Task Clarity and Credibility in Relational Contracts*

Nemanja Antić† Ameet Morjaria‡ Miguel Ángel Talamas Marcos§

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We develop and test a model of building relational contracts where the principal and agent need to solve task clarity and credibility problems. We model task clarity as the likelihood of the agent finding a productive action for the principal and show that it influences the agent's propensity to fulfill promises, the usual notion of credibility. This is because improving task clarity increases the ease of replacing a relationship after a defection, making defection more tempting. We validate our model using administrative data from the Ethiopian floriculture industry. We show that: (i) task clarity problems are economically relevant and more severe for domestic firms, (ii) consistent with our theoretical results, exporters with higher task clarity are more likely to defect on relationships in response to positive shocks to the outside option, and (iii) the buyer and seller components of task clarity explain differences between foreign and domestic firms in credibility and overall success in relational contracts.

JEL classifications: D86, F14, L14, O13, O19; Q17
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†Northwestern University: nemanja.antic@kellogg.northwestern.edu
‡Northwestern University, CEPR and NBER: a.morjaria@kellogg.northwestern.edu
§Inter-American Development Bank: miguelta@iadb.org

1 Introduction

Many market transactions are plagued by imperfect contract enforcement. In such situations, trading parties rely on informal mechanisms, such as relational contracts, where collaboration is sustained by the expectation that repeated cooperative payoffs exceed gains from defection (Baker, Gibbons and Murphy, 2002). While the literature has mostly focused on how parties maintain such relationships, we are interested in how they build these contracts in the first place.

To shed light on this question, we develop and test a relational contracting model where building and maintaining relationships requires players to solve two problems: clarity and credibility (Gibbons and Henderson, 2012). Clarity is the problem of communicating the terms of the relational contract to each other. Do parties understand each other's preferences and promises? We focus on one aspect of clarity: *task clarity*, which captures the fact that the agent may not know which actions the principal finds productive.[1] Credibility, on the other hand, is convincing each other that they are likely to keep their promises. Does each party *believe* the promises of the other? While credibility is a problem that exists throughout the relationship, task clarity is resolved early on because understanding is achieved through repeated interaction.

Distinct from most of the theoretical and empirical literature on relational contracts which focuses on credibility and assumes the clarity problem has been solved, we study relationship formation in a setting where players are yet to resolve task clarity issues. In our model, players have incomplete information about *how* to cooperate and whether productive cooperation with the current partner is possible. Early in the relationship, the players must find an action, if one exists, that the other finds productive, and once this happens, the relationship settles into an established, productive relationship where only the credibility problem remains.

We study a long-lived agent who may take an outside option in each period or pay a cost to be matched with a principal. If matched, the parties face a task clarity problem: the agent does not know which actions from his action set (if any) produce a positive surplus for the principal. The early part of the relationship is characterized by relationship-specific learning: the agent attempts to find a productive action, and the principal responds by either paying the agent a bonus, which signals whether the action is productive or not. In each period, the agent may decide to try an action with the current principal or to break off the relationship and take the outside option. In the latter case, an unmatched agent may decide to pay a cost to be matched to a new principal in the next period. Once a productive action has been found with a particular principal, the task clarity problem has been resolved, but credibility concerns remain, i.e., the agent may still take the outside option if its realization is sufficiently high. We characterize when a self-enforcing relational contract exists in this setting and show that assuming that the principal is sufficiently patient, this equilibrium is unique.

Rather than explicitly modeling the process of searching for a productive action, we give several microfoundations for the assumption that the probability of success is single-peaked: it initially increases with time, then decreases and converges to zero. Under this single-peaked

[1] Gibbons and Henderson (2012) discuss four components of clarity: (i) whether the agent knows which actions the principal perceives as cooperation (task clarity), (ii) the choice set of the principal, (iii) the payoffs of the principal, and (iv) the payoff of the agent.

assumption, we characterize equilibria in the repeated game and find that agents are more likely to defect in early periods than in later periods, once clarity problems have been resolved. We also show that increased clarity has a negative effect on credibility. Namely, when it is easier for an agent to replace a relationship because of improved clarity, he is more likely to take the outside and break off any given relationship. That is, higher task clarity leads to lower credibility. To the best of our knowledge, this is novel in the literature since our model is the first to study task clarity and credibility in a context where new relationships may be built and strategically broken.

We test our model using a decade of administrative transaction data and two waves of firm surveys from the Ethiopian floriculture industry. This industry is based on relational contracts: flowers are highly perishable, so upon receiving a shipment, a buyer could always claim the flowers were not of acceptable quality and refuse to pay. But, on the other hand, the seller could also claim the buyer somehow spoiled the flowers to avoid payment. On average, exporters receive higher prices through direct relationships with global buyers than through the spot market (auctions). However, the spot market acts as an outside option because, due to its volatility, it often pays a higher price than the relationship does. Despite the advantages of selling in direct relationships, domestically owned firms are much less successful at exporting directly to global buyers than foreign-owned firms.

The empirical analysis takes advantage of five features of the setting. First, unlike domestic sales, all export sales are administratively recorded by customs, and there is a very low domestic demand for flowers – practically all production is exported. Second, we use a decade of transaction-level data of all cut-flower exports from Ethiopia, including the IDs of domestic sellers and foreign buyers and information on units traded, prices, and transaction dates. Third, in the flower industry, direct supply relationships coexist alongside a well-functioning spot market, the Dutch auctions, and our data also include the prices Ethiopian firms receive at the auctions, which we can use to model the outside option of direct relationships. Fourth, the industry structure features a unique opportunity to test the predictions across two firm types: foreign and domestic firms. While these two types of firms have no differences, on average, in the quality of their products or their operation size, they present clear differences in their cost of capital and propensity to sell in relational contracts. Five, the Dutch flower auction, akin to a centralized exchange, operates with standardized guidelines for quality, packaging, and logistics, ensuring consistency and reducing task clarity challenges for growers. In contrast, direct trade resembles over-the-counter transactions, requiring sellers to navigate unique challenges such as tailoring flower ripeness, cut length, packaging designs, and transportation volumes to bespoke buyer preferences, with each new relationship demanding individualized solutions.

In our estimation, we first emphasize the role of task clarity. While credibility issues are independent of the number of shipments to the direct buyer, task clarity issues predominantly arise and are resolved during initial shipments. Consistently, our findings reveal that the probability of a relationship termination remains mostly constant beyond the fourth shipment when only credibility issues are present. However, in line with the importance of task clarity in relational contracts, the probability of relationships ending within the first four shipments is, on average, 14 percentage points higher than later on. Furthermore, we find that domestic firms face significantly greater task clarity issues.

We subsequently test a novel prediction of our model: credibility and task clarity are interrelated, and specifically, credibility decreases as clarity increases. This occurs in our model because task clarity affects how easily an exporter can replace a relationship after shirking and going to the auction. In the standard relational contract framework (e.g., Thomas and Worrall (1988); Macleod and Malcomson (1989)), a lower discount factor increases the likelihood of the agent reneging on the relational contract in response to improvements in the outside option. These frameworks would predict in our context that domestic firms, due to their lower discount factor, are more likely to shirk in response to increases in the auction price.

However, this prediction may not hold in our model because domestic firms also have lower task clarity, which leads to higher credibility. Domestic firms may be less likely to shirk if the effect of lower clarity outweighs the effect of a lower discount factor on credibility. Consistent with our model prediction of lower task clarity leading to higher credibility, we find that domestic firms, characterized by lower clarity, have higher credibility than foreign firms; they are less likely to shirk in their relationships in response to improvements in their outside option, thereby demonstrating higher credibility despite having a lower discount factor.

We then dissect the task clarity problem onto a seller, a buyer, and a match component. We employ an AKM model to ascertain the buyer and seller components' contribution to the success of relational contracts (Abowd, Kramarz and Margolis, 1999). We demonstrate that both components are crucial to the success of a relational contract, and the buyer component accounts for twice as much of the variation in the success probability of a relationship. Moreover, the AKM framework provides an estimate of each buyer and seller's component of clarity, allowing us to test whether domestic firms have lower clarity due to a lower seller or buyer component or both. We find that domestic firms have a lower seller component and a weakly lower buyer component. We then assess whether these differences in buyer and seller components explain the observed differences in task clarity and credibility between foreign and domestic firms.

We start by testing whether task clarity issues persist after controlling for the buyer component. Consistent with our variance decomposition estimates, controlling for the buyer component alleviates most of the observed clarity problems. However, the task clarity gap between foreign and domestic firms persists, suggesting that domestic firms still face more challenges in establishing relational contracts due to their inferior ability to select the productive action for the buyer. We then turn to the relationship between the task clarity components and credibility. Consistent with our model, we show that exporters with a higher seller component, which implies higher task clarity, have lower credibility: they are more likely to end their productive relationships in response to more favorable auction prices. The final segments of the estimation section show that higher buyer and seller clarity components are associated with a larger share of direct exports.

Related Literature. This article contributes to several strands of the literature. The first is the economic theory of contracting. In weak contracting environments, trading parties rely on informal mechanisms to guarantee contractual performance (e.g., Johnson, McMillan and Woodruff (2002); Greif (2005); Macchiavello and Morjaria (2015); Fafchamps, van der Leij and Goyal (2010); Macchiavello and Morjaria (2021); Brugués (2024)). Among those mechanisms, long-term relationships based on trust or reputation are the most widely studied and have received theoretical attention. The theoretical literature has developed a variety of models that capture salient features of real-life relationships, e.g., enforcement problems (e.g., Macleod and Malcomson (1989); Baker, Gibbons and Murphy (1994, 2002); Levin (2003)) insurance considerations (e.g., Thomas and Worrall (1988)), or uncertainty over parties' commitment to the relationship (e.g., Halac (2012)). A strand of this literature has focused on the gradual trust-building within relationships, where the stakes of the relationship tend to increase over time (Sobel, 1985; Kranton, 1996; Ghosh and Ray, 1996; Watson, 1999; McAdams, 2011; Halac, 2014). However, these models do not study the problem of task clarity, particularly how parties figure out what is expected of them in a relational contract. In particular Gibbons (2022) notes that *"the theoretical literature has developed great expertise on the credibility problem but essentially ignored the clarity problem."* In this respect, Chassang (2010) is the closest theoretical paper to ours, since one of the players does not know which action the other party will find valuable. Unlike Chassang (2010), we assume that the agent's set of available actions is fixed in every period, and so once a productive action has been identified, the agent is free to keep choosing that action. As a result, we do not have the kind of imperfect public monitoring that Chassang (2010) focuses on. However, we introduce an outside option for the agent, as well as the possibility of ending a relationship and starting again with a new partner, which allows us to better understand how task clarity impacts credibility.

Second, the paper's theoretical advancements and empirical findings contribute to the literature on relationships between firms by not taking for granted the existence of relationships and focusing on the anatomy of relationship-building (task clarity) and how it interacts with parties keeping their promises (credibility). This angle differs from a large portion of the existing work that assumes that parties are already in a relationship and, in turn, focuses on the credibility problem. McMillan and Woodruff (1999) find evidence consistent with long-term informal relationships facilitating trade credit in an environment that lacks formal contract enforcement. 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. Macchiavello and Morjaria (2015) document the importance of credibility in relational contracts by exploiting an exogenous supply shock and relying on within buyer-seller relationships evidence to quantify the importance of the future rents necessary to enforce relational contracts. In contrast to the present study, their focus is not on relationship formation.

Despite a different motivation, this paper technically relates to the literature on labor search, especially Jovanovic (1979). Like our paper, Jovanovic (1979) studies a model where an agent gradually learns about the productivity of their match with the current principal. In our model, resolving task clarity problems within a match is what determines productivity. Our empirical application also means we focus on different comparative statics. See Mortensen and Pissarides (1999) for a survey of this strand of the literature and Wright et al. (2021) for a survey which focuses on directed search. We also relate to the broader literature on search (Chade, Eeckhout and Smith, 2017) and especially learning while searching (Adam, 2001).

Lastly, the paper also complements the broader literature on firm-to-firm linkages and firm performance. Recent studies have uncovered important insights into how these linkages influence firm outcomes. For example, Alfaro-Ureña, Manelici and Vasquez (2022) show that Costa Rican suppliers experience significant and persistent performance gains after starting to sell to foreign firms. Similarly, Atkin, Khandelwal and Osman (2017) find that exporting leads to higher profits and substantial improvements in product quality for Egyptian rug producers. Cai, Lin and Szeidl (2024) demonstrate that firm-to-firm referrals facilitate subsequent transactions and drive increases in revenue, profits, and labor input among supplier firms. Our contribution to the literature is on advancing the knowledge in building and maintaining relationships; in particular, we showcase the central role that task clarity can have in hindering productive direct relationships with global buyers.

Outline. For the interested reader, the next section discusses the model. Section 3 presents the theoretical results and the propositions we take to data. Section 4 provides the necessary institutional details, including descriptions of the various administrative and firm datasets. Section 5 proceeds with the empirical estimation. Section 6 offers some concluding remarks. The appendix contains all proofs not in the text and additional empirical analysis.

2 Model

An agent (e.g., an employee or seller) can either take an outside option or be matched to play a repeated game with a principal (e.g., a manager or buyer). All parties are risk-neutral, time is discrete and the discount factors for the agent and principal are δ and δ_p, respectively. While describing the model we focus on a manager-employee application, but later discuss the buyer-seller application as it relates to our empirical context.

At the start of period t, the agent observes his outside option, $s_t \in [\ell, \infty) \subset \mathbb{R}_{++}$, e.g., the utility the employee gets from leisure. We interpret $\ell > 0$ to be the cost of effort when working for the principal (and any higher realization of s_t is due to a positive opportunity cost). Draws of s_t are identically and independently distributed across time according to CDF F. Let $\upsilon = \int s \, \mathrm{d}F(s)$ denote the expected outside option and A_t be the agent's action set in period t. If the agent is unmatched to a principal $A_t = \{s_t\}$, where s_t denotes the action of taking the outside option as well as the agent's payoff from it. The agent starts the game at time $t = -1$ unmatched.

There are infinitely many possible principals indexed i. When the agent is matched to a principal, the agent chooses an action from the set $A_t = \{s_t\} \cup \mathcal{A}_i$. If the agent chooses the outside option in period t, $a_t = s_t$, the relationship with that principal ends.[2] For simplicity, we assume that an agent cannot return to a previous principal once the relationship has broken down. Actions in $\mathcal{A}_i$ are interpreted as the employee working for manager i.

Each action $a_k \in \mathcal{A}_i$ is either productive, generating $\xi > 0$ surplus for the principal, or non-productive, resulting in no surplus. For example, if the principal is a professor and the agent is a grader, only certain ways of grading may be acceptable to the professor. Even if the professor provides a rubric, it may be incomplete and the grader will have to use his judgement.

[2] This assumption simplifies the analysis, but is not essential for our main results. It is realistic in our empirical context where the agent's outside option is high exactly when the value of a productive action is high for the principal, e.g., around Valentines Day when demand for flowers is high and so are auction prices.

The agent's belief that action a_k is productive is denoted λ_k.

We assume that λ_k does not vary across principals.[3] Learning a productive action for principal i reveals nothing about what principal $j \neq i$ will find productive. That is, what the agent learns while interacting with one principal is not transferable to another principal. As such, the game effectively restarts whenever the agent is matched to a new principal, and we refer to this period as $t = 0$.[4] This allows us to drop the dependence on i from our notation and refer to a generic principal as *the* principal.

We will label actions so that in period t, if the agent has not yet found a productive action and does not take the outside option, he chooses $a_t \in \mathcal{A}$ which is productive with probability λ_t. We assume $\lambda = (\lambda_t)_{t=0}^{\infty}$ converges to 0, so that after some (large) number of failed attempts to find a productive action the agent believes the probability of success on the next attempt is close to zero. While we will show the existence and uniqueness of a relational contracting equilibrium without making further assumptions on λ, in order to characterize the equilibrium more precisely we will assume that λ is single-peaked in the following sense: it is (weakly) increasing up to some $T \geq 0$ and then (weakly) decreasing. Several microfoundations for λ are described in the next subsection.

We allow for two interpretations of the model: either the principal knows which actions are productive, but cannot communicate this information perfectly to the agent, or, the principal only discovers whether a particular action is productive after the agent attempts it. In either case, in period t the agent chooses action $a_t \in \mathcal{A}$ which he believes is productive with probability λ_t. The principal privately observes her payoff and chooses $b_t \in \{0, b\}$. We interpret $b_t = b > 0$ as cooperation (e.g., paying the agent a bonus) and $b_t = 0$ as defection (not paying the bonus). At the end of each period the agent chooses whether to pay a search cost $c \geq 0$ to be matched to a new principal in the next period. If the agent is matched to a new principal, we reset time to $t = 0$.

1. The shock $s_t \in \mathbb{R}$ is realized and observed by the agent.

2. The agent chooses an action $a_t \in A_t$.

3. If $a_t \neq s_t$, the principal observes her payoff and chooses $b_t \in \{0, b\}$.

4. The agent decides whether to pay cost $c \geq 0$ to match with a new principal next period.

The agent's stage game payoff in period t is $u : A_t \times \{0, b\} \to \mathbb{R}$, defined as follows: $u(s_t, \cdot) = s_t$, so if the agent chooses the outside option he gets the payoff s_t, and $u(a_t, b_t) = b_t$ for any $a_t \neq s_t$. We interpret $b > 0$ as the profit the agent gets from the bonus in this period, if the principal chooses to pay it. An unmatched principal gets zero utility in each period. A principal who is matched with the agent gets stage-game payoff $u_p(a_t, b_t) = \xi - b_t$ if a_t is a productive action and $u_p(a_t, b_t) = -b_t$ if a_t is not productive. We assume that an agent who is indifferent breaks ties in favor of the principal he is currently matched with.[5]

[3] We later discuss how our results generalize when this assumption is relaxed.

[4] So while there is learning-by-doing within a particular relationship, there is no learning across relationships. Furthermore, there is no learning about the sequence of shocks to the outside option.

[5] If F is absolutely continuous the agent is almost never indifferent between the outside option and continuing in a relationship.

We assume that $\xi > b > \upsilon > 0$, so that there are benefits from trade and, in expectation, the agent is better off contracting with the principal than taking the outside option if the bonus is paid. The agent's expected value from always taking the outside option is $\delta\upsilon/(1-\delta)$.

The principal's incentives are purposefully straightforward: the only way she gets a positive payoff is when the agent chooses a productive action. Initially, we assume that the principal commits to a strategy where once she pays the agent the bonus, she must continue to pay the bonus for that action in every period. We discuss this assumption and how to relax it in the Discussion section. The very first time the agent chooses a productive action, we verify that the principal wants to signal this to the agent by choosing $b_t = b$ in response.[6] We are particularly interested in these *relational contracting equilibria*. A relational contracting equilibrium is a subgame-perfect equilibrium of the repeated game between the agent and principal. Note that there is another type of equilibrium where the principal always plays $b_t = 0$ and the agent always chooses $a_t = s_t$. This *no relationship equilibrium* is Pareto dominated by the relational contracting equilibria.

2.1 Microfoundations

We provide several microfoundations for the assumption that the sequence of probabilities of finding a productive action, $(\lambda_t)_{t=0}^{\infty}$, is single-peaked, that is, it is (weakly) increasing up to some $T \geq 0$ and then (weakly) decreasing. The first few examples are of simpler environments where λ is decreasing, i.e., where $T = 0$. We do not allow λ to be increasing or constant, since we want to assume that the agent eventually gives up on the current principal if they have not found a productive. In the discussion after our theoretical results we describe how this assumption can be generalized.

2.1.1 Undirected Search

Suppose that the agent believes all actions in $\mathcal{A}$ are productive with the same probability $\nu \in [0, 1]$. We can interpret ν as match quality between the principal and agent: a higher ν means that they are more likely to resolve task clarity issues and are more likely to find a productive action. In the professor-grader example ν may capture how particular the professor is or how good the two are at communicating. If ν was known by the agent the probability of success of every action attempted would be constant and hence the agent would never search for a new match. However, we assume that ν is a random variable with a prior distribution CDF G_0. Let G_t be the agent's posterior distribution after t failed attempts at finding a productive action. Since the agent is risk neutral, this model is equivalent to ours if we simply set $\lambda_t = \int \nu \, \mathrm{d}G_t(\nu)$. We have that $\lambda_t \to 0$ as long as G_t converges to the Dirac distribution which realizes a 0 match value with probability 1.

For a concrete example, suppose that $g_0 = Beta(\alpha, \beta)$ distribution, with $\alpha, \beta > 0$, so that $g_0(\nu) = \nu^{\alpha-1}(1-\nu)^{\beta-1}/B(\alpha, \beta)$ where B denotes the Beta function. We then have that $g_t = Beta(\alpha, \beta + t)$ and $\lambda_t = \frac{\alpha}{\alpha+\beta+t}$, which converges to 0 and is single-peaked with $T = 0$, (i.e., it is decreasing in t).

[6] We check the principal's incentives to report a productive action as soon as it is chosen by the agent in lemma 6, in the proof of the main theorem. The lemma shows that the principal will do so if she is sufficiently patient.

Another example is to set $g_0 = (1-\gamma)\,\delta_0 + \gamma\delta_\eta$, so that the match between the agent and principal is good with probability $\gamma > 0$ and bad otherwise. If the match is good, each action in $\mathcal{A}$ is productive with probability $\eta > 0$. If the match is bad (e.g., the principal is picky), there are no productive actions in $\mathcal{A}$. The agent's belief that the action he tries in period 0 will be productive is $\lambda_0 = \gamma\eta$. More generally, the action the agent tries in period t is productive with probability $\lambda_t = \frac{\gamma(1-\eta)^t\eta}{1-\gamma+\gamma(1-\eta)^t} \to 0$ and is decreasing in t. In our empirical context, one interpretation of the picky type of buyer is a scammer, i.e., a buyer who never pays the seller in full for the product.

2.1.2 Directed Search

We now allow for the possibility that not all actions in $\mathcal{A}$ are equally likely to be productive. Assume that some finite subset of actions $a_k \in \mathcal{A}$ have $\lambda_k > 0$ and suppose that these probabilities are independent of one another. These actions can be ordered by their probability of being productive, as discounting implies that the agent will optimally pick actions in decreasing order of λ_k. Thus we will have $(\lambda_k)_{k=0}^{\infty}$ weakly decreasing and converging to 0. In the professor-grader example, this microfoundation allows for the grader to have different beliefs about what specific ways to grade the professor finds productive. In order to get the principal to behave as stipulated in the equilibrium, it is easiest to think about a situation where the principal learns whether an actions is productive only when the agent attempts it. However, we allow the principal to have different beliefs about the success of each action than the agent. As described in the discussion section, all we need is that the principal faces some uncertainty about whether the agent will choose a productive action next period, i.e., we can allow the principal to have very strong ex ante beliefs about whether actions are going to be productive or not.

