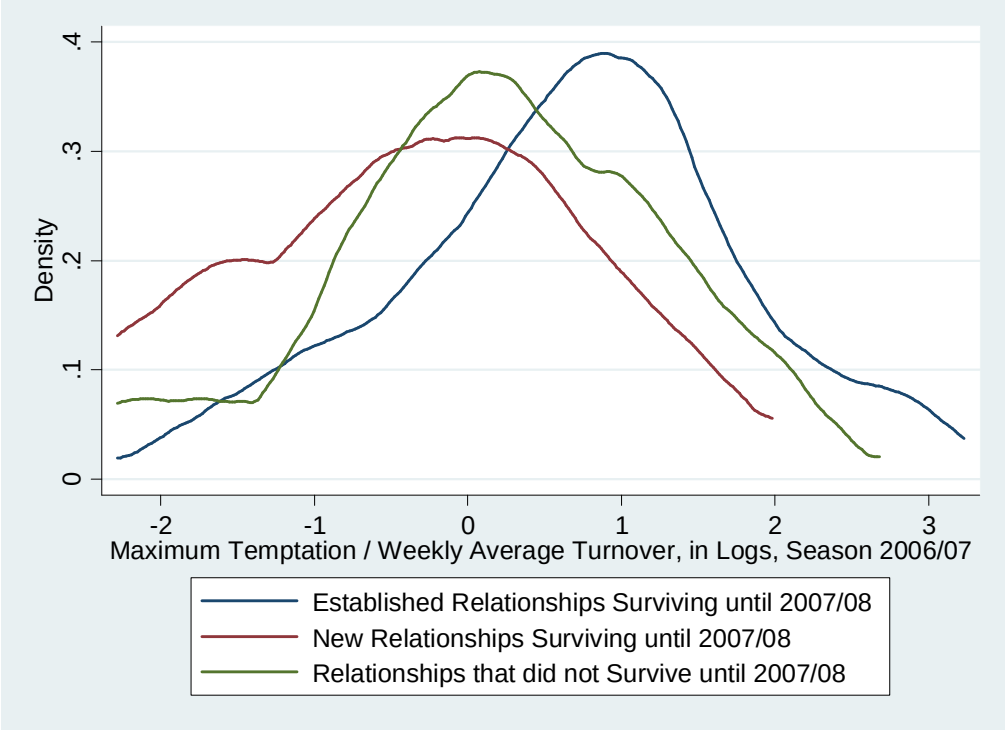
The Figure shows that FOB Prices at the Auctions are highly predictable. A regression of the weekly price at the auction on week and season dummies explains 76% of the variation in prices in the three season preceding the violence period. A season begins in mid august.

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



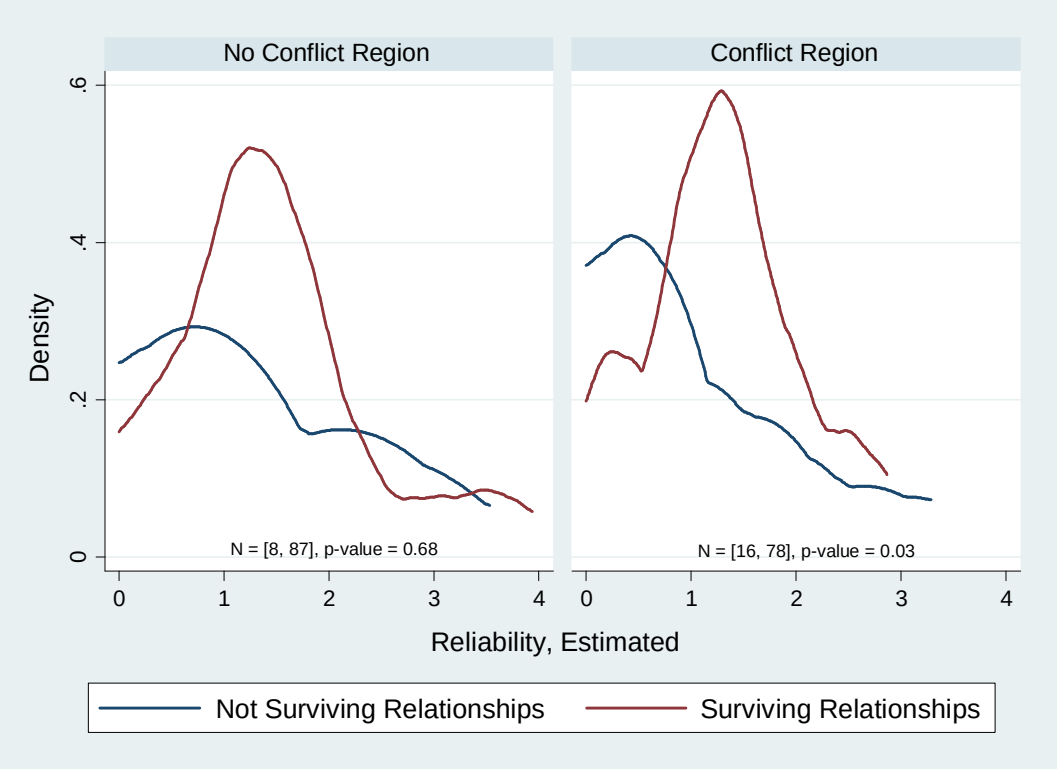
The Figure shows that the number of relationships dying in a given week does not correlate with the price at the Auctions in that week during the two season preceding the violence period. This is consistent with the fact that prices at the auctions are highly predictable. In a regression of the number 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



