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Learning, Incomplete Contracts and Export Dynamics: Theory and Evidence from French Firms

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Learning, Incomplete Contracts and Export Dynamics: Theory and Evidence from French Firms

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Abstract

We consider a model where exporting requires finding a local partner in each market. Contracts are incomplete and exporters must learn the reliability of their partners through experience. In the model, export behavior is state-dependent due to matching frictions, although there are no sunk costs. Better legal institutions alleviate contracting frictions especially in sectors with large contracting problems. Thus, measures of legal quality have a greater positive impact on state dependence and reduce hazard rates by more in those sectors that are more exposed to hold-up problems. Moreover, hazard rates decline with relation age, as unreliable partners are weeded out. We find strong evidence in favor of the model's predictions when testing them with a French dataset which includes information on firm-level exports by destination country.

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Keywords: Trade Dynamics, Learning, Incomplete Contracts,
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1 Introduction

How do firms establish new export relations and what determines the dynamics of exports at the firm level? Finding convincing answers to these questions is important for trade theorists and policy makers alike. While the former try to assess which trade model adequately describes export dynamics, the latter would like to understand which policies are effective for promoting exports.

The most prominent models of export dynamics rely on sunk fixed cost to enter the export market. Such costs can explain why only few very productive firms export (Melitz (2003)), why firms' export status is very persistent over time and why the probability that a firm exports is determined primarily by its past export status (see Roberts and Tybout (1997) among others). However, a growing number of micro studies on export dynamics (Eaton, Eslava, Kugler and Tybout (2007), Buono, Fadinger and Berger (2008), Lawless (2009)) has revealed evidence that is at odds with this view.

First, export values are usually small when a firm breaks into a new market. Second, most export flows have a very short duration (one or two years), few survive for a longer period and these grow fast. This leads to hazard rates that are sharply decreasing with duration and fast growing export values conditional on survival. Finally, a novel stylized fact, which we uncover in the present paper, is the positive relation between persistence of export flows and the quality of legal institutions in the destination country.

We argue that it is crucial to consider that exports at the firm level are relationship-specific in order to explain these observations. Most exporters neither sell a perfectly homogeneous good that can be sold in an organized exchange nor do they own a distribution network in the export destination. As a consequence, exporters need to rely on partners in each market. These are either trade intermediaries, distributors that locally market the exporter's product or foreign firms that import the exporter's product to use it as an intermediate input.

In our model, firms that want to start exporting to a specific country have to search for a partner in that destination. When an exporter is matched with an importer, she is initially uncertain about the importer's reliability. Contracts are incomplete, so that some partners may try to hold-up the exporter. Whether an importer has incentives to do so depends on the value of short terms gains from holding up the partner relative to the value of maintaining a long term relation. This depends – among other things – on the importer's type (patient or impatient), the exporter's productivity, the extent of sectoral contracting frictions and the quality of legal institutions in the destination country. Patient importers sufficiently value future profits from any relation so that they respect contracts with all exporters. Differently, impatient importers try to renegotiate contracts *ex post* if contracting frictions are severe (the payoff from renegotiation is large), legal institutions are weak (the opportunity to renegotiate is big) and exporters are relatively unproductive (the expected value of future profits is low). Since exporters have to learn their partners' type through experience, uncertainty is initially large and thus export values are small. As an exporter observes that the contract is respected she becomes more confident that her partner is reliable and the value of exports grows.

The combination of these ingredients leads to several interesting patterns. Here, we focus on the more important ones. First, matching frictions generate persistence (state dependence) of export decisions, even though there are no sunk costs in the model. An exporter is unwilling to give up a partner unless she is sure that the importer is unreliable. Second, better legal institutions make it more likely that a given relation survives from one period to the next. As a consequence, higher legal quality leads to more state dependence and reduced hazard rates. Moreover, this effect is larger the more severe contracting frictions are in a given sector. Similarly, larger destination market size or higher exporter productivity implies that a given relation is more valuable for importers and thus makes it more likely that she will honor the contract. Hence, state dependence is larger (and hazards are lower) in destinations with larger markets and for more productive exporters. Moreover, hazard rates decrease with the age of the relation because partnerships involving unreliable importers are sorted out, while relations with reliable partners survive in the long run.

We use a panel of roughly 7,000 French manufacturing exporters over 13 years to test these predictions. Our dataset allows us to improve upon the econometric methodology of previous research on firm export dynamics (such as Roberts and Tybout (1997), Bernard and Jensen (2004)). This is because we observe the export value of each plant by destination country, while other studies only had information on the plants' aggregate export status available. First, we find that there is strong evidence for state dependence of export decisions that is positively related to institutional quality. Figure 1 illustrates this point. It presents a plot of the estimated effect of past export status on today's export probability by destination country against a measure of legal quality of the destination country.[1] It is apparent that the coefficients of past export status are larger for countries with higher quality of legal institutions. Second, we find that hazard rates of trade flows are positively correlated with the destination countries' legal quality and are strongly decreasing with relation age. Figure 2 visualizes these observations by plotting a non-parametric estimate of the hazard for different quartiles of legal quality. The hazard has a strongly negative slope. While the probability that a trade flow