2.1.3 Directed Search with Correlation

Consider the asymmetric action environment above, but suppose that the agent's prior over which actions are productive is correlated. So after an agent attempts to find a productive action and fails, his beliefs on whether the other actions are productive are updated. This may also occur if, for example, the principal gives feedback to the agent after a failed attempt. In this variation of the model, it is possible that a_1 has a higher probability of being productive than a_0, i.e., we could have $\lambda_1 \geq \lambda_0$. While for our existence and uniqueness result we do not need any particular structure on λ, when we characterize equilibrium it is helpful to restrict attention to an environment where λ is single-peaked, that is, it is weakly increasing until period $T \geq 0$ and thereafter decreasing and converging to 0.[7] While not all forms of correlation result in a single-peaked λ, this can occur in natural scenarios. For example, if the agent knows that exactly one out of m ex-ante identical actions is productive, we have that $\lambda_0 = 1/m$, $\lambda_1 = 1/(m-1)$, ... $\lambda_{m-1} = 1$ and $\lambda_t = 0$ for all $t > m$. This λ is single-peaked with $T = m$.

[7] Note that a fully rational agent would take into account the expected feedback when choosing the order in which to try actions.

3 Theoretical Results

In period $t = -1$ the agent is unmatched, takes the outside option and decides whether to pay matching cost $c \geq 0$. The agent wants to pay this cost if

$$\delta W_0 - c \geq \frac{\delta v}{1-\delta}, \tag{RC}$$

where W_0 is the agent's continuation value if he starts period 0 matched to a new principal, before the shock is realized. If this inequality is not met, the agent always prefers the outside option and no relational contracting equilibrium exists. As such, in characterizing relational contracting equilibria we will assume that inequality (RC) holds.

Let W_t be the agent's period t continuation value if he starts the period matched to a principal with whom he has interacted $t \geq 0$ times and is not in a productive relationship, i.e., the principal chosen $b_\tau = 0$ for all $\tau < t$. Let $W_t(s_t)$ be his continuation value in period t after shock s_t is realized. Thus we can write $W_t = \int W_t(s_t)\ dF(s_t)$. Let V be the agent's continuation value if he knows a productive action for the principal he is matched with. In this case, we say that the agent is in a *productive relationship*.

Fact 0 There exists an n, such that $\lambda_n (b + \delta V) + (1 - \lambda_n)(\delta W_0 - c) < \ell + \delta W_0 - c$.

The above suggests that after a certain number, n, of failed attempts to establish a productive relationship with the principal, the agent prefers to take even the lowest possible outside option today, pay the search cost and try with a new principal tomorrow. Clearly, this holds for any $\ell > 0$, since λ_n converges to 0 as $n \to \infty$. Period n is therefore an upper bound on when the potential relationship with any given principal can end. As a convention, we let $W_t = 0$ for all $t > n$.

Following shock s_t, the agent can either take the outside option, $a_t = s_t$, which results in a present-value payoff of $s_t - \delta W_0 - c$, since under inequality (RC) the agent will pay the cost to be matched to a new principal in the following period. Alternatively, the agent can take an action $a_t \in \mathcal{A}$. If the agent is not in a productive relationship, the expected continuation value from this action is

$$\lambda_t (b + \delta V) + (1 - \lambda_t) \max \{\delta W_{t+1}, \delta W_0 - c\},$$

where the maximum represents the agent's choice after an unsuccessful attempt at a productive relationship to either continue with the same principal or pay a search cost and start with a new one. This is a function of clarity, i.e., the sequence λ. For $s_t \in \mathbb{R}$ we can then write the agent's continuation value after shock s_t is realized at time t as

$$W_t(s_t) = \max \{s_t + \delta W_0 - c, \lambda_t (b + \delta V) + (1 - \lambda_t) \max \{\delta W_{t+1}, \delta W_0 - c\}\}. \tag{1}$$

This expression is intuitive: in the outer maximum, the agent either chooses the outside option or makes an attempt at forming a productive relationship by choosing $a_t \in \mathcal{A}$. In the latter case, if the result is unsuccessful, in the inner maximum the agent chooses to continue with the current principal or pay a search cost and start next period with a new principal.

Clearly $V \geq W_t$ for all t, since V is the best possible expected continuation for the agent, where he knows a productive action for the principal he is matched with. In all other instances, a productive action is not known and is only found with some probability.

If the agent is in a productive relationship his continuation payoff is $b + \delta V$. Taking the outside option yields continuation payoff $s_t + \delta W_0 - c$. It is easy to see that, fixing W_0 and V, there exists a unique cutoff s^*, so that if the outside option today $s > s^*$ the agent has an incentive to break a productive relationship.

We can therefore write

$$V = \int_{\ell}^{s^*} (b + \delta V)\ \mathrm{d}F(s) + \int_{s^*}^{\infty} (s + \delta W_0 - c)\ \mathrm{d}F(s). \tag{2}$$

If $F(s^*) = 1$, then there is no shock which occurs with positive probability that leads the agent to break a productive relationship. In this case $V = \frac{b}{1-\delta}$, since the agent will choose the productive action and earn b forever. If $F(s^*) = 0$, then the agent wants to break a productive relationship for any shock. In this case, inequality (RC) fails to hold since the agent would not pay the cost to be matched to a principal in the first place.

Given W_0 and V, we can find the s^* which makes the agent indifferent between the outside option and continuing in a productive relationship by solving

$$s^* = b + \delta V - \delta W_0 + c. \tag{3}$$

Lemma 2 shows that for a fixed W_0, there exists a unique V and respective cutoff s^*. It also shows that V is increasing in W_0, while s^* is decreasing in W_0.

In each period, from equation (1) we can derive a cutoff shock, s_t^*, so that if $s_t > s_t^*$ the agent would like to take the outside option. This cutoff is

$$s_t^* = \lambda_t (b + \delta V) + (1 - \lambda_t) \max\{\delta W_{t+1}, \delta W_0 - c\} - \delta W_0 + c. \tag{4}$$

Lemma 2 shows that s_t^* is decreasing in W_0, even after accounting for the fact that V and W_{t+1} are increasing in W_0. Observe also that $s^* \geq s_t^*$ for all t and that the inequality is strict if $\lambda_t < 1$. This is because $b + \delta V > \max\{\delta W_{t+1}, \delta W_0 - c\}$.

Theorem 1. *A unique relational contracting equilibrium exists as long as the principal is sufficiently patient and inequality (RC) holds. A sufficient condition for inequality (RC) is*

$$\lambda_0 \geq \frac{(1-\delta)(\delta \upsilon + c)}{\delta b - \delta^2 \upsilon}.$$

Appendix A.1 shows the details of the existence and uniqueness proof, assuming that inequality (RC) holds. Note that the no relationship equilibrium, where the agent always takes the outside option, always exists. If inequality (RC) fails, then only this equilibrium exists.

There is a slightly more permissive sufficient condition for existence given in the proof of the theorem, which says that $\lambda_0 \geq \frac{(1-\delta)(\delta\upsilon + c)}{\delta(1-\delta)(b+\delta V) - \delta^2 \upsilon}$. The sufficient condition in the statement of Theorem 1 notices that $V \geq \frac{b}{1-\delta}$ and is hence purely expressed in terms of the primitives of the model.

3.1 Characterizing the Equilibrium

So far, our results have not used the fact that λ is single-peaked. However, this assumption allows for a more precise characterization of the relational contracting equilibrium, which is what we turn to next. Recall that λ is single-peaked if there exists some period $T \geq 0$ such that $(\lambda)_{t=0}^{T}$ is increasing and $(\lambda_t)_{t=T}^{\infty}$ is decreasing. Our first observation is that $(W_t)_{t=0}^{n}$ is also single-peaked.

Theorem 2. *If λ is single-peaked with peak T, $(W_t)_{t=0}^{n}$ is single peaked with a peak $\tau \leq T$.*

Proposition 2 also shows that the peak of $(W_t)_{t=0}^{n}$ comes before the peak of λ, although the two may coincide. This is intuitive, since, for example, if λ_T is not much larger than λ_{T-1}, we could have that $W_{T-1} > W_T$ since at time $T-1$ the agent still has two actions to try which are likely to be productive, but in period T only one is left.

This Proposition is useful in further characterizing the equilibrium. In particular, it implies that there is a final period, which we will denote K at which the agent makes an attempt at direct contracting with the principal. If no productive action is found in period K, the agent immediately pays the cost and matches to a new principal. This is formally stated in the next proposition.

Proposition 3. *There exists a $K \geq T$ such that $\delta W_t \geq \delta W_0 - c$ for all $t \leq K$ and $\delta W_t < \delta W_0 - c$ for all $t > K$.*

Proposition 3 allows us to simplify the expression in equation (1) to give a more precise characterization of $W_t(s)$ as follows

$$W_t(s) = \begin{cases} \max\{s + \delta W_0 - c, \lambda_t (b + \delta V) + (1-\lambda_t)\delta W_{t+1}\} & \text{if } t < K \\ \max\{s + \delta W_0 - c, \lambda_t (b + \delta V) + (1-\lambda_t)(\delta W_0 - c)\} & \text{if } t = K \end{cases}. \tag{5}$$

We can also simplify the expression in (4) to write

$$s_t^* = \begin{cases} \lambda_t (b + \delta V) + (1-\lambda_t)\delta W_{t+1} - \delta W_0 + c & \text{if } t < K \\ \lambda_K (b + \delta V - \delta W_0 + c) & \text{if } k = K \end{cases}. \tag{6}$$

Note that since period K is effectively the last period in the game we will not need values for W_t and s_t^* for $t > K$. We will use the above characterizations to prove comparative statics. For example, consider

$$s_t^* - s_{t-1}^* = (\lambda_t - \lambda_{t-1})(b + \delta V - \delta W_{t+1}) + (1-\lambda_{t-1})(\delta W_{t+1} - \delta W_t).$$

Both terms are negative for $t > T$ and both terms are positive for $t < \tau$. So for sufficiently small t, we have that s_t^* is increasing, while for large t it is decreasing. The main comparative static we are interested in will be on clarity.

3.2 Benchmarks

One benchmark to consider is the case of a standard repeated interaction without clarity issues, e.g., $\lambda_0 = 1$. This corresponds to a relational contracting setting where there are no clarity issues and the agent finds a productive action with probability 1.[8] In this instance, the sufficient condition for the existence of a relational contracting equilibrium given in the proof of Theorem 1 reduces to

$$\frac{\delta b}{1-\delta} - c \geq \frac{\delta v}{1-\delta}.$$

This makes sense as in this case we have $W_0 = V = b/(1-\delta)$. This condition states that an agent who knows that he will enter a productive relationship tomorrow by paying the cost c today prefers to do so when the expected value of it exceeds the expected value of taking the outside option in perpetuity starting tomorrow. It is easy to see that in this instance the condition is both necessary and sufficient.

Lemma 1. *Without clarity concerns, in any relational contracting equilibrium, the probability of a relationship ending in any period is constant.*

Note that $V = b/(1-\delta)$ only when the agent never wants to break a productive relationship. In general, the agent would break a productive relationship if today's shock $s > s^*$, for some cutoff s^*. The probability of a shock above s^* is $1 - F(s^*)$. In this benchmark, equation (3) and the fact that $W_0 = V$ can be used to calculate $s^* = b + c$.

3.3 Comparative Statics

We are now ready to prove some comparative statics. The first result shows that W_0 is weakly increasing in clarity λ_t.

Proposition 4. *In a relational contracting equilibrium W_0 is increasing in λ_t for any $t \leq K$. Furthermore, W_0 is strictly increasing in λ_t if and only if $F(s_k^*) > 0$, for all $0 \leq k \leq t$ and $\lambda_k < 1$ for all $0 < k < t-1$.*

The above also implies that W_k is increasing in λ_t for $t \leq K$, since W_k is increasing in W_0 for any k, and the direct effect of λ_t on W_k is non-negative (and strictly positive if $k = t$). Proposition 4 is quite intuitive—a higher likelihood of finding a productive action in period t can only (weakly) improve the ex ante expected payoff of the agent. It strictly improves the agent's payoff if it happens with a positive probability on the path of play. For that to be the case, the agent does not always take the outside option in any period up to and including t, since otherwise the agent would quit the relationship before searching for a productive action in period t. Furthermore, it must be that a productive action has not been found with probability 1 before period t.

We defined λ_t as the probability that the agent finds a productive action, conditional on the fact that he has tried and failed t times to find one. A related concept, which is useful for empirical work, is the unconditional probability that the agent enters into a productive relationship before period t. The probability of not doing so, assuming a sequence of shocks which are sufficiently low so that the outside option is never taken, is $\phi_t = \prod_{k=0}^{t}(1-\lambda_k)$.

Proposition 5. *We have that W_0 is decreasing in ϕ_t, i.e., $\frac{\mathrm{d}W_0}{\mathrm{d}\phi_t} > 0$.*

[8] Note that in this special case of our model the agent still has to pay a cost c to get into a relationship. Because most relational contracting models do not study this decision, to get to that benchmark we would further have to set $c = 0$.

We can interpret $1-\phi_t$ as the cumulative probability distribution of reaching a productive relationship by period t, assuming sufficiently low shocks, the above proposition implies that if two such CDFs are first-order stochastic dominance ordered, the dominant distribution will result in higher utility for the agent than the dominated distribution. In describing the following facts, we think of improved clarity, as either an improvement in λ_t or an improvement in $1-\phi_t$. As clarity improves, the agent's ex-ante payoff improves and a relational contracting equilibrium is more likely to exist.

The above fact simply restates the content of the previous two proposition and notes that an increase in W_0 makes it more likely for inequality (RC) to hold. The next proposition allows us to say what happens on the probability of a relationship ending when clarity improves.

Proposition 6. *For each $t \leq K$, the total derivative $\frac{\mathrm{d}s_t^*}{\mathrm{d}W_0} < 0$. Furthermore $\frac{\mathrm{d}s^*}{\mathrm{d}W_0} < 0$.*

Recall that the probability that an agent takes the outside option when in a productive relationship is $1-F(s^*)$. This probability is decreasing in s^* and since s^* decreases with W_0, the probability that the agent ends a productive relationship is increasing in W_0. Combining this with the Proposition 4 we have the following observation.

Fact 2 As clarity improves, the agent is more likely to end a productive relationship.

Note that s^* is not affected by any specific value of λ_t. We can also say that if λ_t improves the agent is more likely to take the outside option in every period, except for period t. This is because s_k^* only depends on λ_t through W_0. Thus, we can conclude that the agent is more likely to take the outside option as clarity improves in any period except period t.

This is in contrast to models of starting small (Sobel, 1985; Ghosh and Ray, 1996; Kranton, 1996 and Watson, 1999). In these frameworks, there is incomplete information about the other player's willingness to cooperate and players screen each other by increasing the stakes of a relationship gradually. The probability of ending a relationship decreases with time, but these models cannot explain the fact that players who end relationships less early on (i.e., have higher clarity), end up ending relationships more later on (once relationships are productive).

Proposition 7. *In any relational contracting equilibrium, $\frac{\mathrm{d}W_t}{\mathrm{d}\delta} > 0$ for all $t \leq K$.*

The above shows that increases in the discount factor improve expected continuation values for the agent. This is rather intuitive, but note that it does not imply that as the discount factor increases the agent renegs more on promises. Since $s^* = b + \delta V - \delta W_0 + c$, as the discount factor increases we have that

$$\frac{\mathrm{d}s^*}{\mathrm{d}\delta} \quad = \quad (V - W_0) + \delta\left(\frac{\mathrm{d}V}{\mathrm{d}\delta} - \frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right) \geq 0,$$

where the inequality follows from the bounds on the derivatives (the proof is in Proposition 8 in the Appendix A). This implies the following fact.

Fact 3 As the agent becomes more patient, he is less likely to end a productive relationship.

Since s^* increases in δ we have that the agent will only break a productive relationship for larger shocks as δ increases.

3.4 Discussion

In this section we provide a brief discussion of our modeling assumptions and how results may be altered if some of these are relaxed.

3.4.1 Different Match Types

Consider a version of the model where after an initial conversation the agent learns something about the potential match quality and updates beliefs about λ. Let Θ be a finite set of match types and for all $\theta \in \times$ let $\left(\lambda_k^\theta\right)_{k=0}^\infty$ denote the sequence of probabilities which define the likelihood of the agent choosing a productive action. Our results can then be interpreted as being conditional on each θ, i.e., if we can add a superscript θ to our previous notation to denote the different types of matches, our qualitative results go through. The model can be solved in a similar way: fix a value for $W_0 = \mathbb{E}\left[W_0^\theta\right]$, then for each θ compute the induced W_k^θ and find a fixed point. For each type of match θ there will be different cutoffs $s_t^{*,\theta}$ describing the agent's equilibrium behavior in response to shocks.

3.4.2 Principal Incentives

We can allow the principal to have a more active role in the model by dropping the assumption that the principal is committed to paying a bonus "b" once the bonus has been revealed. If we select the agent-preferred subgame-perfect equilibrium, we get the same outcome as the above.

3.4.3 Principal Knowledge of Productive Actions

Key to ensuring that the principal's incentives for paying the bonus after a productive action is chosen is the fact that the principal is uncertain of whether the agent will choose a productive action tomorrow. In microfoundations with symmetric actions when the agent uniformly randomizes over the actions she is choosing, this will naturally happen. In microfoundations with asymmetric actions, if the principal can perfectly forecast which action that the agent will choose tomorrow, she may choose not to pay the bonus for a productive action today if the agent will choose a productive action tomorrow. In these environments we need to assume that the principal is not certain about which actions are productive (but that this uncertainty is resolved only after the agent chooses an action). We can allow the principal to have (very accurate) beliefs about which actions will be productive and that (due to clarity issues) these beliefs may be different to the agent's beliefs. Alternatively, we need that the principal faces some uncertainty about which action the agent will choose (perhaps due to a idiosyncratic shock to the costs of different possible actions which may change the order).

4 Industry Background and Data

This section provides background information on the prevalence of relational contracts in the cut-flower industry, the industry in Ethiopia, the role of task clarity across marketing channels, and the differences and similarities between foreign and domestic producers. The empirical analysis relies on administrative datasets, information obtained through two representative surveys of the Ethiopian flower industry, and numerous face-to-face interviews and engagements with stakeholders over the last twelve years.

Data. Customs records on flower exports are available from July 2007 to the present. Practically all production is exported. Our sample spans June 2008 to June 2019, where the data is at the transaction level, encompassing approximately 270,000 transactions.[9] For the analysis on relationships, we need to account for both left and right-side censoring of the data. Thus, we only include relationships that begin after July 2008 to ensure that the first transaction in the data is actually a relationship starting and not just the first *observed* transaction. Similarly, we only include relationships that start prior July 2018 to allow them to have enough time to potentially end within our data.

Table 1: Summary Statistics

	Foreign	Domestic
Firms	44	31
Year of Entry	2009.9	2008.3
Quality: Unit Weight of Stem (g) - Shipment	42.0	38.9
Quality: Unit Weight of Stem (g) - Production	40.0	38.0
Yearly Shipments	167	163
Yearly Shipments Direct	123	35
Yearly Shipments Auction	44	127
Share Sell Direct	0.66	0.19
Buyers per Seller	61.11	31.55
Av Relationships Attempted	59.16	28.19
Share Success	0.30	0.18
Relationships Ended	36.75	18.71
Seasonal Production Direct (Roses, Mill Stems)	2.38	0.65
Seasonal Production Auction (Roses, Mill Stems)	1.46	7.18

Note: The table displays summary statistics for foreign and domestic firms based on the administrative transaction-level data of Ethiopian flower exports.

We focus on roses, which account for 88% of production and hence exports. We exclude flower traders as they account for a relatively tiny share of exports (<1%) and we lack information on the location of producers where they source flowers; furthermore traders rarely export to the auctions. As our study focus is on relationship building, we exclude shipments of vertically integrated firms to their parent company. In total, we have 75 flower producers.

To complement these records, we obtained access to two firm surveys conducted near the onset of the industry in 2008 and 2010. To ensure consistency and trace the same firms over time despite company name changes, we engaged with the sector through mini-surveys between 2012 and 2022 to track the industry's ownership structure. Additional descriptive information

[9] Transaction-level data recording ceased after July 2019. From this point onward, data is aggregated at the buyer-seller-month level, making it unsuitable for transaction-level analysis.

was gathered through unstructured interviews with policymakers, CEOs of the horticulture and producer associations, and managing directors of prominent flower producers.

Cut-flowers and Contracting. From the perspective of testing ideas about relational contracts, the cut-flower export market offers several advantages. Relational contracts exist alongside a well-functioning spot market, the Flower Auction in Holland, which makes it possible to measure temptations to deviate. Trade in flowers, a fragile and perishable product, has the innate feature of potentially leaving trading parties on both sides of the exchange exposed to opportunism. The seller might not export flowers "reliably " and/or the buyer could claim that flowers did not arrive in the "promised condition" and withhold payment, while the seller could always claim otherwise. It would be difficult for an outside entity to adjudicate in such cases. The problem is amplified by the fact that it is also cross-border trade. Thus, producers do not write complete contracts with their buyers, and even if better bilateral contracts could be written they would not be easily enforceable. Therefore, trade in flowers offers the scope for transactions to occur through informal contracts: self-enforcing agreements such as a relational contract.

Consequently, flowers are exported through two market channels: the Flower Auction in the Netherlands and direct long-term relationships with global buyers. These distribution channels have similar transportation logistics and phytosanitary certifications but differ in terms of contractual arrangements and, crucially for us, in the role of task clarity between the exporter and global buyer. First, on contractual arrangements, the Flower Auction provides institutional support: flowers are inspected and graded, buyers bid for flowers, delivery is guaranteed, and payments are enforced (buyers must have an account at the auction with funds prior to bidding) before flowers are transferred to buyers. However there is no obligation to ship particular volumes/qualities to the auction. Using the Flower Auctions incurs higher transport costs (the shipment travels a substantial distance to the Netherlands), various handling fees, and prevents buyers and sellers from agreeing on long-term plans.

Direct trade with global buyers, on the other hand, bypasses these costs and constraints but exposes parties to short-run vulnerability and contracting malfunctions. Typically, producers and their global buyers negotiate a plan at the beginning of the harvest season for the upcoming season based largely on some target volume, also leaving room for some headroom to be managed as circumstances evolve. Prices in these negotiations are settled at some constant price with their main buyer throughout the year but some have prices changing twice or thrice a year, usually through a catalog. Prices are not referenced on quality or on benchmark tracking prices at the auctions. Moreover, our interviews with several producers and the flower association reveals that contracts do not contain any exclusivity clause.