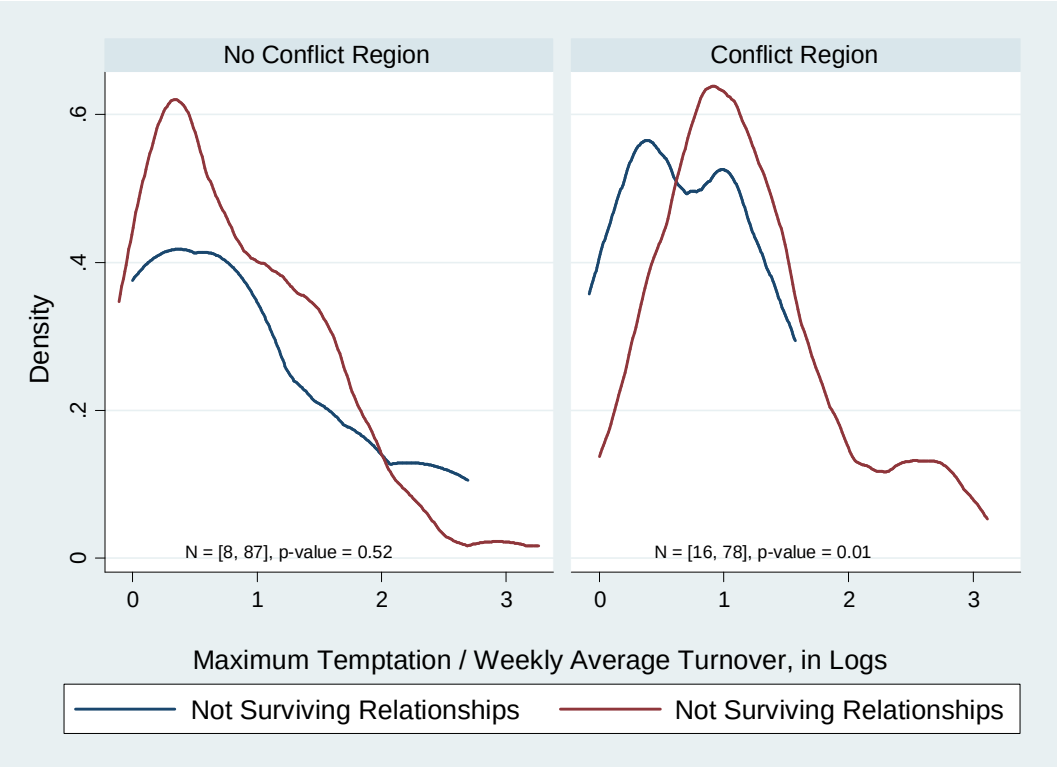
The Figure shows the distribution of the (log of the) value of relationships in the season 2006/07. The value is given by the ratio of the maximum temptation to deviate in any given week of the season, divided by the average weekly value of transactions in the relationship during the season. The maximum 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