[1] We use a linear probability model and regress current export status of each plant on the export status in the previous year by destination country. This figure is meant to be purely illustrative. We provide more formal econometric evidence for this relation in the empirical section of this paper.

stops is around 20 percent in the beginning, for trade flows that survive for 9 years the hazard drops to around five percent. Moreover, note that the hazard is lower for higher quartiles of legal quality. Third, export values are initially small and grow with relation age. In Figure 3 we depict box plots by relation age.[2] The figure shows nicely that median export sales are initially very small (around 10,000 euros). As relations get older export values increase substantially.[3]

Our model also has several policy implications. On the one hand, in our model trade is hindered by information frictions. Thus, there is a role for institutional arrangements that improve information available on potential trade partners such as trade fares or trade representations. On the other hand, these frictions are caused by risks exporters face due to contract incompleteness. This rationalizes institutions that try to alleviate these risks, such as export insurance agencies. The model also suggests that export subsidies are not a very effective policy to increase trade flows because exporters are unwilling to increase exports if uncertainty about their partners is large.

Moreover, the model provides a micro-foundation for the sluggish adjustments of exports to changes in the real exchange rate, which was the original motivation for the hysteresis literature of the 1980's. In reaction to a depreciation, both extensive and intensive margins of trade react slowly. The first because of matching frictions and the second because of informational frictions that reduce exporters' willingness to increase their exports fast. Similarly, exporters are reluctant to give up established relations in reaction to an appreciation of the real exchange rate.

We now turn to a discussion of the related literature. While there is a growing body of research on the firm-level dynamics of exporting, we are not aware of an alternative explanation that can explain all the empirical facts emphasized in this paper. A large empirical literature, which builds on the classical hysteresis models by Baldwin and Krugman (1989) and Dixit (1989), focuses on sunk costs as the main reason for state dependence of exporting decisions. The seminal contribution is Roberts and Tybout (1997) using data on Colombian exporters, followed, among other studies, by similar evidence for the US by Bernard and Jensen (2004). These papers estimate reduced form models for export decisions and show that past export status is an important predictor for current export status. In an influential study, Das, Roberts and Tybout (2007) perform a structural estimation of a model with heterogeneous firms and sunk costs to quantify the size of sunk entry costs to start exporting. They estimate these costs to be substantial for Colombian exporters (around $US 400,000). More recently,

[2]The box plot depicts the median and the 25th and 75th percentile of the distribution of export values, as well as the minimum and maximum export value. Note that the distribution has a long right tail, with most of the mass of the distribution being concentrated at very low values.

[3]Similar evidence has also been reported by Eaton et al. (2007) for Colombian exporters.

Ruhl and Willis (2008) show that the standard model of firm heterogeneity with sunk costs predicts too large export values upon entry and hazard rates that are increasing over time, which is at odds with the empirical evidence. The intuition for these counterfactual predictions is that in such a model firms enter the export market when they have very good productivity draws which enable them to overcome the sunk cost entry hurdle.

Another line of research is motivated by the empirical observations that: entry into export markets usually occurs with small values; and that hazards are declining with relation age. To explain these facts, Eaton, Eslava, Krizan, Kugler and Tybout (2008a) develop a model of Bayesian learning. In this setting, firms are initially uncertain about their demand in the exporting market and therefore start small. If they discover that demand is large they spend resources in order to reach more consumers and their exports grow fast. This idea is related to our paper but – since firms sell directly to consumers – their model remains silent on the role of institutions and contractual frictions for export dynamics.[4]

Our paper is also very related to the literature on relationship-specific trade. In Rauch and Watson (2003) importers are uncertain about the reliability of foreign suppliers. They test the waters by initially placing small orders, which are followed by large orders if the test is successful. This leads to small import values at the beginning of the import relation that grow as the relation matures. Besedes and Prusa (2006) find empirical support for this story using highly disaggregated product level import data for the US.

The paper most closely related to our model is Araujo and Ornelas (2007). They consider a model where exporters have to match with a distributor, whose type is unknown and has to be learned through experience. Export values are initially small and increase as exporters become more confident about the reliability of their partners. They also study the role of institutions on firm-level and aggregate trade flows. Our modeling approach borrows the basic setup and mechanics from Araujo and Ornelas (2007). Nonetheless, our model differs from theirs in several respects. First, we focus on incomplete contracts, while they assume that goods are shipped before they are paid, so that importers have the opportunity to cheat on exporters.[5] More importantly, we add firm heterogeneity in terms of marginal costs to their homogeneous firm model. This is crucial because most of our empirical predictions hinge on firm heterogeneity. Finally, we allow sectors to differ in the extent of their contracting frictions. Taken together, these modifications allow us to obtain a set of predictions that focus on the interaction

[4] Other related papers are Segura-Cayuela and Vilarrubia (2008) and Albornoz, Pardo, Corcos and Ornelas (2009), who focus on learning from other exporters (export destinations).