Cut-flowers and the Role of Clarity. To sell at the auction, growers must meet specific standards set by the Dutch Flower Auctions Association in agreement with growers and traders. These specific requirements pertain to quality, size, packaging, and product information. Roses are traded in three quality groups, exporters (i.e. growers) are responsible for the grading and the reliability of the information that they provide with their lot at the flower auction.[10] Let us turn to packaging. To sell at the auction, the arrival of flowers must satisfy certain logistical requirements. Flowers must be packed in standard boxes in accordance with the EU pallet sizes to enable easy transfer to plastic buckets at the auction. The auction also requires specific flower ripeness requirements so that the vase life is at least a week while trading takes place. Moreover, the requirements at the auction rarely change, allowing the producers to learn and solve any potential information friction.

When selling to direct buyers, exporters often require bespoke preparation tailored to individual buyers' needs. The buyer specificity inherent in direct trade is non-trivial, emphasizing the importance of task clarity – an issue less critical when transacting through the auction. Sales to direct buyers do not follow *particular* pre-specified standards – requirements are buyer-specific. For instance, our interviews with those engaged with direct trade highlight that buyers can specify a particular level of ripeness, level of cut and post-harvest treatment to match their onward sales. Packaging requirements are also buyer-specific, e.g., that incorporate both different sleeves and wraps depending on the buyer's desire for a particular micro-climate, i.e., temperature and humidity while the flower is in transit.

The buyer will also specify transportation volume to ensure appropriate handling and logistics at the receiving point for quick retail distribution. For instance, some direct buyers prefer "compact packaging", a rather tight wrapping of the flowers and plants in sleeves, cylinders, etc., in cardboard boxes. In contrast, other buyers dislike the method because it may damage the flowers. Depending on the type of flowers – sensitive flower heads may need to be separated by specifically designed folding cardboard pieces. But the "compact packaging" should not come at the cost of "overfilling", getting the balance correct is essential as this impacts the stacking strength of the boxes while in transit and often damages the flowers. However, the optimal balance varies across buyers and is typically not an issue when sending to the auction due to the fixed requirements.

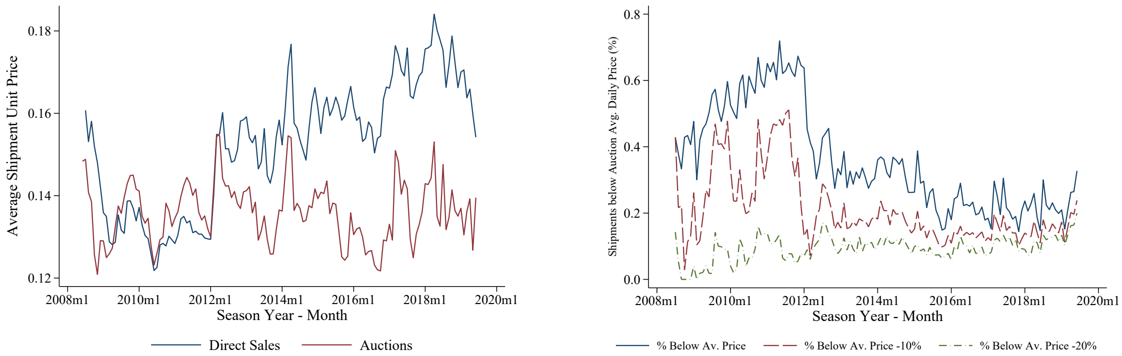
Overall, task clarity problems are prevalent in trading with direct buyers but largely irrelevant when selling to the auction. The consistency at the auction allows the sellers to resolve any clarity problem that may arise in their first shipments. However, when selling to direct buyers, solving the clarity problem with one buyer does not help when transacting with a different buyer because each buyer has *different* requirements. Hence, sellers need to solve task clarity problems *every time* they pursue a new relationship with a direct buyer.

Value of Long-term Relationships. Conceptually, direct trade can result in prices that are either higher or lower than those at auction. Auctions provide price discovery due to the potential of thick markets, while relational contracts prioritize supply assurance, which can lead to higher prices than the auction. Empirically, our data show that relationships are valuable, as

[10] A1, A2 and B1: A1 roses must meet all the minimum requirements for internal quality, freshness, freedom from parasites, damage, deficiencies, deviations, contamination, absence of leaves on the lower 10 cm of the stem, stems that are straight and sturdy enough to bear the flower, uniformity of color, thickness, sturdiness and bouquet volume, and proper packaging. Any deviations from these requirements may result in downgrading. Cut flowers that do not meet the minimum criteria for B1 are not traded. The auction monitors customers' claims for refunds to check supplier reliability. Growers receive their Quality Index (QI) over the past eight weeks which is based on the number of customer refund claims or other complaints. The QI is also shared with customers.

they pay higher than auctions on average (left side of Figure 1). However, auction prices exhibit significant fluctuations. Approximately 20% of direct shipments are sold below the daily average auction price. Additionally, 10% are sold for less than 80 cents on the dollar compared to the daily average auction price. This occurs even in months when the average auction price is lower than the average price of direct shipments (right side of Figure 1). This variation between the auction and relational contract price allows us to treat auction price changes as an exogenous shock to the outside option.

Figure 1: Average Prices in Relationships and Auctions



a) Average Shipment Unit Price in Relationships and Auctions

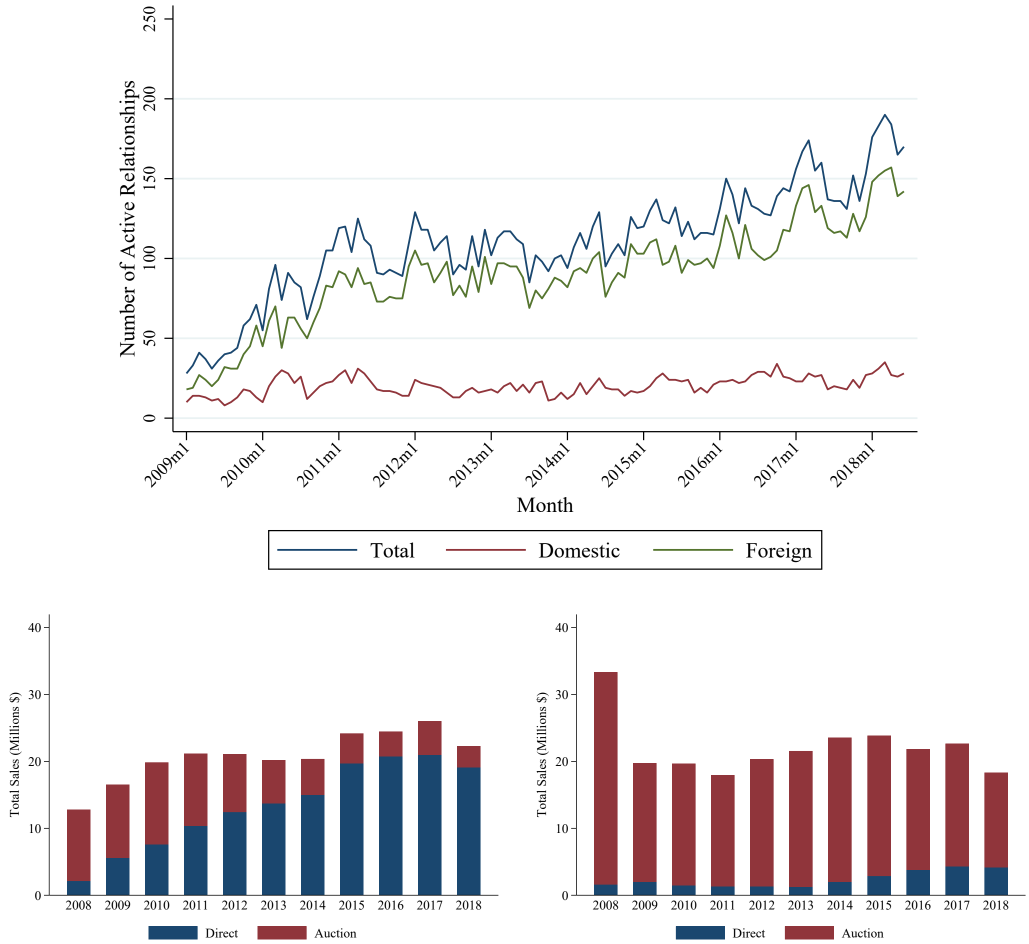
b) Share of Shipments below Auction Average Daily Price

Note: Panel (a) illustrates the monthly average shipment unit price for direct sales and auctions. All prices are USD. Panel (b) exhibits the monthly share of direct shipments sold with a unit price below the average auction price of the day.

Domestic and Foreign Producers. While domestic and foreign producers share many similar characteristics, such as total production and quality of their produce, they differ in others relevant to relational contracts; for instance, domestic firms have a lower discount factor.

First, regarding the production volume of roses, including production sold to direct buyers and auctions, Figure A.2 shows that foreign and domestic producers are similar in size. The four largest producers are two foreign and two domestic, and similarly, out of the 10 largest producers, six are domestic. An important reason why the size of operations does not significantly differ between foreign and domestic firms is that the Ethiopian government's industrial policy has also stimulated growth for domestic firms.

Recall, as highlighted earlier, that relationships are valuable, direct trade offers higher prices. Thus it is not surprising that we observe an expansion of relational trade in the industry. The number of active relationships has grown from less than 50 in 2009 to more than 150 a decade later (top graph in Figure 2). The growth of foreign firms has driven overall growth because their has been limited entry of domestic firms nor have they increased relationship formation. This increase in relational contracts has occurred due to a reallocation of shipments from the auction to direct buyers. The left-side bar chart on the bottom of Figure 2 shows that the total sales of foreign firms have not increased much since 2009. However, their share of direct sales has increased from less than half to almost the totality of foreign firms' exports. This is not the case for domestic firms, whose share of sales to direct buyers has remained constant through the same period.



Foreign Firms Domestic Firms

Figure 2: Relationships and Flower Exports

Note: The figure on top displays the number of active relationships by month. The figures on the bottom present seasonal sales splitting by direct transactions and auctions.

Table 2: Cost of Capital and Discount Factor

	External Funds Initial Year		Hardship with Credit		Share of Collateral		Interest Rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Domestic	0.529***	0.565***	0.733***	0.942***	0.973***	1.038***	9.214***	9.318***
	(0.0679)	(0.0808)	(0.117)	(0.126)	(0.164)	(0.204)	(0.497)	(0.514)
Foreign	0.325***	0.309***	0.393***	0.359***	0.521***	0.540***	8.356***	8.252***
	(0.0569)	(0.0559)	(0.0945)	(0.0814)	(0.143)	(0.167)	(0.248)	(0.244)
Difference (D-F)	0.204**	0.256**	0.340**	0.583***	0.451**	0.498*	0.858	1.066*
	(0.089)	(0.101)	(0.150)	(0.154)	(0.218)	(0.260)	(0.555)	(0.588)
Controls		Y		Y		Y		Y
Firms (N)	48	46	43	42	69	46	39	38

Note: The table displays the difference in reliance on credit, access to it, and its cost between foreign and domestic firms based on the 2008 and 2011 surveys. External funds are the share of working capital that is not from the firm's internal funds or retained earnings. Hardship with credit is a dummy that takes the value of 1 if the firm responds that access to credit and the cost of financing (e.g., interest rates) are a major or very severe obstacle to the operation or growth of the business. Share of collateral is the value of the collateral required as a percentage of the firm's loan value. Interest rate is the marginal interest rate of the firm, the maximum interest rate that the firm pays in short or long-term liabilities that can be domestic or foreign. Columns 2, 4, 6, and 8 incorporate controls. Control variables include the first three principal components (PCs) derived from a PCA conducted on the following variables from 2008 Survey: total owned land (ha), land covered by flowers (ha), land covered by greenhouses for flowers (ha), land covered by roses (ha), distance from the farm to the airport (km), weekly number of flower stems delivered to the airport , total number of workers, full-time employees, number of production workers in 2007, and joint venture status. External funds, hardship with credit and interest rate variables are from the 2008 survey (not asked in 2011 survey), while the share of collateral is the average of the firm's response in 2008 and 2011. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level.

Second, domestic firms have a lower discount factor (i.e., they have a higher willingness to pay for accessing cash earlier rather than later) because they are more cash- and credit-constrained. Using the firm-level surveys, we observe this lower discount factor in domestic firms relying more on external funds, experiencing more hardships in funding their operations, having to post higher collateral values, and paying higher interest rates. Table 2 shows that while foreign firms only fund 32% of their operations with external funds in the first year, domestic firms' external funds amount to more than 50% of their working capital.

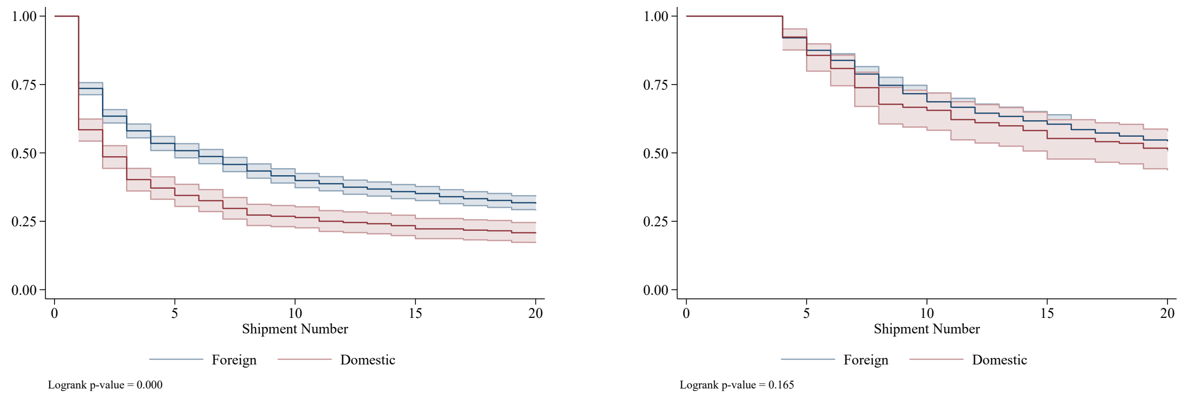
The Ethiopian Development Bank funds account for most of this excess external working capital, funding 20pp more of the working capital of domestic firms than foreign ones. However, almost 75% of domestic firms respond that access to credit and the cost of financing (e.g., interest rates) are major or very severe obstacles to the operation or growth of their business, almost twice as likely as foreign firms to face these obstacles. Domestic firms also have to post collateral almost twice as large as foreign firms for their loans, reaching an average collateral of 97% of the loan value. Moreover, domestic firms pay one percentage point (10%) higher interest rates.

Consistent with clarity being an important component in relationship building in this context, Figure 3 shows that relationships are more likely to fail in early transactions. In particular, only around 50% of relationships make it past the third shipment. Moreover, the issue of clarity is more severe for domestic firms. While almost 30% of foreign relationships do not make it past the first shipment, this share increases to almost 50% for domestic firms. Even though domestic firms are significantly worse at making it past the third shipment in the relationship, they are as likely to retain the relationship as foreign firms after passing the third shipment.

A potential concern is *different quality* of flowers being supplied by domestic and foreigners. Roses can be divided into three segments based on stem length and bud size: sweethearts, intermediates, and T-hybrids. Customs transactions do not record these actual exported varieties. However, industry practitioners typically point to using unit stem weight as a suitable proxy for quality, as heavier heads are typically higher quality and valued more (an approach also justified in Macchiavello and Morjaria, 2015). We investigate along these lines in Table A.2 and show that domestic firms do not have lower quality measured by the unit stem weight of the flowers — the standard measure of quality in the industry.

5 Estimation

The preceding section illustrated the suitability of the Ethiopian floriculture industry for studying relational contracts and especially the role of task clarity. This section connects the theoretical framework with the data, underscoring the model's key components and predictions. First, we study the task clarity problem. While the credibility problem should be present throughout the relationship and, therefore, be independent of the number of transactions between the buyer and seller, the task clarity problem arises and is resolved in early iterations. Our estimates reveal that the probability of a relationship terminating remains constant beyond the fourth shipment, which is consistent with the credibility problem being independent of the number of transactions so far. However, in line with the significant role of task clarity in relational contracts, the probability of relationships ending within the first four shipments is, on average,



$T > 0$ $\qquad$ $T > 3$

Figure 3: When Do Relationships Fail?

Note: The figures present the estimated Kaplan–Meier failure function for foreign and domestic sellers. The figure on the left includes all relationships, and the figure on the right includes all relationships that have passed the third shipment.

14 percentage points higher than later on. Furthermore, we find that domestic firms face a significantly greater clarity problem.

Subsequently, we test a unique prediction of our model: *higher clarity leads to lower credibility*. In the standard relational contract framework, a lower discount factor increases the likelihood of the agent reneging on the relational contract in response to improvements in the outside option. These frameworks would predict in our context that domestic firms are more likely to shirk in response to increases in the auction price because they have a lower discount factor. However, this prediction may not hold in our framework because domestic firms also have lower task clarity, which leads to higher credibility. In particular, the discount factor, δ, and task clarity, λ, are positively correlated. Domestic firms may be less likely to shirk as a response to improvements in the outside option if the effect of lower clarity outweighs the effect of a lower discount factor on credibility. We find that domestic firms, characterized by lower clarity, have higher credibility; i.e., they are less likely to shirk in their relationships in response to improvements in their outside option. Thereby demonstrating higher credibility despite having a lower discount factor.

We then dissect the task clarity problem. We decompose the task clarity parameter into three components: i) seller (λ_s), ii) buyer (λ_b), and iii) match ($\lambda_{b,s}$). The seller component is the seller's ability to choose productive actions, which varies across sellers due to differences in screening ability, managerial practices, capability to understand buyer's requirements, and communications skills, among others.[11] The buyer component is a measure of the selectivity of the buyer—e.g., the share of actions of sellers that would be productive. Finally, the match component captures the idiosyncratic part of a buyer-seller pair.

We employ an AKM model to ascertain the buyer and seller's contribution to the success of a relationship (Abowd, Kramarz and Margolis (1999), henceforth AKM). We demonstrate that both components are crucial to the success of a relationship. Moreover, the AKM framework provides an estimate of the seller component for each buyer and seller, allowing us to test

[11]This is a constant in our model because we do not have more than one seller.

whether domestic firms have a lower clarity due to the buyer or the seller component or both. We find that domestic firms have a lower seller component of clarity, but their buyers do not have a statistically different buyer component. Can the difference in the seller component explain the differences in task clarity and credibility between foreign and domestic firms?

We start by testing whether task clarity issues persist after controlling for the buyer component using buyer-fixed effects. Consistent with the buyer component explaining a significant fraction of the variance in the probability of a relationship becoming productive, we find that controlling for the buyer alleviates most of the observed task clarity problems. For example, the difference in the probability of a relationship ending within the first four periods compared to later periods declines by up to 80%, and it becomes negligible for foreign firms. However, the clarity gap between foreign and domestic firms persists, suggesting that domestic firms face more challenges in establishing relational contracts due to their inferior ability to select productive actions.

We then turn to the relationship between the seller component of task clarity and credibility. We show that exporters with a higher seller component of clarity have lower credibility: one standard deviation higher task clarity leads to doubling the probability of the seller ending at least one relationship in response to improvements in the outside option. The final segments of this section assess the relationship between the buyer and seller components of task clarity and the firm's overall success in establishing and sustaining relational contracts. We find that sellers who are proficient in selecting productive actions for the buyer (higher λ_s) and those facing better buyers (higher λ_b) sell a larger share of their exports in direct transactions.

5.1 The Task Clarity Problem

The issue of task clarity in relational contracts pertains to whether the agent knows which of her actions will be productive to the principal. While the credibility problem (keeping promises) persists throughout the relationship due to shocks to the outside option, task clarity issues primarily exist only early on, as repeated interactions within a stable environment tend to resolve these concerns.

The first testable prediction is that if task clarity issues exist, relationships are more likely to end during early shipments. This occurs because the shock required to end a productive relationship (s^* in equation 3) is larger than the shock required to end a relationship that has not yet resolved the clarity problem (s_t^* in equation 4). In other words, a relationship that has resolved the task clarity problem is more valuable for the seller; hence, the seller is less likely to terminate it.

Furthermore, the second testable prediction is that once clarity problems have been resolved, the probability of a relationship ending at any shipment should be constant. This occurs because the shock required to end a productive relationship (s^* in equation 3) is constant, therefore the probability of a shock realization larger than s^* that will lead to the relationship ending is also constant. This prediction distinguishes our model from one with continuous learning. With learning, the probability of relationship termination decreases monotonically. In contrast, in our framework, the probability of relationship terminating becomes constant after task clarity issues are resolved.

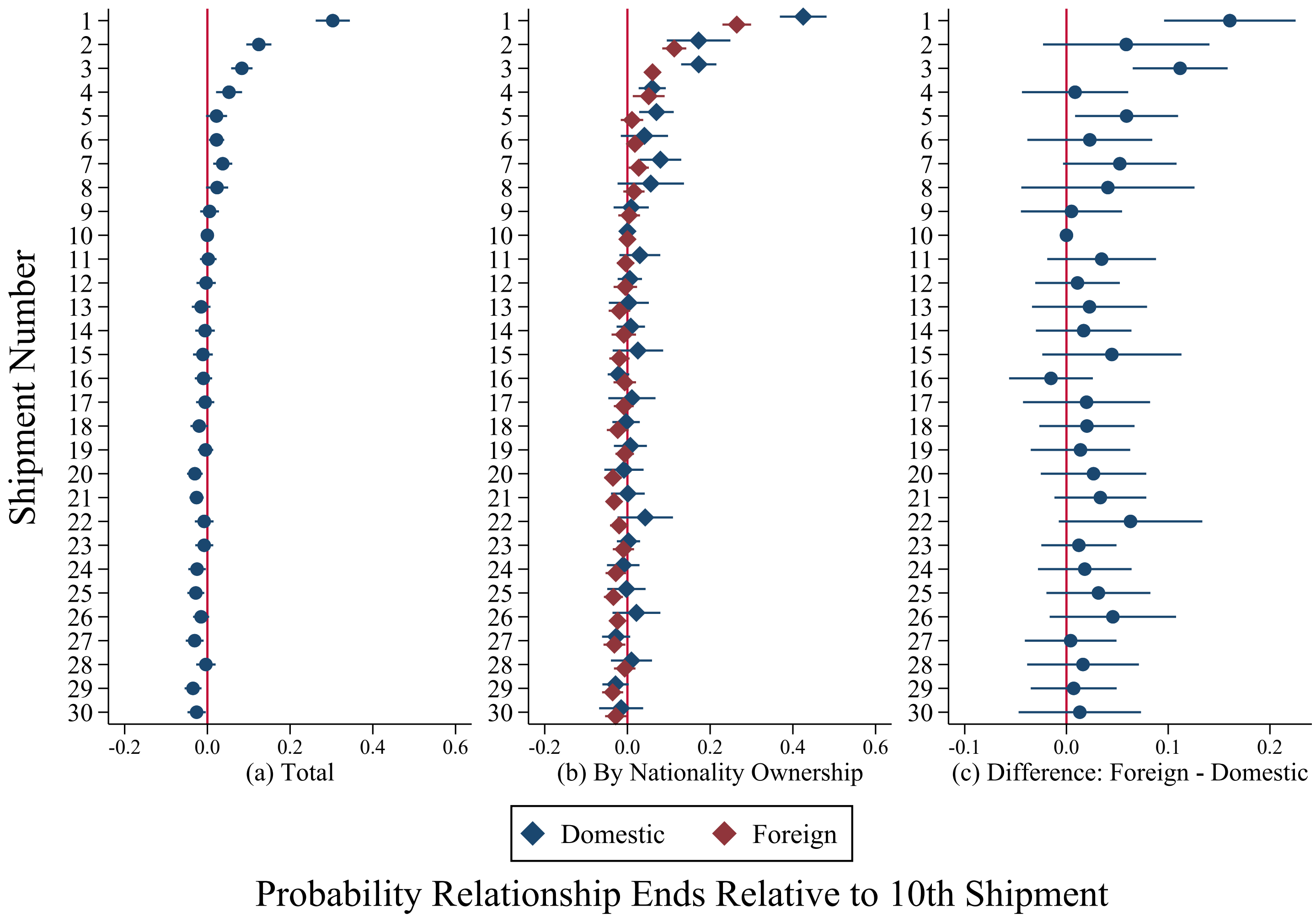


Figure 4: Clarity Issues in Ethiopian Flower Exports

Note: Panel (a) presents the $\hat{\beta}_{1,i}$ estimates of equation 7. Panel (b) displays the estimates of equation 8 for domestic ($\hat{\beta}_{1,i}$) and foreign ($\hat{\beta}_{1,i} + \hat{\beta}_{2,i}$) firms. Panel (c) includes the estimate for the differences between foreign and domestic firms ($\hat{\beta}_{2,i}$). Standard errors are two-way clustered at the exporter and buyer levels. All coefficients are displayed with their 95% confidence interval.