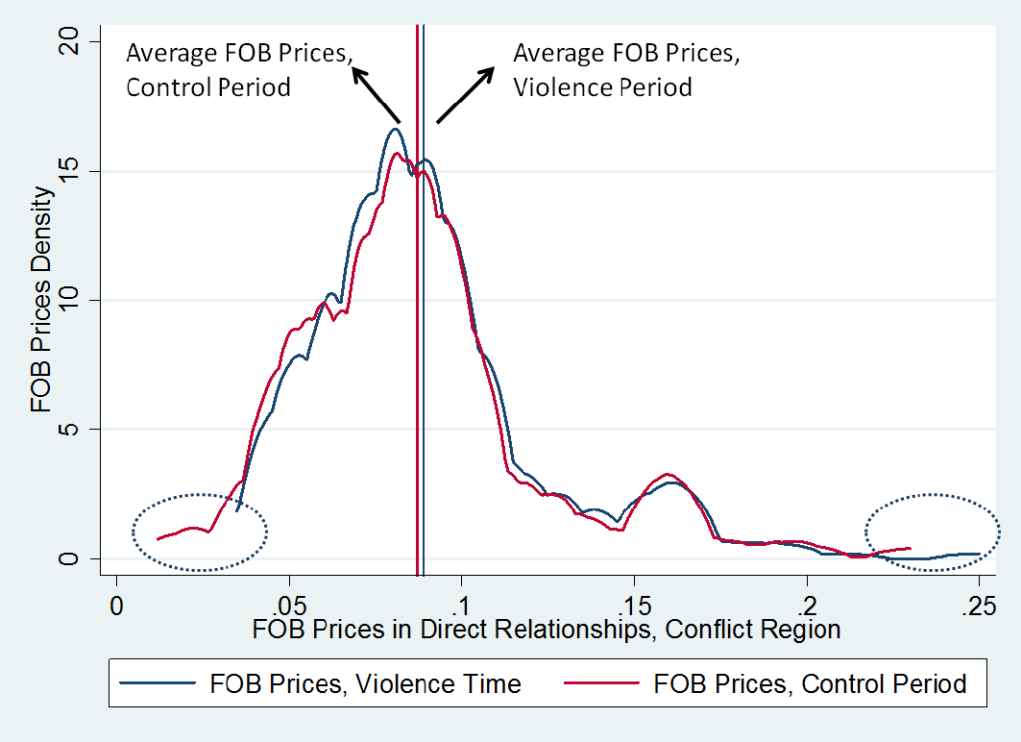
The Figure shows the distribution of the estimated reliability at the time of the violence in the two regions depending on whether the relationship survived until the following season. The Figure shows that the estimated reliability is higher for relationships that survived relative to relationships 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



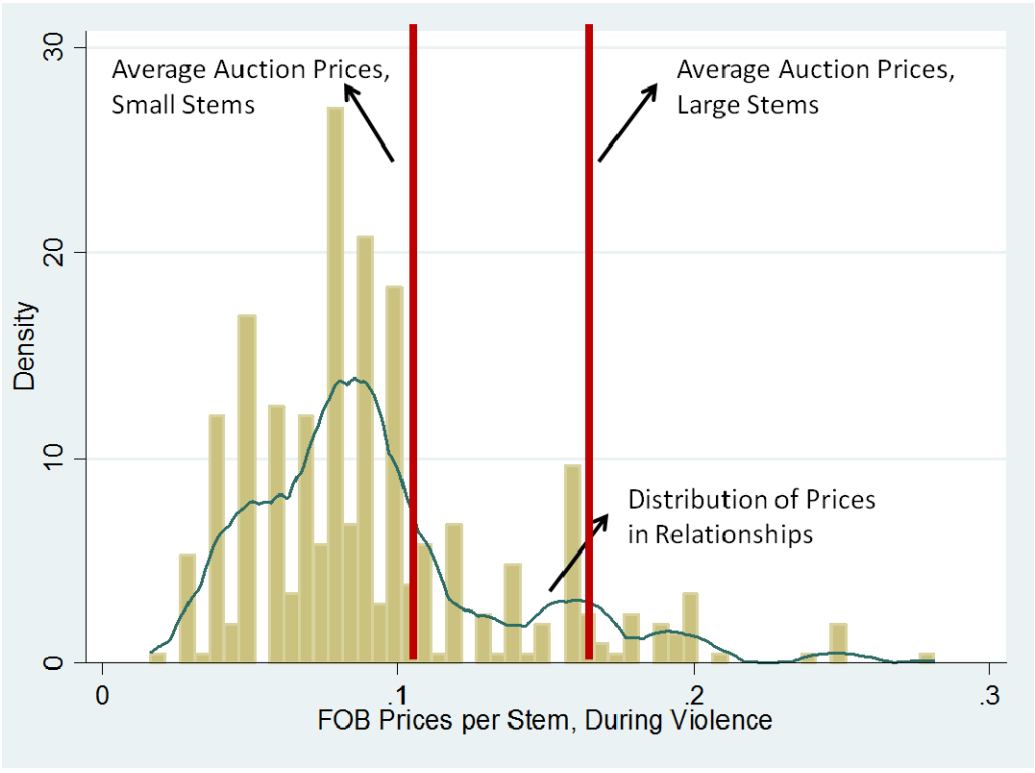
The Figure shows the distribution of the (log of the) value of relationships in the season 2006/07 for relationships in the conflict and no-conflict regions depending on whether the relationship survived until the following season. The value is given by the ratio of the maximum temptation to deviate 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