[5] In our empirical investigation we found no evidence that trade credit has any robust effect on state dependence or hazard rates.

of persistence with market size, productivity and legal quality and to exploit also the cross-sectoral variation of our data in the empirical section. Most importantly, our main contribution is the careful empirical test of the model's predictions with regard to export dynamics.

Finally, there is a connection with the substantial literature on trade and firm organization based on incomplete contracts (Antras (2003)). Using that approach, Felbermayr and Jung (2009) study the role of importers and incomplete contracts in a model with heterogeneous firms and choice of different export modes but they do not investigate export dynamics.

Summing up, the contribution of our paper is to provide a micro-foundation for the dynamics of exporting at the firm level that highlights the importance of both informational and contracting frictions. Our model generates state dependence of exporting decisions without relying on sunk costs, while also being consistent with other stylized facts on exporting dynamics. In addition, the model has implications for the interaction between state dependence/hazard rates and the quality of legal institutions that differentiate it from alternative explanations. We show that these predictions are strongly supported by empirical evidence.

In the next section we motivate our assumptions on relationship-specificity of exports and discuss the model. We also derive a set of testable predictions. In section 3 we present the data and test the predictions derived in the theory section. The final section concludes.

2 A Model of Exporting and Learning

In standard trade models exporting is not different in nature from being active in the domestic market – firms can directly sell their goods to consumers. In reality, however, exporters usually sell their products to a very small number of importers in each foreign market. These are either distributors who locally market and sell the exporters' products, trade intermediaries, or foreign firms that use these products as intermediate inputs.

Empirically, many – especially smaller – exporters use importers to sell their goods in foreign markets. Few products are sufficiently standardized in order to be sold on an organized market. Thus, if an exporter wants to penetrate a foreign market she can either market the product herself – which entails substantial costs for getting to know the local business environment and setting up a distribution network – or it has to rely on a local partner. One type of firm that specializes in bringing exporters and potential importers together are trade intermediaries. These agents are familiar with the local legal framework, social norms and have established relations with potential customers. Felbermayr and Jung (2009) report that around half of German exporters use trade intermediaries in order to export their goods. The importance of trade intermediation for exporting is also highlighted in the business literature (Peng and Ilinitch (1998)).

Turning to the evidence on trade in intermediate goods, a typical OECD country imports around 40% of its manufacturing inputs (WTO (2008)) and in 1995 at least 10-20% of OECD countries' imports in manufacturing consisted of intermediate inputs (Yeats (1998)).

In both cases – exports of final goods through an importer and exports of intermediate inputs to a local firm – trade is relationship-specific, since it involves a bilateral relation between an exporter and an importer. Hence, we emphasize that our model encompasses both forms of trade relations, even though we will focus on the first interpretation.

Regarding evidence on the relationship-specificity of trade, Eaton et al. (2008a) combine Colombian firm-level export data with US import data and show that each Colombian exporter is involved in a very small number of trade relations with the US. On average, Colombian firms that export to the US have 1.4 trade relations in the US, 80% of Colombian exporters to the US have only one relation and 90% at most two relations, providing strong support for the hypothesis that most trade is relationship-specific. In our model, we abstract from direct exports to consumers, setting up a distribution network and other forms of intra-firm trade, an option that is viable only for very large exporters because it requires substantial amounts of fixed investments.[6]

Informational frictions about the quality and reliability of local partners are important obstacles for exporters, who want to establish in new markets. For example, the U.S. department of commerce (U.S. Commerce Department (2000)) advises that "a proper channel of distribution needs to be carefully chosen for each market," warning potential exporters that they "should investigate potential representatives or distributors carefully before entering into an agreement." Some local partners may behave opportunistically if they have incentives to do so and this depends to a large extent on the quality of the local legal system. Reputation may help to overcome institutional weaknesses, but it takes time to build up. We now turn to a description of the model.

2.1 Setup

Consider an economy with two countries, Home and Foreign, and many sectors $j = 1, ..., J$.

In Home there is a measure $M >> 1$ of infinitely lived producers in each sector j, which discount the future at rate β_E. Producers, indexed by f, face a constant marginal cost c to produce,[7] which is firm-specific and drawn from a distribution $G(c)$ with support on $(0, \infty)$. Each firm produces a

[6]Felbermayr and Jung (2009) report that only 4% of German exporters have wholesale affiliates.

[7]We omit indices for notational ease whenever this does not cause confusion.

differentiated variety and is a monopolist for that specific variety. If a producer wants to export she cannot sell her goods directly to Foreign consumers but needs to form a partnership with an importer located in Foreign.

Since we are mainly interested in the formation of export relations and because the export decision is independent of the behavior in the domestic market (as marginal costs are constant), we disregard the activities of producers in their domestic market.