We evaluate these predictions by comparing the likelihood of a relationship between seller s and buyer b terminating at shipment h relative to the 10th shipment, as per equation 7. The estimation incorporates year x month-fixed effects (ζ_t) to account for industry-wide shocks and seller fixed effects (ϕ_s) to ensure that the β_i's reflect within-firm variations in the probability of relationship termination rather than across-firm differences in clarity or credibility.

$$\mathbb{1}[Relationship\ End]_{s,b,h} = \sum_{i=1,i\neq 10}^{30} \beta_i \mathbb{1}[h=i]_{s,b,h} + \phi_s + \zeta_t + \epsilon_{s,b,h} \tag{7}$$

Additionally, we estimate equation 8 to examine whether this within-firm task clarity issue is more pronounced for domestic firms by interacting the shipment dummies with a variable, D_s, indicating whether seller s is a domestic firm.

$$\begin{aligned}\mathbb{1}[Relationship\ End]_{s,b,h} = &\sum_{i=1,i\neq 10}^{30} (\beta_{1,i}\mathbb{1}[h=i]_{s,b,h} + \beta_{2,i}\mathbb{1}[h=i]_{s,b,h} \times D_s) \\ &+ \phi_s + \zeta_t + \nu_{s,b,h}\end{aligned} \tag{8}$$

The left graph in Figure 4 demonstrates that, in line with the relevance of task clarity in the industry, firms are more likely to terminate their relationships during early shipments than later ones (first testable prediction of this section). Specifically, the likelihood of a relationship terminating within the first 3-4 shipments is significantly higher than in subsequent ones. Moreover, the estimates align with the resolution of task clarity issues beyond the fourth shipment and the relative independence of credibility issues and the shipment number beyond this point (the second testable prediction of this section). Relative to the 10th shipment, the likelihood of relationship failure within the first four shipments is, on average, 14 percentage points higher. However, for shipments 5 to 9 and 11 to 30, the likelihood of relationship termination is, on average, 0.08 percentage points lower.

The middle graph indicates that task clarity issues affect both foreign and domestic firms, but are more severe for domestic firms. The graph on the right reveals that the likelihood of a relationship ending in the first shipment is 16 pp higher for domestic than for foreign firms. Cumulatively, in the first three shipments, the likelihood of a relationship terminating for domestic firms is 33 pp higher than for foreign firms.

5.2 The Relationship between Task Clarity and Credibility

The conventional concept of credibility in relational contracting pertains to the likelihood of an agent honoring their commitments (Gibbons and Henderson, 2012), and in a setting with no task clarity considerations, the likelihood of an agent defecting increases with the quality of the outside option and decreases with the continuation payoff of the current relationship (see Section 3.2 Benchmark with no clarity problems). In our empirical context, the value of the outside option increases with the auction price, which fluctuates over time but remains constant across firms. However, the continuation payoff may exhibit substantial variations across firms due to differences in the discount factor. Specifically, domestic firms, which have a lower discount factor,[12] should be more likely to terminate a relationship in response to an improvement in the outside option.

However, this may not hold true in our model, because domestic firms also exhibit lower task clarity. Therefore, their response to improvements in the outside option, in a framework that considers clarity, is ex ante ambiguous. On one hand, the standard comparative static remains valid: firms with lower discount factors are more likely to defect when the outside option improves. On the other hand, firms with lower task clarity are less likely to defect when the outside option improves, as they consider the difficulty of initiating a new relationship.

A novel contribution of the model is that the credibility inequality is not solely a function of the outside option, discount factor, and continuation payoff within the relationship but also of the task clarity parameter λ_s. Specifically, Fact 2 in the model is that firms with higher λ_s, which facilitate the initiation of new productive relationships and increase W_0, are more likely to shirk in existing relationships.

To test whether improvements in the outside option impact relationship termination, we estimate the effect of the price spread (average price at auctions relative to the average price paid by direct buyers) in month t on the number of relationships that concluded for seller s in month t. This estimation strategy capitalizes on Ethiopian producers being price takers because of their small size relative to global flower production. Consequently, the timing and size of fluctuations in auction prices are exogenous to Ethiopian producers.

We identify a relationship ending as the last transaction between the buyer and the seller. While these terminations could be attributed to either party, our analysis primarily attributes them to the seller, which aligns with incentive compatibility: when the auction price is high, the seller has a higher incentive to renege in its relationship, while the buyer has a lower incentive to do so. Consequently, it is plausible to attribute the rise in relationship terminations to sellers during periods when sellers have a heightened incentive to shirk and buyers have a diminished incentive to do so.

We employ the following equation to estimate the responses of foreign and domestic firms to improvements in the outside option and the difference between these responses:

$$Y_{s,t} = \beta_0 + \beta_1 Price\ Spread_t + \beta_2 D_s + \beta_3 Price\ Spread_t \times D_s + \beta_4 X_{s,t} + \epsilon_{s,t} \tag{9}$$

where the dependent variable, $Y_{s,t}$, is either the number of relationships of seller s that ended in month t, or the seller ended at least one relationship that month. The independent variables are the average monthly price difference between roses sold at auctions and those sold directly to buyers (price spread), an indicator of whether the firm is domestic, and the interaction of these two variables. Our controls, $X_{s,t}$, include the number of active relationships in every specification and the share of shipments to direct buyers in half of them.

In response to a one standard deviation increase in the average monthly price spread between auctions and direct relationships, the number of relationships that foreign sellers terminate escalates by .04 (16%) and the probability of them terminating at least one relationship increases by .024pp (14%) (Table 3). Despite possessing a lower discount factor, domestic firms exhibit less defection in their relationships when the outside option improves to the extent that the

[12] Refer to Table 2.

Table 3: Outside Option and Maintaining Relationships

Dependent Variable:	# Ending Relationships		I[At Least One]	
	(1)	(2)	(3)	(4)
Price Spread (Std)	0.0411**	0.0353**	0.0240**	0.0272**
	(0.017)	(0.015)	(0.010)	(0.010)
I[Domestic]	0.0567**	0.0281	0.0010	0.0167
	(0.027)	(0.031)	(0.018)	(0.020)
Price Spread (Std) x I[Domestic]	-0.0427**	-0.0372**	-0.0351***	-0.0382***
	(0.019)	(0.017)	(0.012)	(0.013)
Mean Dep. Var	0.246	0.246	0.169	0.169
Observations	4210	4210	4210	4210
Control # Active Relantionships	Y	Y	Y	Y
Control % in Direct Transactions		Y		Y

Note: The table displays the estimation of equation 9 using OLS. In Columns 1 and 2, the outcome is the number of relationships that ended in the month while in Columns 3 and 4, it is a dummy that equals one if the seller had at least one relationship that ended in the month. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively.

effects observed for foreign firms dissipate. In our model, this outcome arises because domestic firms, due to their lower task clarity, have a lower incentive to shirk in their relationship because it is harder for them to form new ones, and this effect outweighs the effect of the lower discount factor that increases their incentive to defect.

5.3 Decomposing the Task Clarity Problem

The goal of this section is to understand and estimate the relative significance of the components of task clarity (λ). We decompose this parameter onto three components: i) seller (λ_s), ii) buyer (λ_b), and iii) match ($\lambda_{b,s}$). The seller component is the seller's ability to choose productive actions, which varies across sellers due to differences in screening ability, managerial practices, capability to understand buyer's requirements, and communications skills, among others.[13] The buyer component is a measure of the selectivity of the buyer, for example, the share of actions of sellers that would be productive. Finally, the match component captures the idiosyncratic component of how well a buyer-seller pair may interact; for example, the managers know each other or are alumni of the same school.

We choose to parameterize the relationship between lambda and its components in a form that allows for a convenient estimation using standard econometric tools. In particular, we assume the following functional form:

$$\lambda(\lambda_s, \lambda_b, \lambda_{s,b}) = \frac{1}{1 + e^{-(\lambda_s + \lambda_b + \lambda_{s,b})}}$$

Then, dividing by $1 - \lambda$ both sides of the equation and taking logs, we obtain the following linear relationship:

[13]This is a constant in our model because we do not have more than one seller.

$$Z = log(\frac{\lambda}{1-\lambda}) = \lambda_s + \lambda_b + \lambda_{s,b}$$

We replace each term with their empirical counterparts to estimate the parameters. The buyer and seller components (λ_s and λ_b) are the seller and buyer fixed effects. The idiosyncratic component of the match, $\lambda_{s,b}$, is our error term. And finally, since λ, and hence, Z, are non-observable, we replace Z with an empirical counterpart that is highly correlated with task clarity, whether a buyer and seller pair reached a productive relationship, i.e., reached the fourth shipment.[14] Our estimating equation becomes:

$$\mathbb{1}[Productive]_{s,b} = \lambda_s + \lambda_b + \lambda_{s,b} \tag{10}$$

In summary, we decompose task clarity into its buyer and seller components using a two-way fixed effect regression with fixed effects for buyers and sellers. This methodology is analogous to the one introduced by Abowd, Kramarz and Margolis (1999) (AKM model) to decompose wages by employer and employee components. This framework has been extensively used in the labor literature (e.g., Song et al. (2019); Card, Heining and Kline (2013)). However, Kline, Saggio and Sølvsten (2020) shows that the ordinary least squares estimation of the two-way fixed effects model may lead to bias involving a linear combination of the unknown observation-specific variances. Hence, we follow their recommended approach and estimate the model using the leave-one-out connected set sample, which comprises buyer-seller pairs that remain connected after the removal of any given buyer or seller.

After estimating the buyer and seller components using the AKM framework, we incorporate them as explanatory variables in equation 11. This allows us to estimate the impact of buyer and seller components of clarity on the likelihood of reaching a productive relationship and the fraction of the variance that each of them explains.

$$\mathbb{1}[Productive]_{s,b} = \beta_0 + \beta_1\hat{\lambda_s} + \beta_2\hat{\lambda_b} + \varepsilon_{s,b} \tag{11}$$

Higher seller and buyer components increase the likelihood of reaching a productive relationship (Table 4). This holds true across the four specifications that vary on the minimum number of shipments between a buyer and a seller to consider a relationship productive. Our preferred specification is in Column 2, reaching at least four shipments, because based on the findings of Figure 4, on average, task clarity issues are resolved by the fourth shipment. In our preferred specification, a one standard deviation increase in the seller component corresponds to a 21.4 percentage point (pp) rise in the probability of reaching a productive relationship. Similarly, a one standard deviation increase in the buyer component results in a 29 pp increase in the probability of reaching a productive relationship.

The analysis of variance (ANOVA) presented in Table 4 reveals that the buyer's component accounts for almost 32% of the variance in the probability of a relationship becoming productive, while the seller's component explains 16%. These estimates underscore the importance of

[14] We chose this definition of productive based on the findings of Figure 4 where, on average, clarity issues are resolved by the fourth shipment. Our results are robust to alternative definitions of productive relationships based on reaching the third, fifth, or sixth shipment.

Table 4: Productive Relationships and Task Clarity Components (λ_s, λ_b)

	(1)		(2)		(3)		(4)	
Productive:	Reach 3 Shipments		Reach 4 Shipments		Reach 5 Shipments		Reach 6 Shipments	
	OLS	ANOVA	OLS	ANOVA	OLS	ANOVA	OLS	ANOVA
Exporter (λ_s)	0.216***	19.05%	0.214***	16.32%	0.231***	18.61%	0.229***	20.13%
	(0.019)		(0.016)		(0.017)		(0.014)	
Buyer (λ_b)	0.277***	27.20%	0.290***	31.94%	0.279***	29.14%	0.275***	28.76%
	(0.017)		(0.017)		(0.017)		(0.014)	
Mean Dep. Var	0.527		0.458		0.411		0.385	
Observations	1378		1378		1378		1378	

Note: The table presents the OLS estimates of equation 11 and the corresponding ANOVA decomposition. Standard errors in parentheses are clustered at the exporter level. The stars *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively. Observations are weighted to give each exporter the same weight.

both buyer's and seller's components of clarity in determining the probability of a relationship reaching its productive phase, with the buyer type having a more substantial explanatory power.

5.4 Domestic Firms and Task Clarity Components

The preceding section, in line with our model derivation, demonstrated that the heightened task clarity issues faced by domestic firms could be attributed to two components: the firm's ability to select the productive action (λ_s) and the selectivity of their buyers (λ_b). This section delves into the questions of whether domestic and foreign firms have different λ_s and λ_b and whether these differences are consistent with their differences regarding clarity and credibility.

We test for differences between foreign and domestic firms in the clarity components (λ_s or λ_b) using the following estimating equation at the buyer-seller pair level:

$$Clarity\ Component_{s,b} = \beta_0 + \beta_1 Domestic_s + \nu_{s,b} \tag{12}$$

Table 5: Clarity Components and Domestic Firms

Dependant Variable:	Exporter (λ_s)				Buyer (λ_b)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
[I]Domestic	-0.512*	-0.845***	-0.676***	-0.701***	0.064	0.029	-0.002	0.019
	(0.282)	(0.231)	(0.230)	(0.244)	(0.134)	(0.129)	(0.131)	(0.129)
Productive reach Ship.	3	4	5	6	3	4	5	6
Mean Dep. Var	-0.470	-0.408	-0.324	-0.364	0.076	0.051	0.042	0.052
Observations	2082	2082	2082	2082	1378	1378	1378	1378

Note: The table presents the OLS estimates of equation 12. The dependent variable is the standardized and winsorized exporter component (columns 1-4) and buyer component (columns 5-8). Differences across columns arise from the definition of productive relationship, i.e., the number of shipments required to consider a relationship productive. Standard errors presented in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively. Observations are weighted to give each exporter the same weight.

Our estimates indicate that the main driver of the differences in task clarity between foreign and domestic firms is that domestic firms have a lower λ_s; they are less effective at choosing productive actions for buyers. Table 5 presents the estimates of equation 12 using four alternative definitions of reaching a productive relationship in the estimation of the buyer and seller components with the AKM framework.[15] The estimates' magnitudes are consistent across the specifications. Domestic firms have approximately a half standard deviation lower λ_s, and there is no statistically significant difference in the type of buyers they face.

Our AKM estimates highlighted that the buyer component is crucial to the task clarity problem. However, the evidence suggests that domestic firms do not deal with significantly lower-quality buyers. Hence, the expectation is that controlling for the buyer component should decreases the severity of the clarity problem, but the difference in clarity between foreign and domestic firms should persist because domestic firms have lower λ_s. To test these predictions, we re-estimated equation 7 including buyer fixed effects to control for the buyer component.

Consistent with our framework, our ANOVA estimates, and the estimates of the differences in the clarity components between foreign and domestic firms, we find that controlling for buyer quality significantly reduces the clarity problems but does not eliminate the differences in clarity between foreign and domestic firms. The left-hand side graph in Figure 5 illustrates that controlling for variation across buyers significantly reduces the clarity problem in the industry. The cumulative probability of a relationship ending within the first three shipments decreases by 76% overall, 53% for domestic firms and 86% for foreign firms.

However, the differences in task clarity between foreign and domestic firms persist. On average, the probability of a domestic firm failing within the first three shipments is 12% higher than for the tenth shipment. For foreign firms, this probability is 2%. Consequently, the disparity between foreign and domestic firms remains, averaging 10 pp for the first three shipments. Hence, differences in the seller component of clarity are the primary driver of differences in task clarity between foreign and domestic firms.

Based on our model, differences in task clarity will lead to disparities in credibility. Can differences across sellers in these clarity components explain differences in their credibility? To answer this question, we test whether λ_s and λ_b affect sellers' credibility, i.e., the likelihood of the seller ending the relationship as a response to improvements in the outside option.

Getting a measure of the seller component to test whether it affects credibility is straightforward because we use our seller-specific estimate from the AKM model. However, getting a buyer component at the seller level is more complicated. A natural approach is to average the estimated buyer component from all the buyers the seller has interacted with so far. However, whether this measure should affect credibility depends on the assumptions on the sellers' beliefs about the distribution of buyers that they face. In the model, higher expected clarity has a negative effect on credibility, but previous realizations of clarity do not. Then, only if previous buyers affect the seller's beliefs about the distribution of future buyers will the history of buyers also affect credibility. On the other hand, if the realizations of λ or previous buyers do not affect the beliefs about the expected λ, as we assume in the model, this measure of the buyer component will not affect credibility because it is a measure of the realization of λ and not of its expectation.

[15] The alternative definitions are after reaching the 3rd, 4th, 5th, or 6th shipment,

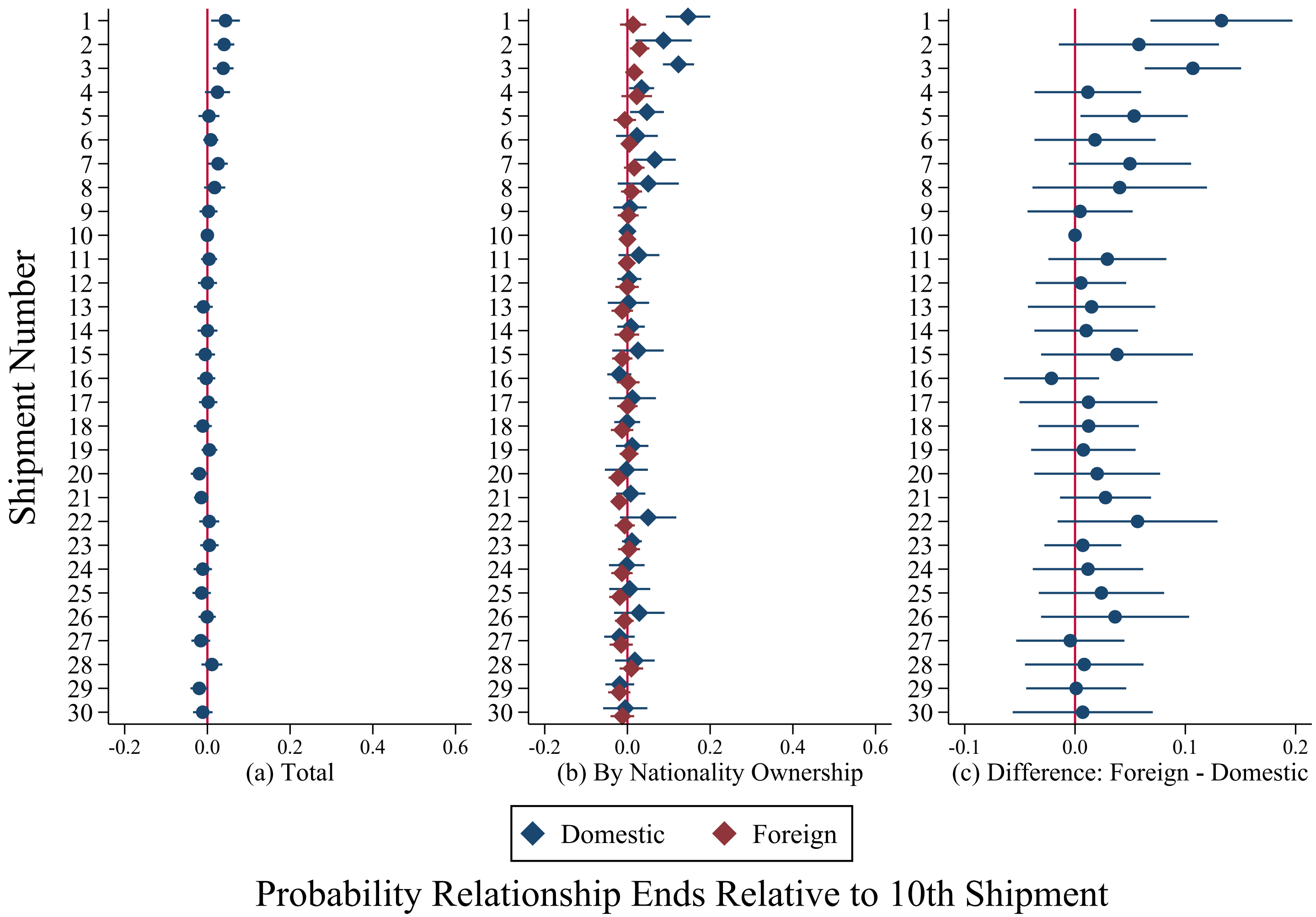


Figure 5: Clarity Issues in Ethiopian Flower Exports Controlling with Buyer Fixed Effects

Note: Panel (a) presents the $\hat{\beta}_{1,i}$ estimates of equation 7, including exporter fixed effects. Panel (b) displays the estimates of equation 8 for domestic ($\hat{\beta}_{1,i}$) and foreign ($\hat{\beta}_{1,i} + \hat{\beta}_{2,i}$) firms including exporter fixed effects. Panel (c) includes the estimate for the differences between foreign and domestic firms ($\hat{\beta}_{2,i}$). Standard errors are two-way clustered at the exporter and buyer levels. All coefficients are displayed with their 95% confidence interval.

The following is the estimating equation, where the dependent variable, $Y_{s,t}$, is either the number of relationships of seller s that ended in month t, whether the seller ended at least one relationship that month, or the share of relationships that the seller terminated that month. The component of clarity used in the estimation is λ_j. When estimating the effect of the seller component, we use $\hat{\lambda_s}$ estimated using the AKM framework, and when estimating the effect of the buyer component, we use the average of the buyers' component, $\hat{\lambda_b}$, that the seller interacted with until last month. The set of controls, $\kappa_{s,t}$, vary across specifications and include the number of active relationships, an indicator for whether the seller is foreign or domestic, and seller fixed effects.

$$Y_{s,t} = \beta_0 + \beta_1 Price\ Spread_t + \beta_2\lambda_j + \beta_3 Price\ Spread_t \times \lambda_j + \beta_4\kappa_{s,t} + \epsilon_{s,t} \tag{13}$$

Table 6: Clarity Components and Ending Relationships

Dependent Variable:	# Ending Relationships				I[At Least One]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price Spread (Std)	0.0216**	0.0191*	0.0195*	0.0213*	0.0145*	0.0153*	0.0156*	0.0135*
	(0.011)	(0.010)	(0.010)	(0.012)	(0.008)	(0.008)	(0.008)	(0.007)
Seller (λ_s)	-0.0340	-0.0288	-0.0253		-0.0072	-0.0089	-0.0062	
	(0.022)	(0.021)	(0.023)		(0.011)	(0.011)	(0.011)	
Price Spread (Std) x Seller (λ_s)	0.0173**	0.0173**	0.0187**	0.0228**	0.0152**	0.0152**	0.0164**	0.0167***
	(0.008)	(0.008)	(0.007)	(0.009)	(0.007)	(0.007)	(0.007)	(0.006)
Mean Dep. Var	0.228	0.228	0.228	0.228	0.167	0.167	0.167	0.167
Observations	3723	3723	3723	3723	3723	3723	3723	3723
Control # Active Relationships	Y	Y	Y	Y	Y	Y	Y	Y
Control % in Direct		Y	Y	Y		Y	Y	Y
Control Domestic			Y				Y	
Exporter FE				Y				Y

Note: The table displays the estimation of equations 13 using OLS. The sample includes all productive relationships (survived past the third shipment). Price Spread is calculated as the standardized difference between the average price at auctions and the average price in direct sales. A relationship ends if no more shipments are observed between a buyer and a seller or if there are more than nine months between two shipments. Columns 1-4 outcome is the number of relationships ending while in Columns 5-8 the outcomes denote a dummy that equals 1 if the seller had at least one relationship ending and zero otherwise. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level, respectively.

As predicted by our model, task clarity affects credibility, and differences in the clarity components lead to differences in credibility. In particular, sellers with a higher seller component of clarity are less likely to keep their promises when the outside option improves. A one standard deviation increase in the price spread between auctions and direct relationships leads to an increase in the number of relationships that end by 0.0216 (9%) for sellers with average λ_s (Table A.4). However, for sellers with one standard deviation higher λ_s, the effect is 0.039 (17%), an increase of 0.0173 for each standard deviation of λ_s. The estimates are robust to include controls for the number of active relationships, the share of production in direct relationships, whether the seller is foreign or domestic and seller fixed effect.

On the other hand, there is no statistically significant relationship between the history of buyers—our measure of the buyer component of clarity at the seller level—and credibility (Table A.5). This would occur if the history of buyers did not affect the sellers' beliefs about the distribution of buyers, which is what we assume in our model. There are many reasons why sellers would not update their beliefs about the distribution of buyers based on the buyers they have faced so far. A first example of why this may happen is that when the relationship does not work, this may indicate that the buyer's component was low or that the match component was low, so it is harder to update when part of the problem may be due to the unobservable quality of the match. Another possible reason is that since the sellers face relatively few buyers, the history of buyers provides very little information about the buyer's distribution. Alternatively, sellers may believe there is regression to the mean in the type of buyers they face, so even if they have faced a couple of good buyers, they do not change their beliefs about the distribution.

5.5 Clarity Components and Relational Contracts

The preceding section underscored the significance of task clarity components in explaining differences in clarity and credibility across firms. This section delves into understanding the empirical relationship between task clarity and selling in relational contracts. In our framework, the effect of clarity on a seller's share of direct sales is ambiguous. On the one hand, firms with higher clarity are more likely to reach a productive relationship (direct effect). However, because higher clarity leads to lower credibility, they are also more likely to end these relationships when the price at the auction becomes more favorable (indirect effect). Hence, the relationship between task clarity and the share of exports to direct buyers is an empirical question because the answer relies on whether the direct effect dominates the indirect one or vice versa.

To answer this empirical question, we use the following estimating equation, where $\hat{\lambda}_s$ is the seller component of clarity, and $\overline{\hat{\lambda}}_{bs,t-1}$ denotes the average $\hat{\lambda}_b$ of buyers that seller s interacted with until last month, $t-1$. The estimation incorporates year-month fixed effects (ζ_t) to account for industry-wide shocks.

$$ShareDirectSales_{s,t} = \beta_1 \hat{\lambda}_s + \beta_2 \overline{\hat{\lambda}}_{bs,t-1} + \zeta_t + \nu_{s,t} \tag{14}$$

In the Ethiopian floriculture industry setting, we find that the direct effect dominates the indirect one. Firms with higher task clarity transact more with direct buyers. This occurs because the easiness of forming new relationships that higher clarity implies (direct effect) dominates the effect of lower credibility (indirect effect). Both task clarity components, λ_s and λ_b, are positively linked to a higher share of direct sales. Firms that are better at understanding what is required from them, those with higher λ_s, have a larger share of direct shipments. In particular, one standard deviation higher λ_s is associated with a 17 to 22 pp higher share of direct monthly sales (Table 7). A similar pattern emerges when analyzing the relationship between the buyer types that a firm faces (λ_b) and the share of its production going to direct buyers. One standard deviation higher average of buyer types so far is linked to a 16 pp larger share of direct sales. Similarly, one standard deviation higher type of buyer last month is associated with a 8 pp larger share of direct sales.

Table 7: Clarity Components and Relational Contracts

	Dependent Variable: % Direct Sales				
	(1)	(2)	(3)	(4)	(5)
Seller (λ_s)	0.177***		0.207***		0.224***
	(0.052)		(0.052)		(0.058)
Buyer (λ_b)		0.050**	0.078***	-0.011	0.159
		(0.022)	(0.020)	(0.115)	(0.098)
Buyer Measure		Last (λ_b)		Cumulative ($\bar{\lambda}_b$)	
Mean Dep. Var	0.491	0.544	0.544	0.545	0.545
Observations	4329	2582	2582	2596	2596
Month x Year FE	Y	Y	Y	Y	Y

Note: The table displays the estimation of Equation 14. Columns 2 and 3 use the last buyer that the seller faced as a measure of λ_b. Columns 4 and 5 use all the buyers the seller has interacted with so far as a measure of λ_b. Standard errors in parentheses are clustered at the seller level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 levels, respectively.

6 Concluding Remarks

We explore the role of task clarity in relational contracts in a model where, upon the matching of an agent and a principal, it is not immediately apparent which actions of the agent, if any, will be valuable to the principal. The likelihood of a productive relationship increases with clarity, which is a function of the principal and agent types. We demonstrate that task clarity influences the agent's propensity to fulfill promises, the usual notion of credibility. This is because task clarity determines the ease of replacing a relationship after defection.

We validate our model in an appropriate context using a decade of transaction data from the Ethiopian floriculture industry. In this industry, exporters obtain higher prices through direct relationships with global buyers relative to the spot market. Our empirical analysis documents: (i) Ethiopian floriculture exporters behave consistently with a relational contract framework where the price at international flower auctions functions as the outside option to direct relationships, (ii) task clarity problems are significant in the industry and larger for domestic firms, (iii) consistent with a unique prediction of our model, domestic firms, despite a lower discount factor, are less likely to defect on a productive relationship as a response to improvements in the outside option due to their lower clarity, (iv) clarity is a function of buyer and seller types, and these types have a significant effect on the share of production exporters sell in direct relationships.

Our message is subtle. Task clarity problems may be less severe with commodities because these goods are non-differentiated, traded according to standardized definitions, and benchmarked to reference prices (e.g. a barrel of oil). However, for differentiated goods, where transactions typically occur through direct relationships with global buyers, producers might struggle not due to a lack of effort or quality but because of the task clarity problems we highlight. Our paper provides an explanation for why a viable domestic exporting sector failed to emerge even a decade later in Ethiopia's floriculture industry. Supporting domestic entrepreneurs in effectively screening buyers and better understanding their needs could enable more successful direct sales.

Our findings encourage further scrutiny of contemporary industrial policy discussions (see, e.g., Juhász, Lane and Rodrik (2023)). Historically, industrial policy – state interventions to stimulate and promote selected industries – has primarily focused on "hard" supply-side support, such as providing land, long-term credit, and facilitating logistics (see, e.g., Rodrik 2004). We show that understanding demand-side factors, especially the challenges of building relationships, is important for increasing the share of exports in differentiated products (rather than commodities), which is associated with a higher GDP per capita (Rauch, 1999).

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A Omitted Proofs

Lemma 2. *Fix W_0. There exists a unique V which satisfies equation (3). This V is increasing in W_0. Furthermore the optimal cutoff shock s^* is decreasing in W_0.*

Proof. Fix V. For a fixed V, let $s^*(V) = \delta(V - W_0) + b + c$ be the shock that makes the agent indifferent between the outside option and continuing in the relationship given some V. Given a guess for V, from equation (2) we can define

$$\xi(V) = \int_{\ell}^{s^*(V)} (b + \delta V)\ \mathrm{d}F(s) + \int_{s^*(V)}^{\infty} (s + \delta W_0 - c)\ \mathrm{d}F(s).$$

We will show that ξ is a contraction. To that end, consider $\widetilde{V} > V$. We have that

$$\begin{aligned}
\xi\left(\widetilde{V}\right) - \xi(V) &= \int_{\ell}^{s^*\left(\widetilde{V}\right)} \left(b + \delta\widetilde{V}\right)\ \mathrm{d}F(s) - \int_{\ell}^{s^*(V)} (b + \delta V)\ \mathrm{d}F(s) + \int_{s^*\left(\widetilde{V}\right)}^{s^*(V)} (s + \delta W_0 - c)\ \mathrm{d}F(s) \\
&= \delta \int_{\ell}^{s^*(V)} \left(\widetilde{V} - V\right)\ \mathrm{d}F(s) + \int_{s^*(V)}^{s^*\left(\widetilde{V}\right)} \left(b + \delta\widetilde{V}\right)\ \mathrm{d}F(s) - \int_{s^*(V)}^{s^*\left(\widetilde{V}\right)} (s + \delta W_0 - c)\ \mathrm{d}F(s) \\
&= \delta F(s^*(V))\left(\widetilde{V} - V\right) + \int_{s^*(V)}^{s^*\left(\widetilde{V}\right)} \left(b + \delta\widetilde{V} - s - \delta W_0 + c\right)\ \mathrm{d}F(s) \\
&\leq \delta F(s^*(V))\left(\widetilde{V} - V\right) + \int_{s^*(V)}^{s^*\left(\widetilde{V}\right)} \left(b + \delta\widetilde{V} - s^*(V) - \delta W_0 + c\right)\ \mathrm{d}F(s) \\
&= \delta F(s^*(V))\left(\widetilde{V} - V\right) + \int_{s^*(V)}^{s^*\left(\widetilde{V}\right)} \delta\left(\widetilde{V} - V\right)\ \mathrm{d}F(s) \\
&\leq \delta F(s^*(V))\left(\widetilde{V} - V\right) + \delta\int_{s^*(V)}^{\infty} \left(\widetilde{V} - V\right)\ \mathrm{d}F(s) \\
&= \delta F(s^*(V))\left(\widetilde{V} - V\right) + \delta\left[1 - F(s^*(V))\right]\left(\widetilde{V} - V\right) \\
&= \delta\left(\widetilde{V} - V\right),
\end{aligned}$$

thus ξ is a contraction. By the Banach Fixed-Point Theorem, for each W_0 there exists a unique V, and $s^* := s^*(V)$, which satisfies the above equation.

For a fixed W_0, equation (2) implicitly defines V as follows

$$V(W_0) = \int_{\ell}^{s^*} (b + \delta V(W_0))\ \mathrm{d}F(s) + \int_{s^*}^{\infty} (s + \delta W_0 - c)\ \mathrm{d}F(s).$$

Recall that s^* is a function of V and W_0, since $s^* = \delta(V - W_0) + b + c$. Differentiating both sides with respect to W_0 we have that

$$\begin{aligned}
\frac{\mathrm{d}V}{\mathrm{d}W_0} &= \int_{\ell}^{s^*} \delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\ \mathrm{d}F(s) + \int_{s^*}^{\infty} \delta\ \mathrm{d}F(s), \text{ or} \\
\frac{\mathrm{d}V}{\mathrm{d}W_0} &= \delta F(s^*)\frac{\mathrm{d}V}{\mathrm{d}W_0} + \delta(1 - F(s^*)).
\end{aligned}$$

Here the terms involving the limits of the integrals cancel sinec the functions coincide at $s = s^*$.

Solving for $\frac{\mathrm{d}V}{\mathrm{d}W_0}$ we find

$$\frac{\mathrm{d}V}{\mathrm{d}W_0} = \delta \frac{1 - F(s^*)}{1 - \delta F(s^*)} \in [0, \delta].$$

We have that $\frac{\mathrm{d}V}{\mathrm{d}W_0} > 0$ if and only if $F(s^*) < 1$. This is intuitive since if $F(s^*) = 1$, the agent almost never breaks a productive relationship and $V = \frac{b}{1-\delta}$, which is independent of W_0. Observe further that $F(s^*) > 0$ and $\frac{\mathrm{d}V}{\mathrm{d}W_0} < \delta$, if the agent is to stay in a productive relationship with positive probability; this is necessary for (RC) to hold for any $c > 0$.

Finally, since $s^* = \delta (V - W_0) + b + c$, we have that $\frac{\mathrm{d}s^*}{\mathrm{d}W_0} = \delta \left(\frac{\mathrm{d}V}{\mathrm{d}W_0} - 1 \right) \leq \delta (\delta - 1) < 0$. $\square$

A.1 Proof of Theorem 1

Theorem. *A unique relational contracting equilibrium exists as long as (RC) holds.*

Let $T_0 : \mathbb{R} \to \mathbb{R}$ be this map that takes a guess for W_0 and maps it to another W_0. The closed form expression is not simple in general (although one can get it for special cases, e.g., if F puts probability 1 on a single point). To show that T_0 is a contraction mapping take two guesses for W_0, namely $W_0^+ > W_0^-$ and we will show that $T_0 \left(W_0^+ \right) - T_0 \left(W_0^- \right) < W_0^+ - W_0^-$. We will denote by $W_k (s_t | W_0)$, the value of $W_k (s_t)$ when starting with a particular W_0 and iterating backwards. First observe that by equation (**??**), $0 \leq V \left(W_0^+ \right) - V \left(W_0^- \right)$ and that

$$V \left(W_0^+ \right) - V \left(W_0^- \right) \leq \delta \left(W_0^+ - W_0^- \right),$$

since $V' (W_0) \leq \delta$ by Lemma 2. Recall that

$$W_t (s_t) = \max \{ s_t + \delta W_0 - c, \lambda_t (b + \delta V) + (1 - \lambda_t) \max \{ \delta W_{t+1}, \delta W_0 - c \} \}.$$

By Fact 0, at $t = n$ we have that $W_n \left(W_0^+ \right) = \upsilon + \delta W_0^+ - c$ and $W_n \left(W_0^- \right) = \upsilon + \delta W_0^- - c$. As such

$$W_n \left(W_0^+ \right) - W_n \left(W_0^- \right) \leq \delta \left(W_0^+ - W_0^- \right). \tag{15}$$

Lemma 3. *Suppose that* $W_{t+1} \left(W_0^+ \right) - W_{t+1} \left(W_0^- \right) \leq \delta \left(W_0^+ - W_0^- \right)$*. Then* $\max \left\{ \delta W_{t+1} \left(W_0^- \right), \delta W_0^- - c \right\} = \delta W_0^- - c$*, implies* $\max \left\{ \delta W_{t+1} \left(W_0^+ \right), \delta W_0^+ - c \right\} = \delta W_0^+ - c$*.*

Proof. Assume by way of contradiction that $\delta W_{t+1} \left(W_0^- \right) < \delta W_0^- - c$ and that $\delta W_{t+1} \left(W_0^+ \right) > \delta W_0^+ - c$. Subtracting the first equation from the second results in $\delta W_{t+1} \left(W_0^+ \right) - \delta W_{t+1} \left(W_0^- \right) > \delta \left(W_0^+ - W_0^- \right)$, but this contradicts the premise that $W_{t+1} \left(W_0^+ \right) - W_{t+1} \left(W_0^- \right) \leq \delta \left(W_0^+ - W_0^- \right)$. $\square$

Lemma 4. *Suppose that* $W_{t+1} \left(W_0^+ \right) - W_{t+1} \left(W_0^- \right) \leq \delta \left(W_0^+ - W_0^- \right)$*. Then* $W_t \left(s_t | W_0^- \right) = s_t + \delta W_0^- - c$*, implies* $W_t \left(s_t | W_0^+ \right) = s_t + \delta W_0^+ - c$*.*

Proof. We consider two cases, either $\delta W_{t+1} \left(W_0^+ \right) \leq \delta W_0^+ - c$ or the opposite.

Case 1: $\max \left\{ \delta W_{t+1} \left(W_0^+ \right), \delta W_0^+ - c \right\} = \delta W_0^+ - c$.

Since $W_t\left(s_t|W_0^-\right) = s_t + \delta W_0^- - c$, we have that

$$\begin{aligned} s_t + \delta W_0^- - c &\geq \lambda_t\left(b + \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0^- - c\right\} \\ &\geq \lambda_t\left(b + \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\left(\delta W_0^- - c\right). \end{aligned}$$

This implies

$$0 \leq s_t - \lambda_t\left(b + \delta V\left(W_0^-\right)\right) - \lambda_t c + \lambda_t \delta W_0^- \leq s_t - \lambda_t\left(b + \delta V\left(W_0^+\right)\right) - \lambda_t c + \lambda_t \delta W_0^+, \quad (16)$$

where the second inequality follows since

$$\begin{aligned} &\lambda_t \delta W_0^+ - \lambda_t \delta W_0^- - \lambda_t\left(\delta V\left(W_0^+\right) - \delta V\left(W_0^-\right)\right) \\ \geq\ &\lambda_t \delta\left(W_0^+ - W_0^-\right) - \lambda_t \delta^2\left(W_0^+ - W_0^-\right) \geq 0. \end{aligned}$$

Rearranging inequality (16) yields $s_t + \delta W_0^+ - c \geq \lambda_t\left(b + V\left(W_0^+\right)\right) + (1-\lambda_t)\left(\delta W_0^+ - c\right)$, which is what we wanted to show.

Case 2: $\max\left\{\delta W_{t+1}\left(W_0^+\right), \delta W_0^+ - c\right\} = \delta W_{t+1}\left(W_0^+\right)$.

By Lemma 3, $\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0^- - c\right\} = \delta W_{t+1}\left(W_0^-\right)$. We have $s_t + \delta W_0^- - c \geq \lambda_t\left(b + \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^-\right)$, which holds only if

$$\lambda_t\left(b + \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^-\right) - \delta W_0^- \leq s_t - c.$$

Since

$$\begin{aligned} &\lambda_t\left(\delta V\left(W_0^+\right) - \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\,\delta\left(W_{t+1}\left(W_0^+\right) - W_{t+1}\left(W_0^-\right)\right) \\ \leq\ &\lambda_t \delta^2\left(W_0^+ - W_0^-\right) + (1-\lambda_t)\,\delta^2\left(W_0^+ - W_0^-\right) \\ <\ &\delta\left(W_0^+ - W_0^-\right), \end{aligned}$$

we have

$$\lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^+\right) - \delta W_0^+ < \lambda_t\left(b + V\left(W_0^-\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^-\right) - \delta W_0^-.$$

Thus

$$\lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^+\right) - \delta W_0^+ < s_t - c.$$

This implies that $s_t + \delta W_0^+ - c > \lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\,\delta W_{t+1}\left(W_0^+\right)$, which is what we wanted to show. □

Lemma 5. *Suppose that* $W_{t+1}\left(W_0^+\right) - W_{t+1}\left(W_0^-\right) \leq \delta\left(W_0^+ - W_0^-\right)$. *Then* $W_t\left(s_t|W_0^+\right) - W_t\left(s_t|W_0^-\right) \leq \delta\left(W_0^+ - W_0^-\right)$.

Proof. Recall that

$$W_t(s_t) = \max\left\{s_t + \delta W_0 - c, \lambda_t(b + \delta V) + (1-\lambda_t)\max\left\{\delta W_{t+1}, \delta W_0 - c\right\}\right\}.$$

We will consider two cases.

Case 1: $W_t\left(s_t|W_0^+\right) = s_t + \delta W_0^+ - c$. By definition $W_t\left(s_t|W_0^-\right) \geq s_t + \delta W_0^- - c$ and we have that

$$
\begin{aligned}
W_t\left(s_t|W_0^+\right) - W_t\left(s_t|W_0^-\right) &\leq s_t + \delta W_0^+ - c - s_t - \delta W_0^- + c \\
&= \delta\left(W_0^+ - W_0^-\right).
\end{aligned}
$$

Case 2: $W_t\left(s_t|W_0^+\right) = \lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\max\left\{\delta W_{t+1}\left(W_0^+\right), \delta W_0^+ - c\right\}$. By Lemma 4, we have that $W_t\left(s_t|W_0^-\right) = \lambda_t\left(b + \delta V\left(W_0^-\right)\right) + (1-\lambda_t)\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0\left(W_0^-\right) - c\right\}$. We will then break it up into three further sub-cases.