In each sector, Foreign aggregate demand for each variety produced by a Home exporter is described by a constant price elasticity demand function $q(p) = Ap^{-\varepsilon}$, where A is a summary measure of Foreign market size in sector j.[8]

In each sector, Foreign is populated by a measure one of infinitely lived firms that can distribute goods produced by Home producers to Foreign consumers, which we call importers.[9] Each of them can sell any imported good in that sector to Foreign consumers but cannot distribute more than one good simultaneously. Importers may be of two types that differ in terms of their discount factor. There are patient importers, indexed by H, with discount factor β_H and impatient importers, indexed by L, with discount factor β_L, where $\beta_L < \beta_H$. The type of the importer $\in \{H, L\}$ is private information. The fraction of impatient importers in the population is θ_0 in each sector.

In every period, exporters and importers that are not in an export relation decide whether to look for a partner or to remain inactive. We assume that exporters are in excess supply, so that the number of exporters that can find an importer is limited by the measure of importers.[10] If importers decide to search for a partner they meet an unmatched exporter with exogenous probability x.

Before a partnership is formed, exporters' marginal cost is unobservable to importers, so that matching occurs randomly. Only once matched, the importer discovers the marginal cost of her partner. At the beginning of every period, matched exporters and importers can both decide whether to maintain the partnership or to dissolve it. If they decide to dissolve it, both the exporter and the importer cease to be active and are replaced by another set of firms of the same type.[11]

[8]Such a demand function can be derived in an environment where Foreign consumers love variety and have Dixit-Stiglitz preferences. We take the Foreign price index and expenditure on each sector as given, implicitly assuming that the share of Home exporters in Foreign is small so that their impact on the sectoral price level in Foreign is negligible.

[9]Alternatively, importers can be interpreted as Foreign manufacturing firms that import intermediate inputs.

[10]This assumption simplifies some of the algebra but is not important for the main results. We could alternatively assume that importers are in excess supply.

[11]The assumption that exporters and importers cannot reenter the pool of unmatched firms simplifies some of the analysis but is innocuous given that in equilibrium the pool of available importers and exporters deteriorates weakly over time. Thus, importers and exporters never have an incentive to wait for a better partner or to break a relation because the available pool of partners has improved.

In each period – if they decide to continue the relation for another period – the partners write a simple one period contract. The contract specifies an export quantity and an exogenous split of current period's surplus.[12] The exporter receives an exogenous fraction α of the current surplus and the remaining fraction goes to the importer. The surplus consists of the revenue of exporting minus the fixed cost to export. In the next stage, exporters produce the quantity of goods specified in the contract and pay the fixed cost and importers make a transfer equal to their fraction of the fixed cost. After that, the importer may try to hold up the exporter by renegotiating the split of current revenues if it pays off to do so. Importers can make a take-it-or-leave-it offer in order to appropriate an additional sector-specific fraction $\gamma_j \in [0, 1]$ of the part of current revenues that the contract originally assigned to the exporter. γ_j measures how sensitive a sector is to hold-up problems. This depends on whether the good has been specifically designed for the export market. The exporter's outside option is to sell the good through a partner in the domestic market with the same split of the revenues but for a fraction $(1 - \gamma)$ of the original price. The lower price in the domestic market reflects the extent to which the good has been tailored to the export market. If $\gamma_j = 0$ the importer cannot appropriate any of the exporter's share of revenues if she tries to renegotiate because the exporter could easily sell the good in the domestic market for the same price as in the current relation. If $\gamma_j = 1$, on the other hand, the good is worthless outside the relation and the importer can appropriate all the revenues by renegotiating the contract. We assume that the exporter always accepts the importer's proposal since she is indifferent between accepting and her outside option.

Moreover, the possibility to renegotiate the contract also depends crucially on the quality of the Foreign legal system, λ. If an attempt of renegotiation is made, it is successful with probability $(1-\lambda)$, otherwise the original contract is respected.[13] We assume that only successful renegotiation attempts are observed by the exporter. In the last stage, the exporter ships the quantity of goods specified in the contract, goods are sold and the importer transfers a fraction of revenues to the exporter.

Finally, at the end of each period there is a positive probability of exogenous separation, $s \in [0, 1]$.

[12] Since we want to focus on the role of reputation for trade relations we do not allow for contracts that can be used to screen between patient and impatient importers.

[13] An alternative interpretation for this setup is that importers may try to default on exporters and run away with the revenues from the sales of shipped goods. This requires that shipments are made before goods are paid (trade credit). If importers try to default, they can steal a fraction γ_j of revenues and are successful with probability $(1 - \lambda)$. Here λ is again a measure of the quality of the local legal system. We prefer the explanation given in the main text since in the empirical section we focus on the incomplete contract interpretation of our setup.

2.2 Nash Equilibrium

In this section we study a perfect Bayesian Nash equilibrium of the game between exporters and importers described above that involves the following considerations.

In each period t potential exporters decide whether to enter the export market in order to search for a partner. If an unmatched exporter meets an importer she decides optimally whether to accept the partner or to continue search given her marginal cost, her belief about the partner's type and the strategies of the importers. Any exporter that has a partner decides at the beginning of each period whether to continue the relation for another period or to terminate it given her beliefs about the type of the importer. If she decides to continue the relation, she chooses the optimal quantity to export given her marginal cost c, her beliefs about the type of the importer and the strategies of the importers.