Case 2a: $\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0^- - c\right\} = \delta W_0^- - c$. By Lemma 3, $\max\left\{\delta W_{t+1}\left(W_0^+\right), \delta W_0^+ - c\right\} = \delta W_0^+ - c$. Thus

$$
\begin{aligned}
W_t\left(s_t|W_0^+\right) - W_t\left(s_t|W_0^-\right) &= \lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\left(\delta W_0^+ - c\right) - \lambda_t\left(b + \delta V\left(W_0^-\right)\right) - (1-\lambda_t)\left(\delta V\right. \\
&= \lambda_t\delta\left(V\left(W_0^+\right) - V\left(W_0^+\right)\right) + (1-\lambda_t)\delta\left(W_0^+ - W_0^-\right) \\
&< \delta\left(W_0^+ - W_0^-\right).
\end{aligned}
$$

Case 2b: $\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0^- - c\right\} = \delta W_{t+1}\left(W_0^-\right)$ and $\max\left\{\delta W_{t+1}\left(W_0^+\right), \delta W_0^+ - c\right\} = \delta W_{t+1}\left(W_0^+\right)$. Now

$$
\begin{aligned}
W_t\left(s_t|W_0^+\right) - W_t\left(s_t|W_0^-\right) &= \lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\delta W_{t+1}\left(W_0^+\right) - \lambda_t\left(b + \delta V\left(W_0^-\right)\right) - (1-\lambda_t)\delta V \\
&\leq \lambda_t\delta^2\left(W_0^+ - W_0^-\right) + (1-\lambda_t)\delta\left(W_{t+1}\left(W_0^+\right) - W_{t+1}\left(W_0^-\right)\right) \\
&\leq \lambda_t\delta\left(W_0^+ - W_0^-\right) + (1-\lambda_t)\delta^2\left(W_0^+ - W_0^-\right) \\
&< \delta\left(W_0^+ - W_0^-\right)
\end{aligned}
$$

Case 2c: $\max\left\{\delta W_{t+1}\left(W_0^-\right), \delta W_0^- - c\right\} = \delta W_{t+1}\left(W_0^-\right)$ and $\max\left\{\delta W_{t+1}\left(W_0^+\right), \delta W_0^+ - c\right\} = \delta W_0^+ - c$. Now

$$
\begin{aligned}
W_t\left(s_t|W_0^+\right) - W_t\left(s_t|W_0^-\right) &= \lambda_t\left(b + \delta V\left(W_0^+\right)\right) + (1-\lambda_t)\left(\delta W_0^+ - c\right) - \lambda_t\left(b + \delta V\left(W_0^-\right)\right) - (1-\lambda_t)\delta W \\
&\leq \lambda_t\delta^2\left(W_0^+ - W_0^-\right) + (1-\lambda_t)\left(\delta W_0^+ - c - \delta W_{t+1}\left(W_0^-\right)\right) \\
&< \lambda_t\delta\left(W_0^+ - W_0^-\right) + (1-\lambda_t)\left(\delta W_0^+ - c - \delta W_0^- + c\right) \\
&= \delta\left(W_0^+ - W_0^-\right),
\end{aligned}
$$

where the second last line follows since $\delta W_{t+1}\left(W_0^-\right) \geq \delta W_0^- - c$. □

Proof of Theorem: We first show that the map $T_0 : \mathbb{R} \to \mathbb{R}$ is a contraction. Take $W_0^+ > W_0^-$. Note that equation (15) showed that $W_n\left(W_0^+\right) - W_n\left(W_0^-\right) \leq \delta\left(W_0^+ - W_0^-\right)$ and we continue by backward induction. Using Lemma 5 we have that $W_{t+1}\left(W_0^+\right) - W_{t+1}\left(W_0^-\right) \leq$

$\delta\left(W_0^+ - W_0^-\right)$ implies

$$\begin{aligned} W_t\left(W_0^+\right) - W_t\left(W_0^-\right) &= \int_\ell^\infty \left[W_t\left(s|W_0^+\right) - W_t\left(s|W_0^-\right)\right] \, \mathrm{d}F\left(s\right) \\ &\leq \delta\left(W_0^+ - W_0^-\right). \end{aligned}$$

That is, $T_0\left(W_0^+\right) - T_0\left(W_0^-\right) = W_0\left(W_0^+\right) - W_0\left(W_0^-\right) \leq \delta\left(W_0^+ - W_0^-\right)$. By the Banach Fixed-Point Theorem, there exists a unique W_0^* which satisfies the above. Thus, the agent's payoff is uniquely defined, the only possible non-uniqueness is the non-generic situation when the agent is indifferent between making an additional attempt with the current principal or starting with a new one. In this case we break ties in favor of the current principal.

We now verify that a principal who is sufficiently patient will indeed play $b_t = b$ if a_t is productive.

Lemma 6. *There exists a $\overline{\delta_p} \in (0,1)$ such that for all $\delta_p > \overline{\delta_p}$, principals optimally play $b_t = b$ if a_t is productive and $b_t = 0$ otherwise.*

Proof. The principal's benefit of playing $b_t = b$ in response to a productive action a_t is a present value payoff of $(\xi - b) / (1 - \delta_p)$. The only possible deviation is that a principal may decide to play $b_t = 0$ even when the agent chose a productive action a_t. Fix the last period the agent makes an attempt at a productive realtionship with the principal, $K \leq n$. The best case for the deviation is that the agent finds a productive action in period 0 and the lowest possible shock is realized up to period n. In this case the principal's expected payoff from deviating is at most $\xi + \delta_p \gamma \frac{(\xi - b)}{1-\delta_p} + (1-\gamma)\,\delta_p^2 \gamma \frac{(\xi-b)}{1-\delta_p} ... + (1-\gamma)^{n-1}\,\delta_p^n \gamma \frac{(\xi-b)}{1-\delta_p}$, assuming that the principal believes that the agent will choose a productive action with at most probability $\gamma \in (0,1)$. In the undirected search microfoundation, we can treat $\gamma = \lambda$ as the realized match quality. In other microfoundations we can take γ to be the highest probability that the principal assigns to the agent choosing a productive action tomorrow, all we require is that $\gamma < 1$. The principal prefers to pay the agent after a productive action if:

$$\begin{aligned} \frac{\xi - b}{1 - \delta_p} &\geq v + \frac{(\delta_p(1-\gamma) - \delta_p^{n+1}(1-\gamma)^{n+1})\gamma(\xi - b)}{(1 - \delta_p + \delta_p\gamma)(1-\gamma)\,(1-\delta_p)} \\ 1 - \delta_p + \gamma(1-\gamma)^n \delta_p^{n+1} &\geq \frac{\xi}{\xi - b}(1 - \delta_p + \delta_p\gamma)\,(1-\delta_p)\,. \end{aligned}$$

Note that when $\delta_p = 1$ the inequality holds strictly since $\gamma\,(1-\gamma)^n > 0$. Since both sides of the expression are continuous in δ_p, there is some $\overline{\delta_p} \in (0,1)$ such that the inequality holds for all $\delta_p > \overline{\delta_p}$. Thus, for sufficiently high δ_p, the principal does prefer to pay the agent even when the very first action chosen by the agent is productive. ☐

Finally, the Lemma below gives the sufficient condition for the existence of a relational contracting equilibrium. As part of the proof it develops a necessary and sufficient condition which cannot be solved in closed form. This necessary and sufficient condition is of independent interest as it, rather than the sufficient condition given, should be used to compute comprative statics on the existence of a relational contracting equilibrium.

Lemma 7. *Inequality (RC) holds if* $\lambda_0 \geq \frac{(1-\delta)(\delta v+c)}{\delta(1-\delta)V-\delta^2 v}$.

Proof. We will focus on the case where

$$\begin{aligned} W_0(s) &= \lambda_0(b+\delta V)+(1-\lambda_0)(\delta W_0-c) \\ &\leq \max\{s+\delta W_0-c, \lambda_0(b+\delta V)+(1-\lambda_0)\max\{\delta W_1, \delta W_0-c\}\}. \end{aligned}$$

Clearly, this is a lower-bound on $W_0(s)$, as comparison to equation (1) shows. Integrating over s, we have that $W_0 = \lambda_0(b+\delta V)+(1-\lambda_0)(\delta W_0-c)$. This implies that

$$W_0 = \frac{\lambda_0(b+\delta V)-c(1-\lambda_0)}{1-\delta(1-\lambda_0)}.$$

Thus a sufficient condition for inequality (RC) and hence existence is

$$\delta\left(\frac{\lambda_0(b+\delta V)-c(1-\lambda_0)}{1-\delta(1-\lambda_0)}\right)-c = \frac{\delta\lambda_0(b+\delta V)-c}{1-\delta(1-\lambda_0)} \geq \frac{\delta v}{1-\delta}.$$

Solving for λ_0 we get

$$\lambda_0 \geq \frac{(1-\delta)(\delta v+c)}{\delta(1-\delta)(b+\delta V)-\delta^2 v}.$$

Since $V \geq \frac{b}{1-\delta}$ and a sufficient condition that is purely in terms of primitives of the model is

$$\lambda_0 \geq \frac{(1-\delta)(\delta v+c)}{\delta b-\delta^2 v}.$$

Note that $\frac{(1-\delta)(\delta v+c)}{\delta b-\delta^2 v} < 1$ as long as $\delta > \frac{c}{c+b-v}$. □

A.2 Proof of Theorem 2

Theorem. *If λ is single-peaked with peak T, $(W_t)_{t=0}^n$ is single peaked with a peak $\tau \leq T$.*

Before proving the Theorem, we have the following Lemma.

Lemma 8. *For all $t \geq T$, $W_t \geq W_{t+1}$.*

Proof. We first show that if $W_{t+1} \geq W_{t+2}$ and $\lambda_t \geq \lambda_{t+1}$, then $W_t \geq W_{t+1}$. Recall that

$$W_t(s) = \max\{s+\delta W_0-c, \lambda_t(b+\delta V)+(1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0-c\}\}.$$

1) Suppose that $s > s^*_{t+1}$. Then

$$\begin{aligned} W_t(s)-W_{t+1}(s) &= \max\{s+\delta W_0-c, \lambda_t(b+\delta V)+(1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0-c\}\}-(s+\delta W_0-c) \\ &\geq s+\delta W_0-c-(s+\delta W_0-c) \\ &= 0. \end{aligned}$$

2) Suppose that $s \leq s^*_{t+1}$. Then

$$\begin{aligned} W_t(s) - W_{t+1}(s) &= \max\{s + \delta W_0 - c, \lambda_t(b + \delta V) + (1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0 - c\}\} \\ &\quad - (\lambda_{t+1}(b+\delta V) + (1-\lambda_{t+1})\max\{\delta W_{t+2}, \delta W_0 - c\}) \\ &\geq (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0 - c\} \\ &\quad - (1-\lambda_{t+1})\max\{\delta W_{t+2}, \delta W_0 - c\}. \end{aligned}$$

Now, if $\delta W_{t+2} < \delta W_0 - c$ we obtain

$$\begin{aligned} W_t(s) - W_{t+1}(s) &= (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0 - c\} - (1-\lambda_{t+1})(\delta W_0 - c) \\ &\geq (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)(\delta W_0 - c) - (1-\lambda_{t+1})(\delta W_0 - c) \\ &= (\lambda_t - \lambda_{t+1})(\delta V - \delta W_0 + c) \\ &\geq 0, \end{aligned}$$

since $\lambda_t \geq \lambda_{t+1}$ and $V \geq W_0$.

But if $\delta W_{t+2} \geq \delta W_0 - c$ we have

$$\begin{aligned} W_t(s) - W_{t+1}(s) &= (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)\max\{\delta W_{t+1}, \delta W_0 - c\} - (1-\lambda_{t+1})\delta W_{t+2} \\ &\geq (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)\delta W_{t+1} - (1-\lambda_{t+1})\delta W_{t+2} \\ &= (\lambda_t - \lambda_{t+1})\delta V + (1-\lambda_t)(\delta W_{t+1} - \delta W_{t+2}) - (1-\lambda_{t+1})\delta W_{t+2} + (1-\lambda_t)\delta W_{t+2} \\ &= (\lambda_t - \lambda_{t+1})(\delta V - \delta W_{t+2}) + (1-\lambda_t)\delta(W_{t+1} - W_{t+2}) \\ &\geq 0, \end{aligned}$$

where the last inequality follows from $\lambda_t \geq \lambda_{t+1}$, $V \geq W_{t+2}$ and $W_{t+1} \geq W_{t+2}$.

Integrating over s we have that $W_t - W_{t+1} = \int (W_t(s) - W_{t+1}(s))\ dF(s) \geq 0$, which proves that if $W_{t+1} \geq W_{t+2}$ and $\lambda_t \geq \lambda_{t+1}$, then $W_t \geq W_{t+1}$.

To complete the proof of the Lemma, recall that by Fact 0, $W_n = v + \delta W_0 - c$. Hence $W_{n-1} \geq W_n$ trivially. Furthermore, we must have that $n > T$ if inequality (RC) holds and hence for $t \geq T$, $\lambda_t \geq \lambda_{t+1}$. Working backwards from n we have that for all $t \geq T$, $W_t \geq W_{t+1}$. $\square$

We are now ready to prove the Theorem.

Let $\tau = \max\{t \leq T : W_t \geq W_{t'} \text{ for all } t'\}$. Note that this is well defined since Lemma 8 implies that $W_T \geq W_{t'}$ for all $t' \geq T$.

We first show that $(W_t)_{t=0}^{\tau}$ is increasing. We will use the fact that $W_\tau \geq W_t$ for all $t \leq \tau$, to show that $W_{\tau-1} \geq W_t$ for all $t \leq \tau - 1$. Take any $t \leq \tau - 1$ and note that since $\lambda_t \leq \lambda_{\tau-1}$ we have

$$\begin{aligned} &\lambda_t(b+\delta V) + (1-\lambda_t)\max\{\delta W_0 - c, W_{t+1}\} \\ \leq\ &\lambda_{\tau-1}(b+\delta V) + (1-\lambda_{\tau-1})\max\{\delta W_0 - c, \delta W_{t+1}\} \\ \leq\ &\lambda_{\tau-1}(b+\delta V) + (1-\lambda_{\tau-1})\max\{\delta W_0 - c, \delta W_\tau\}. \end{aligned}$$

Thus, for any s,

$$\begin{aligned} W_t(s) &= \max\{s+\delta W_0-c, \lambda_t(b+\delta V)+(1-\lambda_t)\max\{\delta W_0-c,\delta W_{t+1}\}\} \\ &\leq \max\{s+\delta W_0-c, \lambda_{\tau-1}(b+\delta V)+(1-\lambda_{\tau-1})\max\{\delta W_0-c,\delta W_{\tau}\}\} \\ &= W_{\tau-1}(s). \end{aligned}$$

Integrating over s, we obtain that $W_t \leq W_{\tau-1}$. The same argument can be repeated for $\tau-1$, since now we have that $W_{\tau-1} \geq W_t$ for all $t \leq \tau-1$.

We are left to show that $(W_t)_{t=\tau}^{T}$ is decreasing. If $\tau = T$ this follows trivially, so consider $\tau < T$. We know that $W_{\tau+1} < W_\tau$ by definition, i.e.,

$$\begin{aligned} & \int \max\{s+\delta W_0-c, \lambda_{\tau+1}(b+\delta V)+(1-\lambda_{\tau+1})\max\{\delta W_0-c,\delta W_{\tau+2}\}\}\ \mathrm{d}F(s) \\ < & \int \max\{s+\delta W_0-c, \lambda_{\tau}(b+\delta V)+(1-\lambda_{\tau})\max\{\delta W_0-c,\delta W_{\tau+1}\}\}\ \mathrm{d}F(s). \end{aligned}$$

This can only hold if

$$\begin{aligned} & \lambda_{\tau+1}(b+\delta V)+(1-\lambda_{\tau+1})\max\{\delta W_0-c,\delta W_{\tau+2}\} \\ < & \lambda_{\tau}(b+\delta V)+(1-\lambda_{\tau})\max\{\delta W_0-c,\delta W_{\tau+1}\} \\ \leq & \lambda_{\tau+1}(b+\delta V)+(1-\lambda_{\tau+1})\max\{\delta W_0-c,\delta W_{\tau+1}\}, \end{aligned}$$

where the last line follows since $\lambda_\tau \leq \lambda_{\tau+1}$ and since $V \geq W_r$ for all r. The above inequality implies

$$\max\{\delta W_0-c,\delta W_{\tau+2}\} < \max\{\delta W_0-c,\delta W_{\tau+1}\} = \delta W_{\tau+1}.$$

Note that the last equality in the above display equation follows from the fact that $\delta W_0 - c < \delta W_{\tau+1}$, as otherwise the inequality would fail. Thus $\max\{\delta W_0-c,\delta W_{\tau+2}\} < \delta W_{\tau+1}$ and in particular $W_{\tau+2} < W_{\tau+1}$. The same argument can be repeated to show that $W_{\tau+3} < W_{\tau+2}$, just by incrementing the indices. The argument continues to apply up to period T, since this is where the λ vector is no longer increasing. ■

A.3 Proof of Proposition 3

Proposition. *There exists a $K \in [T,n]$ such that $\delta W_t \geq \delta W_0 - c$ for all $t \leq K$ and $\delta W_t < \delta W_0 - c$ for all $t > K$.*

Proof. To show that the K defined in the statement satisfies $K \geq T$, we need to prove that $\delta W_T \geq \delta W_0 - c$.

Assume by way of contradiction that in the equilibrium, $\delta W_T < \delta W_0 - c$. Then by Proposition **??**, $\delta W_{T+1} \leq \delta W_T < \delta W_0 - c$ and hence

$$W_T(s) = \max\{s+\delta W_0-c, \lambda_T(b+\delta V)+(1-\lambda_T)(\delta W_0-c)\}.$$

Oberve that in that case, we must have

$$W_{T-1}(s) = \max\{s+\delta W_0-c, \lambda_{T-1}(b+\delta V)+(1-\lambda_{T-1})(\delta W_0-c)\}.$$

Note that since $\lambda_{T-1} \leq \lambda_T$ we have that $W_{T-1}(s) \leq W_T(s)$ for each s. Thus $W_{T-1} \leq W_T$ and hence $\delta W_{T-1} < \delta W_0 - c$.

We proceed by backward induction. Consider some $t \leq T-1$ such that $W_t < \delta W_0 - c$. Then we have that

$$\begin{aligned} W_{t-1}(s) &= \max\{s + \delta W_0 - c, \lambda_{t-1}(b + \delta V) + (1 - \lambda_{t-1})(\delta W_0 - c)\} \\ &\leq \max\{s + \delta W_0 - c, \lambda_t (b + \delta V) + (1 - \lambda_t)(\delta W_0 - c)\} \\ &= W_t(s). \end{aligned}$$

Iterating this until $t = 1$, this implies $\delta W_0 \leq \delta W_0 - c$, which is a contradiction.

Proposition **??** implies that there exists a $K \geq T$ such that $\delta W_t \geq \delta W_0 - c$ for all $T \leq t \leq K$. We now want to show that $\delta W_t > \delta W_0 - c$ for all $t \leq T$. By Proposition 2, we have that $\min\{W_0, W_T\} \leq W_t$ for all $t \leq T$. But $\delta W_0 > \delta W_0 - c$ and $\delta W_T \geq \delta W_0 - c$, so that $\delta W_t \geq \delta W_0 - c$ for all $t \leq K$. $\square$

Lemma 9. *We have that the total derivative* $\frac{dW_t}{dW_0} \leq \delta$ *for all* $t > 0$.

Proof. By the definition of K, for any $t \geq K$ we have

$$W_t(s) = \max\{s + \delta W_0 - c, \lambda_t (b + \delta V) + (1 - \lambda_t)(\delta W_0 - c)\}.$$

Note that for $s \leq s_t^*$ we have

$$\begin{aligned} \frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} &= \lambda_t \delta \frac{\mathrm{d}V}{\mathrm{d}W_0} + (1 - \lambda_t)\delta \\ &\leq \lambda_t \delta^2 + (1 - \lambda_t)\delta \\ &\leq \delta, \end{aligned}$$

where the inequality follows from Lemma 2. For $s > s_t^*$, we have $\frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} = \delta$ and hence $\frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} \leq \delta$ for all s. We can integrate over s and use the Leibniz integral rule to get

$$\begin{aligned} \frac{\mathrm{d}W_t}{\mathrm{d}W_0} &= \frac{\mathrm{d}}{\mathrm{d}W_0} \int W_t(s, W_0)\ \mathrm{d}F(s) \\ &= \int_{\ell}^{s_t^*} \frac{\mathrm{d}W_t(s, W_0)}{\mathrm{d}W_0}\ \mathrm{d}F(s) + \int_{s_t^*}^{\infty} \frac{\mathrm{d}W_t(s, W_0)}{\mathrm{d}W_0}\ \mathrm{d}F(s) \\ &\leq F(s_t^*)\delta + (1 - F(s_t^*))\delta \\ &= \delta, \end{aligned}$$

which is what we wanted to show. Note that derivatives for W_t for $t > K$ will not matter, since they do not enter the agent's expected utility as the game restrats if a productive relationship is not found by period K.

We now proceed by induction (backwards). Given $\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0} \leq \delta$, we want to show that $\frac{\mathrm{d}W_t}{\mathrm{d}W_0} \leq \delta$ for all $t < K$. Since $t < K$ we have that

$$W_t(s) = \max\{s + \delta W_0 - c, \lambda_t (b + \delta V) + (1 - \lambda_t)\delta W_{t+1}\}.$$

Note that for $s \le s_t^*$ we have

$$\begin{aligned}\frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} &= \lambda_t\delta\frac{\mathrm{d}V}{\mathrm{d}W_0} + (1-\lambda_t)\,\delta\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0}\\ &\le \lambda_t\delta^2 + (1-\lambda_t)\,\delta^2\\ &= \delta^2\\ &\le \delta,\end{aligned}$$

where the first inequality follows from Lemma 2.

For $s > s_t^*$, we have $\frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} = \delta$ and hence $\frac{\mathrm{d}W_t(s)}{\mathrm{d}W_0} \le \delta$ for all s. Again integrating over s yields that $\frac{\mathrm{d}W_t}{\mathrm{d}W_0} \le \delta$. □

A.4 Proof of Proposition 4

Proposition. *In a relational contracting equilibrium W_0 is increasing in λ_t for any $t \le K$. Furthermore, W_0 is strictly increasing in λ_t if and only if $F(s_k^*) > 0$, for all $0 \le k \le t$ and $\lambda_k < 1$ for all $0 < k < t-1$.*

Proof. The case of $t = K$ was dealt with earlier, so consider $t < K$. We use similar definitions to the previous lemma. For $r \le t$ define

$$\begin{aligned}\alpha_r &= (1-F(s_r^*))\,\delta + F(s_r^*)\,\lambda_r\delta\frac{\mathrm{d}V}{\mathrm{d}W_0},\\ \beta_r &= F(s_r^*)\,(1-\lambda_r)\,\delta,\\ \gamma_r &= \alpha_r + \beta_r(\gamma_{r+1}),\end{aligned}$$

where we set $\gamma_{t+1} = \frac{dW_{t+1}}{dW_0}$ and define $\frac{dW_{K+1}}{dW_0} = 1$. Note the difference in the definition of γ_{t+1} as opposed to γ_{K+1}. This accounts for the fact that the value function in period K is a little different than in earlier periods. It is easy to see that $0 \le \gamma_r \le \delta$ for all $r \le t$.

For $t = K$, we have that $W_K(s) = \max\{s + \delta W_0 - c, \lambda_K(b+\delta V) + (1-\lambda_K)(\delta W_0 - c)\}$. For $s \le s_K^*$,

$$\frac{\mathrm{d}W_K(s)}{\mathrm{d}\lambda_K} = b + \delta V + \lambda_K\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} + (1-\lambda_K)\,\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} - \delta W_0 + c.$$

while for $s > s_K^*$, $\frac{\mathrm{d}W_K(s)}{\mathrm{d}\lambda_K} = \delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K}$.