Importers face a similar set of decisions. If an importer meets an exporter she decides optimally whether to accept this match and to form an export relation or to continue search given her belief about the partner's type and exporters' strategies. An importer that has a partner decides optimally whether to try to renegotiate or to honor the contract given her type, the exporter's marginal cost and her strategy.

Even though in this infinite-horizon setup many perfect Bayesian Nash equilibria exist, we focus on a Markov-perfect equilibrium, which is especially plausible because of its simplicity. In any period, beliefs about the importers' type, which follow a Markov process, are sufficient to describe the current state. Equilibrium strategies of exporters and importers depend only on current beliefs and on current actions.

Given this, the equilibrium is characterized as follows: Exporters enter the export market as long as they expect to make non-negative profits in expectation given their marginal cost, their beliefs, and the importers' strategies. Impatient and patient importers as well as exporters initially accept any match. Once a match is formed, impatient importers try to renegotiate contracts with unproductive exporters and honor contracts with sufficiently productive exporters – they try to renegotiate the contract if and only if $c > \bar{c}_t$. Patient importers, on the other hand, always honor their contracts with any type of exporter. Exporters who have a partner choose the optimal quantity to export given the split of the surplus, their beliefs about the type of their partner and the strategy of importers. Having observed the behavior of their partners, exporters update their belief about the type of the importer at the end of the period using Bayes' rule. Finally, exporters terminate a relation if and only if they observe that the contract has been renegotiated.

These equilibrium strategies and beliefs imply that sufficiently productive exporters are indifferent to the type of their partner, while less productive exporters fear that an impatient partner will hold them up if she has the chance. Since exporters cannot distinguish between patient and impatient importers unless they observe that the contract is renegotiated successfully, they stick to the importer as long as the contract is respected. The longer importers have honored their contracts, the more confident exporters become that their partner is patient.

We now analyze this equilibrium in more detail. Most proofs are relegated to the Appendix. We start out with the evolution of beliefs.

2.2.1 Beliefs

In equilibrium, exporters maintain a partnership as long as they are not certain that their partner is impatient. Every period they update their beliefs about the probability that their partner is impatient according to Bayes' rule.

Let $\tilde{\theta}$ be the exporter's subjective probability that the importer is impatient and therefore might not honor the contract. The subjective probability of an exporter with $c > \bar{c}$ that the importer is impatient conditional on having observed a violation of the contract and given the equilibrium strategies of importers is $\tilde{\theta}(v) = 1$, while the probability conditional on having observed that the contract was respected in the previous period is $\tilde{\theta}(r) = \frac{Prob(L \cap r)}{Prob(r)} = \frac{\lambda\tilde{\theta}}{\lambda\tilde{\theta}+1-\tilde{\theta}} < \tilde{\theta}$, since impatient importers honor their contracts with exporters with $c > \bar{c}$ with probability λ. The subjective probability for an exporter with $c \leq \bar{c}$ that the importer is impatient if the contract is not respected can in principle be anything, since contracts with these exporters are always respected in equilibrium. Hence, we assume that this probability equals one, which sustains maximal cooperation. If no renegotiation occurs this does not reveal any information on the type of the importer to the exporter, so $\tilde{\theta}(r) = \tilde{\theta}$. More generally, let $\tilde{\theta}_{it}$ be the subjective probability of an exporter with $c > \bar{c}$ that the importer is impatient in a relation of age i that started in period t, then $\tilde{\theta}_{it} = \frac{\lambda^i\tilde{\theta}_{0t}}{\lambda^i\tilde{\theta}_{0t}+1-\tilde{\theta}_{0t}}$ if no renegotiation has occurred for any $i \in \{0, ..., i-1\}$ and $\tilde{\theta}_{it} = 1$ else.

In equilibrium, beliefs must be consistent with actual probabilities to get an impatient partner, such that initial subjective probabilities equal the true fraction of impatient importers in the measure of unmatched importers that are searching for an exporter, $\tilde{\theta}_{0t} = \theta_{0t}$. Next, we determine the exporters' optimal strategies given the strategies of importers and exporters' beliefs.

2.2.2 Exporters

In every period, each exporter chooses the optimal export quantity given her type c, her belief about the type of the importer and the importers' strategies. Remember that in the Nash equilibrium we are considering, impatient importers try to renegotiate the contracts with firms with $c > \bar{c}_t$ and that renegotiation is successful with probability $1 - \lambda$.

The maximization problem of any exporter with $c > \bar{c}_t$ is therefore given by

$$\max_p \Pi(\tilde{\theta}, c > \bar{c}_t) = \max_p \alpha\{\tilde{\theta}[\lambda + (1-\lambda)(1-\gamma)] + (1-\tilde{\theta})\}p^{1-\varepsilon}A - p^{-\varepsilon}Ac - \alpha f. \tag{1}$$

These exporters face an impatient importer with subjective probability $\tilde{\theta}$, who does not respect the contract with probability $(1-\lambda)$. If the importer does not stick to the contract she can appropriate a fraction γ of the exporter's share of revenues. Variable production costs and a fraction α of the fixed costs always have to be incurred by the exporter.