To find $\frac{\mathrm{d}W_K}{\mathrm{d}\lambda_K}$ we need to integrate the above expressions with respect to s and apply the Leibniz integral rule. Note that this applies since W_K is Lebesgue integrable and partial derivatives are bounded and exist almost everywhere. Thus we have that

$$\begin{aligned}
\frac{\mathrm{d}W_K}{\mathrm{d}\lambda_K} &= \frac{\mathrm{d}}{\mathrm{d}\lambda_K}\int W_K\left(s,\lambda_K\right)\ \mathrm{d}F\left(s\right) \\
&= \int_{\ell}^{s_K^*}\frac{\mathrm{d}W_K\left(s,\lambda_K\right)}{\mathrm{d}\lambda_K}\ \mathrm{d}F\left(s\right)+\int_{s_K^*}^{\infty}\frac{\mathrm{d}W_K\left(s,\lambda_K\right)}{\mathrm{d}\lambda_K}\ \mathrm{d}F\left(s\right) \\
&= F\left(s_K^*\right)\left(b+\delta V+\lambda_K\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K}+\left(1-\lambda_K\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K}-\delta W_0+c\right) \\
&\quad+\left(1-F\left(s_K^*\right)\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} \\
&= F\left(s_K^*\right)\left(b+\delta V-\delta W_0+c\right)+F\left(s_K^*\right)\lambda_K\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K}+F\left(s_K^*\right)\left(1-\lambda_K\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} \\
&\quad+\left(1-F\left(s_K^*\right)\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} \\
&= F\left(s_K^*\right)\left(b+\delta V-\delta W_0+c\right)+\left(\alpha_K+\beta_K\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K} \\
&= F\left(s_K^*\right)\left(b+\delta V-\delta W_0+c\right)+\gamma_K\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_K},
\end{aligned}$$

where α_K and β_K are as defined above (note again that $\gamma_{K+1}=1$ by definition).

Now, for $t<K$, $W_t\left(s\right)=\max\left\{s+\delta W_0-c,\lambda_t\left(b+\delta V\right)+\left(1-\lambda_t\right)\delta W_{t+1}\right\}$. For $s\leq s_t^*$,

$$\frac{\mathrm{d}W_t\left(s\right)}{\mathrm{d}\lambda_t}=b+\delta V-\delta W_0+c+\lambda_t\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\left(1-\lambda_t\right)\delta\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}.$$

while for $s>s_t^*$, $\frac{\mathrm{d}W_t(s)}{\mathrm{d}\lambda_t}=\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}$. Again, integrating over s, we get

$$\begin{aligned}
\frac{\mathrm{d}W_t}{\mathrm{d}\lambda_t} &= F\left(s_t^*\right)\left(b+\delta V-\delta W_0+c+\lambda_t\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\left(1-\lambda_t\right)\delta\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}\right)+\left(1-F\left(s_t^*\right)\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} \\
&= F\left(s_t^*\right)\left(b+\delta V-\delta W_0+c\right)+\gamma_t\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}.
\end{aligned}$$

The definition of γ_t implies that we have the same expression for $\frac{\mathrm{d}W_t}{\mathrm{d}\lambda_t}$ and $\frac{\mathrm{d}W_K}{\mathrm{d}\lambda_K}$ and can now thus consider any generic period $r<t$ where $W_r\left(s\right)=\max\left\{s+\delta W_0-c,\lambda_r\left(b+\delta V\right)+\left(1-\lambda_r\right)\delta W_{r+1}\right\}$. Through a similar argument we find that

$$\begin{aligned}
\frac{\mathrm{d}W_r}{\mathrm{d}\lambda_t} &= F\left(s_r^*\right)\left(\lambda_r\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\left(1-\lambda_r\right)\delta\frac{\mathrm{d}W_{r+1}}{\mathrm{d}\lambda_t}\right)+\left(1-F\left(s_r^*\right)\right)\delta\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} \\
&= \left(\left(1-F\left(s_r^*\right)\right)\delta+F\left(s_r^*\right)\lambda_r\delta\frac{\mathrm{d}V}{\mathrm{d}W_0}\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+F\left(s_r^*\right)\left(1-\lambda_r\right)\delta\frac{\mathrm{d}W_{r+1}}{\mathrm{d}\lambda_t} \\
&= \alpha_r\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\beta_r\frac{\mathrm{d}W_{r+1}}{\mathrm{d}\lambda_t}.
\end{aligned}$$

Working backwards from t to $r=t-1$, we have that

$$\begin{aligned}
\frac{\mathrm{d}W_{t-1}}{\mathrm{d}\lambda_t} &= \alpha_{t-1}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\beta_{t-1}\frac{\mathrm{d}W_t}{\mathrm{d}\lambda_t} \\
&= \left(\alpha_{t-1}+\beta_{t-1}\gamma_t\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\beta_{t-1}F\left(s_t^*\right)\left(b+\delta V-\delta W_0+c\right) \\
&= \gamma_{t-1}\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}+\beta_{t-1}F\left(s_t^*\right)\left(b+\delta V-\delta W_0+c\right).
\end{aligned}$$

More generally, we obtain that

$$\frac{\mathrm{d}W_r}{\mathrm{d}\lambda_t} = \gamma_r \frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} + \left(\prod_{k=r}^{t-1} \beta_k\right) F\left(s_t^*\right)\left(b + \delta V - \delta W_0 + c\right). \tag{17}$$

Taking this to $t = 0$, we get

$$\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} = \frac{\left(\prod_{k=0}^{t-1} F\left(s_k^*\right)\left(1-\lambda_k\right)\right) F\left(s_t^*\right)\delta^t\left(b + \delta V - \delta W_0 + c\right)}{1-\gamma_0} \geq 0, \tag{18}$$

where the inequality holds because $\gamma_0 \leq \delta$. Since the denominator is strictly negative, W_0 is strictly increasing in λ_t if $F\left(s_k^*\right) > 0$ for all $0 \leq k \leq t$ and $\lambda_k < 1$ for all $0 < k < t-1$, since that makes the numerator strictly positive. This makes sense, since if some $\lambda_k = 1$ for $k < t$ then the relationship becomes productive and values of λ_t above k do not matter. Furthermore, if $F\left(s_k^*\right) = 0$ for some $k < t$, then the agent always takes the outside option in period k, so that the relationship ends at this time and again higher realizations of λ_t do not matter. □

A.5 Proof of Proposition 5

Proposition. *We have that W_0 is decreasing in ϕ_t, i.e.,* $\frac{\mathrm{d}W_0}{\mathrm{d}\phi_t} > 0$.

Proof. Recall that $\phi_t = \prod_{k=0}^{t}\left(1-\lambda_k\right)$, so that

$$\lambda_t = 1 - \frac{\phi_t}{\phi_{t-1}},$$

so that $\frac{\mathrm{d}\lambda_t}{\mathrm{d}\phi_t} = \frac{-1}{\phi_{t-1}}$ and $\frac{\mathrm{d}\lambda_{t+1}}{\mathrm{d}\phi_t} = \frac{\phi_{t+1}}{\phi_t^2}$. Observe that from equation (18), we can conclude that

$$\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_{t+1}} = \left(1-\lambda_t\right)\delta F\left(s_{t+1}^*\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}.$$

Thus

$$\begin{aligned}
\frac{\mathrm{d}W_0}{\mathrm{d}\phi_t} &= \frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t}\frac{\mathrm{d}\lambda_t}{\mathrm{d}\phi_t} + \frac{\mathrm{d}W_0}{\mathrm{d}\lambda_{t+1}}\frac{\mathrm{d}\lambda_{t+1}}{\mathrm{d}\phi_t} \\
&= \left(\frac{-1}{\phi_{t-1}} + \frac{\left(1-\lambda_t\right)\delta F\left(s_{t+1}^*\right)\phi_{t+1}}{\phi_t^2}\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} \\
&= \left(\frac{-\left(1-\lambda_t\right)}{\phi_t} + \frac{\delta F\left(s_{t+1}^*\right)\left(1-\lambda_t\right)\left(1-\lambda_{t+1}\right)}{\phi_t}\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} \\
&= \left(1-\lambda_t\right)\left(\frac{\delta F\left(s_{t+1}^*\right)\left(1-\lambda_{t+1}\right)-1}{\psi_t}\right)\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} \\
&< 0,
\end{aligned}$$

where the inequality follows since $\frac{\mathrm{d}W_0}{\mathrm{d}\lambda_t} > 0$ and $\delta < 1$. □

A.6 Proof of Proposition 6

Proposition. *For each $t \leq K$, s_t^* is strictly decreasing in W_0.*

Proof. By equation (6), $s_K^* = \lambda_K (b + \delta V - \delta W_0 + c)$. Differentiating this with respect to W_0 we get

$$\frac{\mathrm{d}s_K^*}{\mathrm{d}W_0} = \lambda_K \delta \left(\frac{\mathrm{d}V}{\mathrm{d}W_0} - 1 \right) \leq 0,$$

since $\frac{\mathrm{d}V}{\mathrm{d}W_0} = \frac{1-F(s^*)}{1/\delta - F(s^*)} \in [0, \delta]$.

By equation (6), for any $t < K$, $\lambda_t (b + \delta V) + (1 - \lambda_t) \delta W_{t+1} - \delta W_0 + c$. Differentiating we get

$$\begin{aligned} \frac{\mathrm{d}s_t^*}{\mathrm{d}W_0} &= \lambda_t \delta \frac{\mathrm{d}V}{\mathrm{d}W_0} + (1 - \lambda_t) \delta \frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0} - \delta \\ &= \lambda_t \delta \left(\frac{\mathrm{d}V}{\mathrm{d}W_0} - 1 \right) + (1 - \lambda_t) \delta \left(\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0} - 1 \right) \\ &< 0, \end{aligned}$$

since $\frac{\mathrm{d}W_{t+1}}{\mathrm{d}W_0} \leq \delta$ by Lemma 9 and $\frac{\mathrm{d}V}{\mathrm{d}W_0} \leq \delta$ by Lemma 2. □

A.7 Proof of Proposition 7

Proposition. *We have that* $\frac{\mathrm{d}W_t}{\mathrm{d}\delta} > 0$ *for all* $t \leq K$.

Proof. To prove the Proposition, we start with the following claim.

Claim: The total derivative $\frac{\mathrm{d}V}{\mathrm{d}\delta} = \alpha + \beta \frac{\mathrm{d}W_0}{\mathrm{d}\delta}$, where $\alpha > W_0$ and $\delta > \beta \geq 0$.

Proof of Claim: By the definition of V in equation (2), we have

$$V = \int_\ell^{s^*} (b + \delta V) \ \mathrm{d}F(s) + \int_{s^*}^\infty (s + \delta W_0 - c) \ \mathrm{d}F(s).$$

The total derivative of both sides with respect to δ is

$$\frac{\mathrm{d}V}{\mathrm{d}\delta} = F(s^*) \left(V + \delta \frac{\mathrm{d}V}{\mathrm{d}\delta} \right) + (1 - F(s^*)) \left(W_0 + \delta \frac{\mathrm{d}W_0}{\mathrm{d}\delta} \right),$$

since the

By solving for $\frac{\mathrm{d}V}{\mathrm{d}\delta}$ we find

$$\begin{aligned} \frac{\mathrm{d}V}{\mathrm{d}\delta} &= \frac{F(s^*) V + (1 - F(s^*)) W_0}{1 - \delta F(s^*)} + \frac{\delta - \delta F(s^*)}{1 - \delta F(s^*)} \frac{\mathrm{d}W_0}{\mathrm{d}\delta} \\ &= \alpha + \beta \frac{\mathrm{d}W_0}{\mathrm{d}\delta}, \end{aligned}$$

where $\alpha = \frac{F(s^*)V + (1-F(s^*))W_0}{1 - \delta F(s^*)} > W_0$ and $\delta > \beta = \frac{\delta - \delta F(s^*)}{1 - \delta F(s^*)} \geq 0$ where the first inequality follows since $F(s^*) > 0$ in any relational contracting equilibrium. This proves the claim. ■

Observe that

$$\frac{\alpha}{1 - \beta} = \frac{F(s^*) V + (1 - F(s^*)) W_0}{1 - \delta}.$$

With the quantities α and β defined above, it will be conventient to write

$$\alpha = F(s^*)(V + \delta\alpha) + (1 - F(s^*)) W_0, \text{ and} \tag{19}$$

$$\beta = F(s^*) \delta \beta + (1 - F(s^*)) \delta, \tag{20}$$

so that $1-\beta = 1-\delta + F(s^*)\,\delta\,(1-\beta)$.

To prove the Proposition, observe that for $t = K$, by equation (5) we have $W_K(s) = \max\{s + \delta W_0 - c, \lambda_K(b+\delta V) + (1-\lambda_K)(\delta W_0 - c)\}$. So that if $s > s_K^*$, $\frac{\mathrm{d}W_K(s)}{\mathrm{d}\delta} = W_0 + \delta \frac{\mathrm{d}W_0}{\mathrm{d}\delta}$ and if $s \leq s_K^*$ then

$$\frac{\mathrm{d}W_K(s)}{\mathrm{d}\delta} = \lambda_K\left(V + \delta\frac{\mathrm{d}V}{\mathrm{d}\delta}\right) + (1-\lambda_K)\left(W_0 + \delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right).$$

Integrating over s, as usual, we get

$$\begin{aligned}
\frac{\mathrm{d}W_K}{\mathrm{d}\delta} &= F(s_K^*)\left(\lambda_K\left(V+\delta\frac{\mathrm{d}V}{\mathrm{d}\delta}\right) + (1-\lambda_K)\left(W_0+\delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right)\right) + (1-F(s_K^*))\left(W_0+\delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right)\\
&= F(s_K^*)\left(\lambda_K V + \delta\lambda_K\alpha + \delta\lambda_K\beta\frac{\mathrm{d}W_0}{\mathrm{d}\delta} + (1-\lambda_K)\left(W_0+\delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right)\right)\\
&\quad + (1-F(s_K^*))\left(W_0+\delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right)\\
&= F(s_K^*)(\lambda_K V + \delta\lambda_K\alpha + (1-\lambda_K)W_0) + (1-F(s_K^*))W_0\\
&\quad + [\delta F(s_K^*)(\lambda_K\beta + (1-\lambda_K)) + \delta(1-F(s_K^*))]\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\\
&= W_0 + F(s_K^*)\lambda_K(V+\delta\alpha - W_0) + [\delta - \delta F(s_K^*)\lambda_K(1-\beta)]\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\\
&= \alpha_K + \beta_K\frac{\mathrm{d}W_0}{\mathrm{d}\delta},
\end{aligned}$$

where we now define $\alpha_K = F(s_K^*)\lambda_K V + (1-F(s_K^*)\lambda_K)W_0 + F(s_K^*)\lambda_K\delta\alpha$ and $\beta_K = \delta - \delta F(s_K^*)\lambda_K(1-\beta)$. Note that

$$\frac{\alpha}{1-\beta} = \frac{F(s^*)V + (1-F(s^*))W_0}{1-\delta} \geq \frac{F(s_K^*)\lambda_K V + (1-F(s_K^*)\lambda_K)W_0}{1-\delta},$$

since $F(s^*) \geq F(s_K^*)$ and $\lambda_K \leq 1$. Letting $\xi = F(s_K^*)\lambda_K$, the above then implies

$$\begin{aligned}
\alpha(1-\delta) &\geq (1-\beta)(\xi_K V + (1-\xi_K)W_0)\\
\alpha(1-\delta) + \delta\xi_K\alpha(1-\beta) &\geq (1-\beta)(\xi_K V + (1-\xi_K)W_0) + \delta\xi_K\alpha(1-\beta)\\
\alpha(1-\delta+\delta\xi_K(1-\beta)) &\geq (1-\beta)(\xi_K V + (1-\xi_K)W_0 + \delta\xi_K\alpha)\\
\frac{\alpha}{1-\beta} &\geq \frac{\xi_K V + (1-\xi_K)W_0 + \delta\xi_K\alpha}{1-\delta+\delta\xi_K(1-\beta)}\\
\frac{\alpha}{1-\beta} &\geq \frac{\alpha_K}{1-\beta_K}.
\end{aligned}$$

We further have that $\beta_K \geq \beta$ since

$$\begin{aligned}
\beta_K &= \delta - \delta F(s_K^*)\lambda_K(1-\beta)\\
&= F(s_K^*)\lambda_K\beta + (1-F(s_K^*)\lambda_K)\delta\\
&\geq F(s^*)\delta\beta + (1-F(s^*))\delta\\
&= \beta
\end{aligned}$$

where the inequality follows because $F(s^*) \geq F(s_K^*)$ and $\lambda_K \leq 1$. Finally, $\alpha_K \leq \alpha$ since

$$\begin{aligned}
\alpha_K &= W_0 + F(s_K^*)\lambda_K(V + \delta\alpha - W_0) \\
&= \delta F(s_K^*)\lambda_K\alpha + F(s_K^*)\lambda_K V + (1 - F(s_K^*)\lambda_K) W_0 \\
&\leq \delta F(s^*)\alpha + F(s^*) V + (1 - F(s^*)) W_0 \\
&= \alpha.
\end{aligned}$$

For $t < K$, by equation (5) we have $W_t(s) = \max\{s + \delta W_0 - c, \lambda_t(b + \delta V) + (1 - \lambda_t)\delta W_{t+1}\}$. So that if $s > s_t^*$, $\frac{\mathrm{d}W_t(s)}{\mathrm{d}\delta} = W_0 + \delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}$ and if $s \leq s_t^*$ then

$$\frac{\mathrm{d}W_t(s)}{\mathrm{d}\delta} = \lambda_t\left(V + \delta\frac{\mathrm{d}V}{\mathrm{d}\delta}\right) + (1 - \lambda_t)\left(W_{t+1} + \delta\frac{\mathrm{d}W_{t+1}}{\mathrm{d}\delta}\right).$$

Integrating over s, we find that

$$\begin{aligned}
\frac{\mathrm{d}W_t}{\mathrm{d}\delta} &= F(s_t^*)\left(\lambda_t\left(V + \delta\frac{\mathrm{d}V}{\mathrm{d}\delta}\right) + (1 - \lambda_t)\left(W_{t+1} + \delta\frac{\mathrm{d}W_{t+1}(s)}{\mathrm{d}\delta}\right)\right) + (1 - F(s_t^*))\left(W_0 + \delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right) \\
&= F(s_t^*)\left(\lambda_t V + \delta\lambda_t\alpha + \delta\lambda_t\beta\frac{\mathrm{d}W_0}{\mathrm{d}\delta} + (1 - \lambda_t) W_{t+1} + \delta(1 - \lambda_t)\frac{\mathrm{d}W_{t+1}(s)}{\mathrm{d}\delta}\right) \\
&\quad + (1 - F(s_t^*))\left(W_0 + \delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right) \\
&= F(s_t^*)(\lambda_t V + \delta\lambda_t\alpha + (1 - \lambda_t) W_{t+1}) + (1 - F(s_t^*)) W_0 \\
&\quad + F(s_t^*)\delta\lambda_t\beta\frac{\mathrm{d}W_0}{\mathrm{d}\delta} + F(s_t^*)\delta(1 - \lambda_t)\frac{\mathrm{d}W_{t+1}(s)}{\mathrm{d}\delta} + (1 - F(s_t^*))\delta\frac{\mathrm{d}W_0}{\mathrm{d}\delta}.
\end{aligned}$$

We proceed by backward induction. Assuming that $\frac{\mathrm{d}W_t}{\mathrm{d}\delta} = \alpha_t + \beta_t\frac{\mathrm{d}W_0}{\mathrm{d}\delta}$ where $\alpha \geq \alpha_t > 0$ and $\delta \geq \beta_t \geq \beta$ we have that

$$\begin{aligned}
\frac{\mathrm{d}W_{t-1}}{\mathrm{d}\delta} &= F(s_{t-1}^*)(\lambda_{t-1}V + \delta\lambda_{t-1}\alpha + (1 - \lambda_{t-1}) W_t) + (1 - F(s_{t-1}^*)) W_0 \\
&\quad + \left[F(s_{t-1}^*)\delta\lambda_{t-1}\beta + (1 - F(s_{t-1}^*))\delta\right]\frac{\mathrm{d}W_0}{\mathrm{d}\delta} + F(s_{t-1}^*)\delta(1 - \lambda_{t-1})\frac{\mathrm{d}W_t(s)}{\mathrm{d}\delta} \\
&= F(s_{t-1}^*)(\lambda_{t-1}V + \delta\lambda_{t-1}\alpha + (1 - \lambda_{t-1}) W_t) + (1 - F(s_{t-1}^*)) W_0 + F(s_{t-1}^*)\delta(1 - \lambda_{t-1})\alpha_t \\
&\quad + \left[F(s_{t-1}^*)\delta\lambda_{t-1}\beta + (1 - F(s_{t-1}^*))\delta + F(s_{t-1}^*)\delta(1 - \lambda_{t-1})\beta_t\right]\frac{\mathrm{d}W_0}{\mathrm{d}\delta} \\
&= \alpha_{t-1} + \beta_{t-1}\frac{\mathrm{d}W_0}{\mathrm{d}\delta},
\end{aligned}$$

where $\alpha_{t-1} = F(s_{t-1}^*)(\lambda_{t-1}V + \delta\lambda_{t-1}\alpha + (1 - \lambda_{t-1}) W_t) + (1 - F(s_{t-1}^*)) W_0 + F(s_{t-1}^*)\delta(1 - \lambda_{t-1})\alpha_t > 0$ and $\beta_{t-1} = F(s_{t-1}^*)\delta\lambda_{t-1}\beta + (1 - F(s_{t-1}^*))\delta + F(s_{t-1}^*)\delta(1 - \lambda_{t-1})\beta_t$.