The optimal price and quantity for these exporters are given by $p^*(\tilde{\theta}_t, c > \bar{c}_t) = \frac{\varepsilon}{\varepsilon-1}\frac{c}{\alpha[1-\tilde{\theta}\gamma(1-\lambda)]}$, $q^*(\tilde{\theta}_t, c > \bar{c}_t) = \left\{\frac{\varepsilon-1}{\varepsilon}\frac{\alpha[1-\tilde{\theta}\gamma(1-\lambda)]}{c}\right\}^{\varepsilon} A$.

Total revenue is given by $Rev^*(\tilde{\theta}_t, c > \bar{c}_t) = \left\{\frac{\varepsilon-1}{\varepsilon}\alpha[1-\tilde{\theta}\gamma(1-\lambda)]\right\}^{\varepsilon-1} c^{1-\varepsilon}A$, while exporters' profits are $\Pi^*(\tilde{\theta}_t, c > \bar{c}_t) = \frac{\alpha}{\epsilon}[1-\tilde{\theta}\gamma(1-\lambda)]Rev^*(c > \bar{c}_t) - \alpha f$.

Note that prices are inefficiently high while export quantities and revenues are too low compared with a monopolist who can directly export his product to Foreign. This reflects the facts that exporters face the full marginal costs of production while receiving only a fraction α of revenues and their uncertainty about the importer's type. Ceteris paribus, an improvement in the quality of legal institutions (higher λ) increases export quantities and revenues because it implies less uncertainty about the exporter's behavior.[14] Moreover, more severe contracting problems (higher γ) lower export quantities and revenues, since exporters have more to lose in the case of successful renegotiation.

Similarly, the maximization problem of exporters with $c \leq \bar{c}_t$ is

$$\max_p \Pi(c \leq \bar{c}_t) = \max_p \alpha p^{1-\varepsilon}A - p^{-\varepsilon}Ac - \alpha f, \tag{2}$$

with solution $p^*(c \leq \bar{c}_t) = \frac{\varepsilon}{\varepsilon-1}\frac{c}{\alpha}$, $q^*(c \leq \bar{c}_t) = \left(\frac{\varepsilon-1}{\varepsilon}\frac{\alpha}{c}\right)^{\varepsilon} A$, total revenues $Rev^*(c \leq \bar{c}_t) = \left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} c^{1-\varepsilon}A$ and profits $\Pi^*(c \leq \bar{c}_t) = \left(\frac{\alpha}{\varepsilon}\right) Rev^*(c < \bar{c}_t) - \alpha f$.

These exporters charge lower prices and sell higher quantities than exporters with $c > \bar{c}_t$ both because they are more productive and because they face no risk that impatient importers may violate the contract.

[14] There is also an indirect effect of λ through its impact on equilibrium beliefs, $\tilde{\theta}$, which are increasing in λ.

The implication of incomplete information is that the longer exporters observe no contract violation, the more confident they become that their partner is patient. As a consequence, they put more at stake and increase the quantity they export. At the same time, for firms with $c \leq \bar{c}$ learning plays no role because even impatient importers honor their contracts with these exporters. Thus, we can state the following lemma.

Lemma 1: *Export revenues are increasing in the age of the relation as long as $c > \bar{c}_t$ and constant for $c \leq \bar{c}_t$.*

Proof:

Note that as long as $c > \bar{c}_t$, $\tilde{\theta}$ is decreasing in i and revenues are decreasing in $\tilde{\theta}$. Hence, revenues are increasing in i. For $c \leq \bar{c}_t$ there is no learning and therefore revenues are independent of the relation's age.

We assume that for all $\lambda < 1$, $\gamma > 0$ exporters expect to make losses in every period if their subjective probability that their partner is impatient equals one and impatient importers violate the contract if they can: $\Pi(v, \tilde{\theta} = 1, c) = Ac^{1-\varepsilon}(\varepsilon - 1)^{\varepsilon-1}[\lambda + (1-\lambda)(1-\gamma)]^{\varepsilon} \left(\frac{\alpha}{\varepsilon}\right)^{\varepsilon} - \alpha f < 0$. We also make the assumption that there exists a $c^* > 0$ such that for all $c \leq c^*$ it holds that $\Pi(r, \tilde{\theta} = 0, c \leq c^*) = Ac^{1-\varepsilon}(\varepsilon - 1)^{\varepsilon-1} \left(\frac{\alpha}{\varepsilon}\right)^{\varepsilon} - \alpha f \geq 0$. This means that sufficiently productive exporters make profits in each period when they believe that importers are patient with probability one and patient importers respect contracts.

Next, define $\theta^*(c)$ as the level of θ such that exporters with $c > \bar{c}_t$ make zero per period profits given their marginal cost c and importers' equilibrium strategies: $\Pi(c, \theta^*(c)) = 0$. Then we can state the following lemma:

Lemma 2: *Let $\tilde{\theta}_{0t}$ be non-decreasing in t. Then given importers' equilibrium strategies and exporters' equilibrium beliefs there is a unique value $\bar{\theta}(c) \in [\theta^*(c), 1)$ such that for all t an exporter with marginal cost $c > \bar{c}_t$ accepts any importer she meets as long as $\tilde{\theta}_{0t} \leq \bar{\theta}(c)$. Moreover, she maintains a partnership if and only if the importer does not violate the contract. Exporters with $c \leq \bar{c}_t$ accept any partner for $\tilde{\theta}_{0t} \in [0, 1]$ and maintain a partnership as long as the importer does not violate the contract given importers' equilibrium strategies and exporter's equilibrium beliefs.*

Proof: See Appendix.

Lemma 2 states that given her marginal cost an exporter only enters if her belief about the probability of meeting an impatient importer is sufficiently low. Moreover, if the exporters' subjective probability at the beginning of the relation that the importer is impatient is weakly increasing over time, it never pays off to wait for a better partner. The reason is that the expected value of finding a partner in the future is lower than the one of finding a partner today because exporters' per period profits and the probability for the relation to survive are decreasing in initial beliefs $\tilde{\theta}_{0t}$. In addition, an exporter sticks to any importer as long as she does not observe a violation of the contract. This is because as long as the contract is respected, she cannot be certain whether her partner is patient or whether the importer has not managed to violate the contract even though she tried to. Each time an importer honors the contract, the exporter becomes more confident that her partner is patient and increases exports, which in turn increases the value of the relation. Consequently, it does not make sense to terminate a relation before a violation of the contract occurs. Very productive exporters with $c < \bar{c}$, on the other hand, do not fear that contracts are not respected by impatient importers. Thus, their beliefs about the probability that their partner is impatient do not influence their decision to form a relation.

The least productive exporter that enters the export market and accepts an importer makes zero profits in expected terms. This defines a cutoff marginal cost $\tilde{c}_t$ such that $\tilde{\theta}_{0t} = \bar{\theta}(\tilde{c})$. Thus exporters accept a match if and only if $c \leq \tilde{c}_t$.

To make things interesting, we assume that $\tilde{c}_t > \bar{c}_t$. Since impatient importers try to violate contracts with exporters with $c \geq \bar{c}_t$, the cutoff marginal cost level is implicitly defined by the following zero profit condition:

$$V_E(\tilde{c}_t, \tilde{\theta}_{0t}) = \Pi(\tilde{c}_t, \tilde{\theta}_{0t}) + \sum_{i=1}^{\infty} (\beta_E(1-s))^i \Pi(\tilde{c}_t, \tilde{\theta}_{it}) \prod_{j=0}^{i-1} (1 - \tilde{\theta}_{jt} + \tilde{\theta}_{jt}\lambda) = 0. \tag{3}$$

Here, $V_E(\tilde{c}_t, \tilde{\theta}_{0t})$ is the value function for a match for exporters with $c = \tilde{c}_t$. Future profits are discounted by the exporters' discount factor β_E, the probability of no exogenous separation occurring, $1 - s$ and the subjective probability that the contract is not violated before the relation reaches age i, $\prod_{j=0}^{i-1}(1 - \tilde{\theta}_{jt} + \tilde{\theta}_{jt}\lambda)$. This means that the least productive firms that match are willing to incur initial losses because if contracts are respected export revenues grow over time and allow these firms to break even in expectations. The following lemma summarizes the free entry condition.

Lemma 3: *Given equilibrium strategies and beliefs there is a $\tilde{c}_t$ such that exporters enter the export market if and only if $c \leq \tilde{c}_t$.*

Since per period profits, $\Pi(\tilde{c}_t, \tilde{\theta}_{it})$, and the probability that the relation survives until age i, $\prod_{j=0}^{i-1}(1 - \tilde{\theta}_{jt} + \tilde{\theta}_{jt}\lambda)$, are both decreasing in the subjective probability that the partner is impatient in the period of the match, $\tilde{\theta}_{0t}$, we can establish the following:

Lemma 4: *Let $\tilde{\theta}_{0t}$ be non-decreasing in t. Then the cutoff marginal cost $\tilde{c}_t$ is non-increasing in t.*

Having described the exporters' equilibrium strategies, we now turn to importers.

2.2.3 Importers

Initially, importers accept any partner because they do not observe the exporters' marginal cost before they match and because the value of waiting is always smaller than the value of accepting a partner today. This is because the expected value of a match is decreasing over time for two reasons: first, the surplus from any relation decreases the later the relation starts because exporters' initial subjective probability that importers are impatient increases; second, the expected marginal cost of unmatched exporters, $E_t(c)$, increases over time and this reduces per period expected surplus. Lemma 5 summarizes this behavior.

Lemma 5: *Let $\tilde{\theta}_{0t}$ be non-decreasing in t and let $E_t(c)$ be non-decreasing in t. Then, given the equilibrium strategies and beliefs, importers initially accept any partner.*

Proof: See Appendix.