Note that

$$\frac{\alpha}{1 - \beta} = \frac{F(s^*) V + (1 - F(s^*)) W_0}{1 - \delta} \geq \frac{F(s_{t-1}^*) V + (1 - F(s_{t-1}^*)) W_0}{1 - \delta},$$

since $F(s^*) \geq F(s^*_{t-1})$. Thus $\alpha(1-\delta) \geq (1-\beta)(F(s^*_{t-1})V + (1-F(s^*_{t-1}))W_0)$ and

$$\begin{aligned}
\alpha\left(1-\delta+\delta F\left(s^*_{t-1}\right)(1-\beta_t)\right) &\geq (1-\beta)\left(F\left(s^*_{t-1}\right)V + \left(1-F\left(s^*_{t-1}\right)\right)W_0\right) + (1-\beta_t)F\left(s^*_{t-1}\right)\delta\alpha \\
&\geq (1-\beta)\left(F\left(s^*_{t-1}\right)V + \left(1-F\left(s^*_{t-1}\right)\right)W_0\right) + (1-\beta)F\left(s^*_{t-1}\right)\delta\alpha \\
&= (1-\beta)\left(F\left(s^*_{t-1}\right)(V+\delta\alpha) + \left(1-F\left(s^*_{t-1}\right)\right)W_0\right).
\end{aligned}$$

We can therefore write

$$\begin{aligned}
\frac{\alpha}{1-\beta} &\geq \frac{F\left(s^*_{t-1}\right)(V+\delta F_0\alpha) + \left(1-F\left(s^*_{t-1}\right)\right)W_0}{1-\delta+\delta F\left(s^*_{t-1}\right)(1-\beta_t)} \qquad (21) \\
&\geq \frac{F\left(s^*_{t-1}\right)\left(\lambda_{t-1}(V+\delta\alpha) + (1-\lambda_{t-1})(W_t+\delta\alpha_t)\right) + \left(1-F\left(s^*_{t-1}\right)\right)W_0}{1-\delta\left(1-F\left(s^*_{t-1}\right)\right) - \delta F\left(s^*_{t-1}\right)\beta_t} \\
&\geq \frac{F\left(s^*_{t-1}\right)\left(\lambda_{t-1}(V+\delta\alpha) + (1-\lambda_{t-1})(W_t+\delta\alpha_t)\right) + \left(1-F\left(s^*_{t-1}\right)\right)W_0}{1-\delta\left(1-F\left(s^*_{t-1}\right)\right) - \delta F\left(s^*_{t-1}\right)\left(\lambda_t\beta + (1-\lambda_t)\beta_t\right)} \\
&= \frac{\alpha_{t-1}}{1-\beta_{t-1}}.
\end{aligned}$$

Therefore we conclude that $\alpha \geq \alpha_t > 0$, $\delta \geq \beta_t \geq \beta$ and that $\frac{\alpha}{1-\beta} \geq \frac{\alpha_t}{1-\beta_t}$ for all $t \leq K$. In particular, at $t=0$ we get

$$\begin{aligned}
\frac{\mathrm{d}W_0}{\mathrm{d}\delta} &= \alpha_0 + \beta_0\frac{\mathrm{d}W_0}{\mathrm{d}\delta} \\
\frac{\mathrm{d}W_0}{\mathrm{d}\delta} &= \frac{\alpha_0}{1-\beta_0} > 0
\end{aligned}$$

since $\alpha_0 > 0$ and $\beta_0 \leq \delta$. Going back to $t=K$, we have that $\frac{\mathrm{d}W_K}{\mathrm{d}\delta} = \alpha_K + \beta_K\frac{\mathrm{d}W_0}{\mathrm{d}\delta} > 0$, since all terms are positive and $\alpha_K > 0$. Similarly, we have $\frac{\mathrm{d}W_t}{\mathrm{d}\delta} > 0$ for any $t \leq K$. Finally, $\frac{\mathrm{d}V}{\mathrm{d}\delta} = \rho + \kappa\frac{\mathrm{d}W_0}{\mathrm{d}\delta} > 0$, where the equality follows from the claim. □

Proposition 8. *We have that $s^* = b + \delta V - \delta W_0 + c$ is increasing in δ.*

Proof. We have that
$$\frac{\mathrm{d}s^*}{\mathrm{d}\delta} = V - W_0 + \delta\left(\frac{\mathrm{d}V}{\mathrm{d}\delta} - \frac{\mathrm{d}W_0}{\mathrm{d}\delta}\right).$$
Now, from the proof above we have that

$$\begin{aligned}
\frac{\mathrm{d}V}{\mathrm{d}\delta} - \frac{\mathrm{d}W_0}{\mathrm{d}\delta} &= \alpha + \beta\frac{\mathrm{d}W_0}{\mathrm{d}\delta} - \frac{\mathrm{d}W_0}{\mathrm{d}\delta} \\
&= \alpha - (1-\beta)\frac{\mathrm{d}W_0}{\mathrm{d}\delta} \\
&= \alpha - (1-\beta)\frac{\alpha_0}{1-\beta_0} \\
&\geq 0,
\end{aligned}$$

where the inequality follows from (21). Since $V - W_0 \geq 0$, $\frac{\mathrm{d}s^*}{\mathrm{d}\delta} \geq 0$ and strictly so if $V > W_0$. □

B Additional Tables and Figures

B.1 Tables

Differences in Attempts:

$$I[Attempt]_{s,t} = \zeta_t + \beta Domestic_s + X_{s,t} + \epsilon_{s,t} \tag{22}$$

Table A.1: Attempting New Relationships

	I[Attempt]				Number of Attempts			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I[Domestic]	-0.124***	-0.116**	-0.010	0.004	-0.770***	-0.686***	-0.128	-0.018
	(0.045)	(0.047)	(0.028)	(0.029)	(0.244)	(0.263)	(0.162)	(0.174)
Model	Linear				Poisson			
N	4056	4056	4056	4056	3472	3472	3472	3472
Seller Age		Y	Y	Y		Y	Y	Y
Seller Success History			Y	Y			Y	Y
Seller Last Year Direct Sales				Y				Y
Month x Year FE	Y	Y	Y	Y	Y	Y	Y	Y

Note: The table compares differences in attempts to establish new relationships between foreign and domestic firms. An attempt is defined as the first shipment between a seller and a buyer. In Columns 1-4, the outcome is indicated by whether the seller made at least one attempt, while Columns 5-8 capture the total number of attempts made by the seller in a given month. Controls include Seller Age, Success History, direct sales in previous year, each included as deciles, and month-by-year fixed effects as specified. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level, respectively.

Table A.2: Differences in Quality

	Dependent Variable: Unit weight (log)								
	All			Direct			Auction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I[Domestic]	.0332	.0368	.0386	.1100	.0940	.0912	-.0373	-.0025	.0003
	(0.105)	(0.0975)	(0.0955)	(0.149)	(0.141)	(0.134)	(0.0887)	(0.0820)	(0.0813)
Observations	120,437	120,437	120,437	66,069	66,069	66,069	54,368	54,368	54,368
Season FE		Y			Y			Y	
Month x Year FE			Y			Y			Y

Note: The table compares the quality across all shipments (Columns 1-3), direct shipments (Columns 4-6), and auction shipments (Columns 7-9) between foreign and domestic firms. The outcome variable represents the natural logarithm of flower unit weight. Season Fixed Effects and Month x Year Fixed Effects are included as specified. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level, respectively.

Table A.3: Rob: Clarity Components and Ending Relationships (6 months)

Dependent Variable:	# Ending Relationships				I[At Least One]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price Spread (Std)	0.0298**	0.0265**	0.0269**	0.0321***	0.0194**	0.0202**	0.0205**	0.0218***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.008)	(0.008)	(0.008)	(0.008)
Seller (λ_s)	-0.0390	-0.0323	-0.0292		-0.0094	-0.0111	-0.0085	
	(0.023)	(0.022)	(0.025)		(0.011)	(0.011)	(0.012)	
Price Spread (Std) x Seller (λ_s)	0.0253***	0.0252***	0.0265***	0.0329***	0.0203**	0.0204**	0.0215**	0.0236***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
Mean Dep. Var	0.241	0.241	0.241	0.241	0.171	0.171	0.171	0.171
Observations	3798	3798	3798	3798	3798	3798	3798	3798
Control # Active Relationships	Y	Y	Y	Y	Y	Y	Y	Y
Control % in Direct		Y	Y	Y		Y	Y	Y
Control Domestic			Y				Y	
Exporter FE				Y				Y

Note: The table displays the estimation of equations 13 using OLS. The sample includes all productive relationships (survived past the third shipment). Price Spread is calculated as the standardized difference between the average price at auctions and the average price in direct sales. A relationship ends if no more shipments are observed between a buyer and a seller or if there are more than six months between two shipments. Columns 1-4 outcome is the number of relationships ending while in Columns 5-8 the outcomes denote a dummy that equals 1 if the seller had at least one relationship ending and zero otherwise. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level, respectively.

Table A.4: Rob: Clarity Components and Ending Relationships (12 months)

Dependent Variable:	# Ending Relationships				I[At Least One]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price Spread (Std)	0.0298**	0.0265**	0.0269**	0.0321***	0.0194**	0.0202**	0.0205**	0.0218***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.008)	(0.008)	(0.008)	(0.008)
Seller (λ_s)	-0.0390	-0.0323	-0.0292		-0.0094	-0.0111	-0.0085	
	(0.023)	(0.022)	(0.025)		(0.011)	(0.011)	(0.012)	
Price Spread (Std) x Seller (λ_s)	0.0253***	0.0252***	0.0265***	0.0329***	0.0203**	0.0204**	0.0215**	0.0236***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
Mean Dep. Var	0.241	0.241	0.241	0.241	0.171	0.171	0.171	0.171
Observations	3798	3798	3798	3798	3798	3798	3798	3798
Control # Active Relationships	Y	Y	Y	Y	Y	Y	Y	Y
Control % in Direct		Y	Y	Y		Y	Y	Y
Control Domestic			Y				Y	
Exporter FE				Y				Y

Note: The table displays the estimation of equations 13 using OLS. The sample includes all productive relationships (survived past the third shipment). Price Spread is calculated as the standardized difference between the average price at auctions and the average price in direct sales. A relationship ends if no more shipments are observed between a buyer and a seller or if there are more than twelve months between two shipments. Columns 1-4 outcome is the number of relationships ending while in Columns 5-8 the outcomes denote a dummy that equals 1 if the seller had at least one relationship ending and zero otherwise. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at the .10, .05, and .01 level, respectively.

Table A.5: Clarity Components and Ending Relationships

Dependent Variable:	# Ending Relationships				I[At Least One]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price Spread (Std)	0.0075	0.0071	0.0074	0.0101	0.0053	0.0055	0.0058	0.0081
	(0.011)	(0.011)	(0.011)	(0.017)	(0.008)	(0.008)	(0.008)	(0.010)
Cumulative Buyer $(\bar{\lambda}_b)$	-0.0181	-0.0147	-0.0141	-0.0550	-0.0299	-0.0323	-0.0317	-0.0528*
	(0.044)	(0.044)	(0.044)	(0.043)	(0.025)	(0.026)	(0.026)	(0.030)
Price Spread (Std)	0.0027	-0.0022	-0.0023	0.0306	0.0117	0.0150	0.0149	0.0269
x Cumulative Buyer $(\bar{\lambda}_b)$	(0.030)	(0.031)	(0.031)	(0.034)	(0.019)	(0.019)	(0.019)	(0.021)
Mean Dep. Var	0.238	0.238	0.238	0.238	0.182	0.182	0.182	0.182
Observations	2267	2267	2267	2267	2267	2267	2267	2267
Control # Active Relationships	Y	Y	Y	Y	Y	Y	Y	Y
Control % in Direct		Y	Y	Y		Y	Y	Y
Control Domestic			Y				Y	
Exporter FE				Y				Y

Note: The table displays the estimation of Equations 13 but with buyer component instead of seller component, using OLS. The sample includes all productive relationships (survived past the third shipment). Price Spread is calculated as the standardized difference between the average price at auctions and the average price in direct sales. A relationship ends if there are no more shipments observed between a buyer and a seller or if there are more than nine months between two shipments. In Columns 1-4 the outcome is the number of relationships ending while in Columns 5-8 the outcome denotes a dummy that equals 1 if the seller had at least one relationship ending and zero otherwise. Standard errors in parentheses are clustered at the exporter level. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively.

Table A.6: Buyers not included in the Leave One Out Connected Set

Dependant Variable:	Success Rate	% Buyer $\notin$ LOO
	(1)	(2)
I[Buyer $\notin$ LOO]	-0.162***	
	(0.025)	
I[Seller Domestic]		0.083
		(0.079)
Mean Dep. Var	0.375	0.473
Observations	1,060	64

Note: Column 1 tests whether the buyer's success rate differs depending on whether the buyer is included in the Leave-One-Out Connected Set (LOO) or not. A relationship is considered successful if it involves more than three shipments. Column 2 tests whether the seller's share of buyers not included in the LOO differs between domestic and foreign firms. Robust standard errors in parentheses. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively.

Table A.7: Differences in Roses Varieties Production by Foreign and Domestics Firms

Dependent Variable:	Land (has)			Share Roses			I[Produces Variety]			Av. Yield		
	SW	IM	T-H	SW	IM	T-H	SW	IM	T-H	SW	IM	T-H
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
I[Domestic]	1.676	-0.073	-0.432	0.088	-0.018	-0.061	0.109	0.314**	0.126	44.500	6.292	2.778
	(1.266)	(1.476)	(0.757)	(0.082)	(0.115)	(0.117)	(0.131)	(0.122)	(0.153)	(45.657)	(15.208)	(13.559)
Mean Dep. Var	0.883	4.307	2.245	0.073	0.546	0.383	0.189	0.642	0.509	230.333	167.879	129.259
Observations	52	53	53	40	41	41	53	53	53	9	33	27

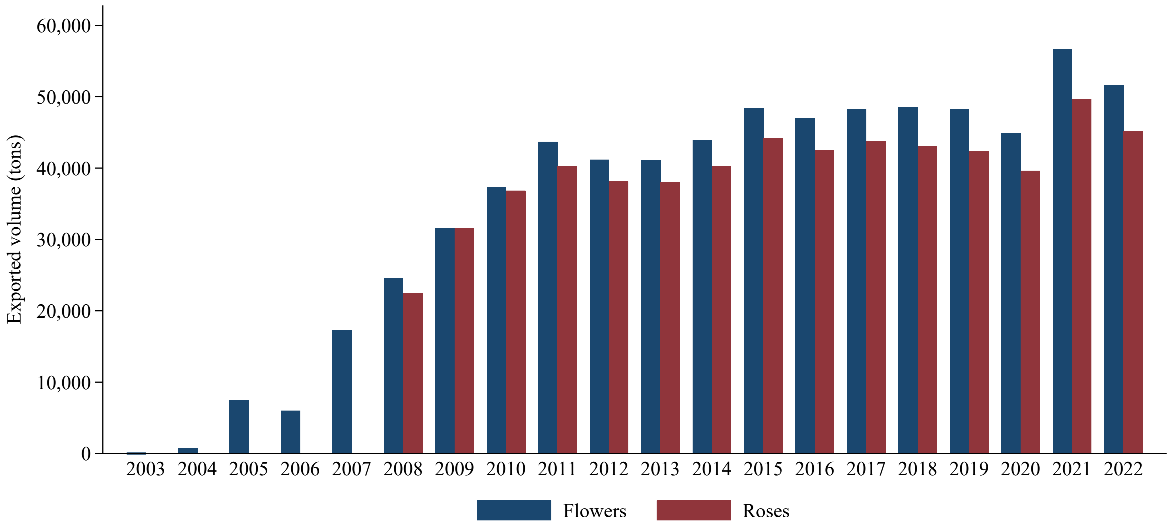
Note: The table compares rose variety production between foreign and domestic firms based on a 2008 survey. Columns 1-3 detail the differences in land allocation for Sweetheart (SW), Intermediate (IM), and Tea-Hybrid (TH) varieties. Columns 4-6 show the share of land dedicated to each variety, while Columns 7-9 indicate whether firms produce each variety (as a dummy variable). Finally, Columns 10-12 present the average yield (stems per square meter) for each variety, conditional on production. Robust standard errors in parentheses. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively.

Table A.8: Differences in Production setting by Foreign and Domestics Firms

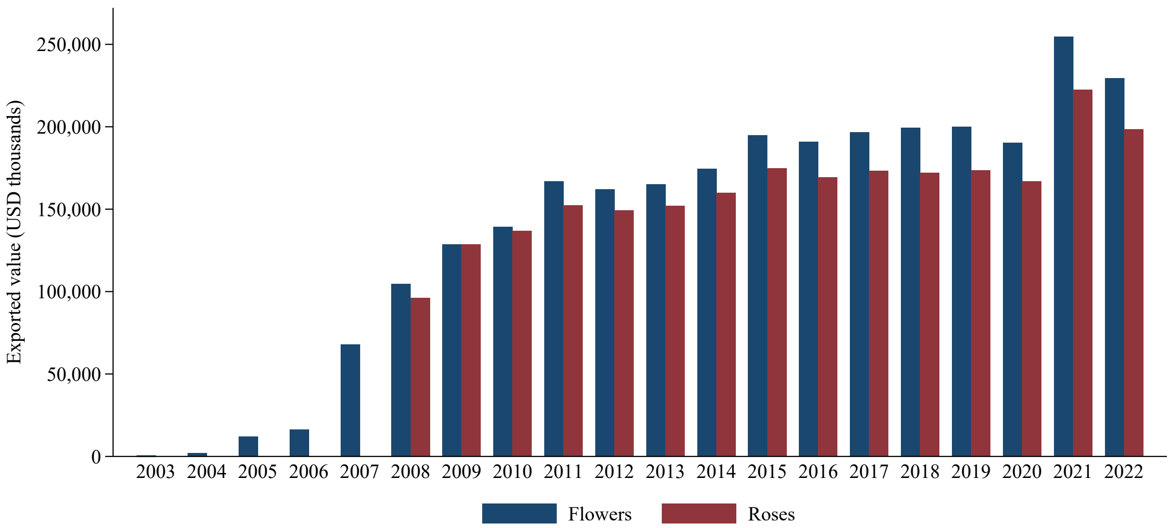
Dependent Variable:	Altitude	Land (has) GH	Rej. Rate	Importance for quality control (scale 0-4)					% Local	
				Feedback	Seedlings	Phyto. Insp.	Sorting	Ext. Insp.	Fertilizers	Chemicals
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I[Domestic]	82.83	-1.10	-0.32	0.55***	-0.18	0.02	0.45***	0.32	19.58	16.06
	(128.67)	(1.80)	(0.91)	(0.20)	(0.39)	(0.34)	(0.14)	(0.45)	(14.51)	(14.78)
Mean Dep. Var	2064.94	8.53	2.89	3.47	3.40	3.32	3.68	2.04	32.40	34.90
Observations	53	53	51	53	53	53	53	53	52	52

Note: The table compares various farm characteristics and quality control practices between foreign and domestic firms based on 2008 survey. Column 1 indicates the altitude of the farm (in meters above sea level). Column 2 shows the land covered by greenhouses for flower production. Column 3 compares the rejection rate (% in terms of quantity) at export destination. Rejection rate was winsorized at 5 and 95 percentiles. Columns 4-8 assess the importance of various quality control measures in the business, rated on a scale from 0 (not important) to 4 (critical importance). Column 4 evaluates the presence of quality control staff who gather feedback on flower quality from buyers. Column 5 focuses on the use of high-quality seedlings. Column 6 addresses the conduct of phytosanitary inspections to ensure pre- and post-harvest quality control. Column 7 looks at the regular sorting of damaged and diseased flowers, while Column 8 examines the practice of inviting external periodic inspections. Columns 9 and 10 report the percentage of local fertilizers and chemicals used in 2007, respectively. Robust standard errors in parentheses. The stars next to the estimate, *, **, ***, represent statistical significance at a .10, .05, and .01 level, respectively.

B.2 Figures



a) Volume



b) Value

Figure A.1: Flowers Exports Ethiopia

Source: International Trade Center

Note: Panel a) illustrates the volume of exported flowers and roses, while panel b) delineates their respective values in US Dollars in yearly basis. Flowers, categorized under code 603, encompass cut flowers and flower buds suitable for bouquets or ornamental purposes, whether fresh, dried, dyed, bleached, impregnated, or otherwise prepared. Roses (code 60311) specifically denote fresh cut roses and buds suitable for bouquets or ornamental use. Data pertaining to roses is solely accessible from 2008 onwards.

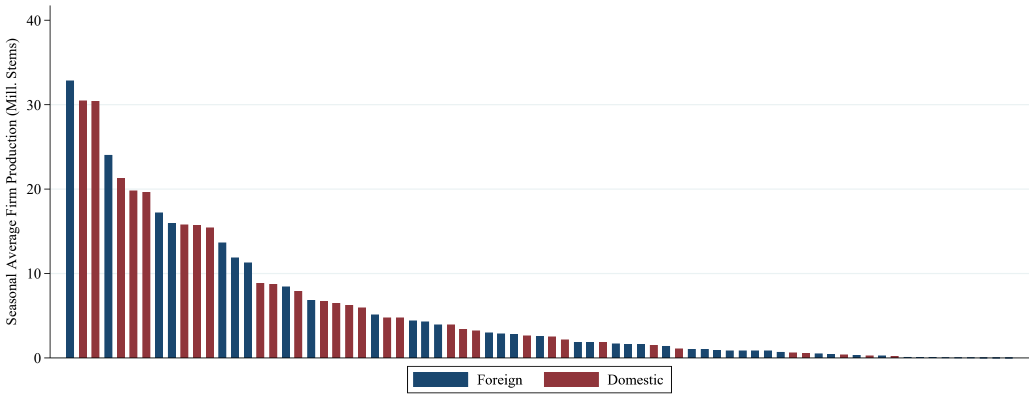


Figure A.2: Firm Production by Ownership Type

Note: The figure depicts the seasonal average total firm production, ordered from largest to smallest, and indicates whether each firm is domestic or foreign. The values are expressed in millions of flower stems.

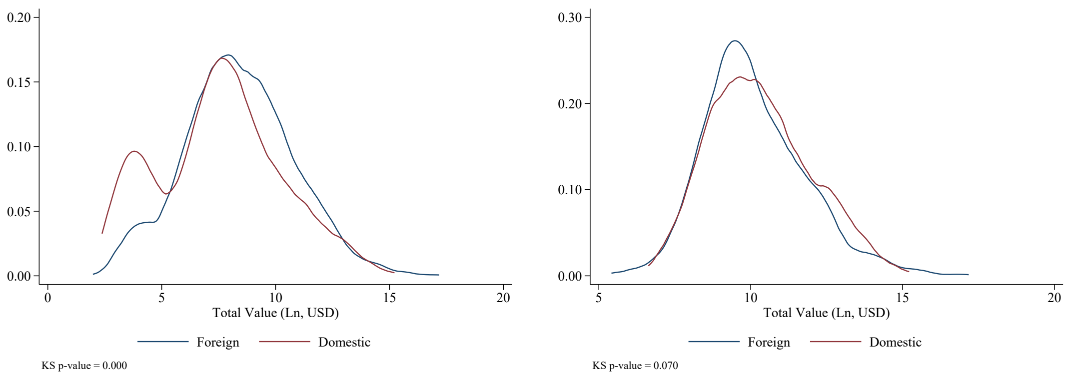


Figure A.3

Note: The figures display the Kolmogorov–Smirnov equality-of-distributions test of the total value of transactions in a relationship comparing foreign and domestic producers. The left-hand side includes all direct transactions, while the right-hand side includes only relationships that have passed the third shipment. The total value is expressed in the natural logarithm of USD.