In equilibrium, impatient importers honor contracts with low cost exporters and try to violate contracts with high cost exporters. Given a sufficiently high level of patience, β_L, renegotiating contracts with productive exporters is not profitable because the loss of future shared revenues is too large compared to current profits from violating the contract. Differently, when impatient importers face a less productive partner, future surplus from the relation is not large enough to compensate for impatience, so impatient importers try to violate the contract.

Lemma 6: *Given the equilibrium strategies and beliefs and if β_L is sufficiently large, impatient importers try to violate contracts if and only if $c > \bar{c}_t$.*

Proof: See Appendix.

Patient importers, on the other hand, value the future sufficiently in order not to renegotiate contracts with high cost exporters. They would only renegotiate contracts with producers with extremely high marginal costs, which do not enter the export market in equilibrium.

Lemma 7: *Given the equilibrium strategies and beliefs, patient importers honor contracts with all exporters that enter.*

Proof: See Appendix.

2.3 Industry Equilibrium

In this section we determine how the measure of impatient importers that search for an exporter, v_{Lt}, and the measure of patient importers that search for an exporter, v_{Ht}, evolve over time since they determine $\tilde{\theta}_{0t}$ and therefore agents' beliefs. In addition, we establish the evolution of the distribution of unmatched exporters that are searching for an importer, $G_t^u(c)$, which determines $E_t(c)$.

The law of motion for the measure of impatient importers that are searching for an exporter is given by:

$$v_{Lt+1} = (1-x)v_{Lt} + [s + (1-s)(1-\lambda)Pr(\bar{c}_t)](\theta_0 - v_{Lt}) \tag{4}$$

A fraction $(1-x)$ of the population of currently unmatched impatient importers v_{Lt} does not find an exporter and therefore remains inactive. Moreover, a proportion s of the measure of matched impatient importers is dissolved exogenously. Out of the remaining proportion $(1-s)$ of the relations that involve exporters with marginal cost larger than $\bar{c}$, $Pr(\bar{c}_t)$, a fraction $(1-\lambda)$ is dissolved endogenously. $Pr(\bar{c}_t) \equiv \sum_{i=0}^{t-1} \frac{\mu_{it\bar{c}}}{(\theta_0 - v_{Lt})}$ is the total probability that relations involve a partner with $c > \bar{c}_i$ conditional on $c \leq \tilde{c}_i$, taking into account that the threshold marginal cost from which on impatient importers try to violate contracts, $\bar{c}$, depends on time. Here, $\mu_{it\bar{c}} \equiv v_{Li} x \lambda^{t-i-1}(1-s)^{t-i-1}(1-G_i^u(\bar{c}_i))$ is the measure of matches of impatient importers with unproductive exporters formed in period i that survive until period t.

A similar difference equation describes the evolution of the measure of unmatched patient importers:

$$v_{Ht+1} = (1-x)v_{Ht} + s(1-\theta_0 - v_{Ht}) \tag{5}$$

It is easy to show that v_{Lt} and v_{Ht} are both strictly decreasing sequences that converge to $v_L = \frac{\theta_0[s+(1-\lambda)(1-s)Pr(\bar{c})]}{x+s+(1-\lambda)(1-s)Pr(\bar{c})}$ and $v_H = \frac{s}{x+s}(1-\theta_0)$ respectively.

Given the laws of motion (4) and (5), one can show that $\theta_t = \frac{v_{Lt}}{v_{Lt}+v_{Ht}}$ is weakly increasing over time and converges to the steady state value θ_{SS}. The intuition is that relations with impatient importers are dissolved both for exogenous and endogenous reasons, while relations with patient importers are dissolved exclusively exogenously, so that the proportion of impatient in the population of unmatched importers increases over time. This verifies the assumption on $\tilde{\theta}_t$ made in order to derive exporters' and importers' equilibrium strategies.

Lemma 8: *θ_t is weakly increasing in t.*

Proof: See Appendix.

Finally, we turn to the law of motion of the distribution of unmatched exporters. Let $M^u \equiv MG(\tilde{c}) - (1 - v_L - v_H)$ be the measure of unmatched exporters that are looking for an importer.

There are four types of exporters searching for an importer:

- There are $M^u - x(v_L + v_H)$ exporters which do not find an importer. Those have a distribution $G^u(c)$.
- There are $s(1-\theta_0 - v_H)$ exporters that have been exogenously separated from patient importers, with a distribution $G^H(c)$.
- There are $s(\theta_0 - v_L)$ exporters that have been exogenously separated from an impatient importer, with a distribution $G^L(c)$.
- Finally, there are $(1-s)(1-\lambda)(\theta_0 - v_L)$ exporters that have been endogenously separated from an impatient importer, with conditional distribution $\frac{G^L(c) - G^L(\bar{c})}{1 - G^L(\bar{c})} 1_{\{c > \bar{c}\}}$.

Thus, the distribution of unmatched exporters evolves according to the following law of motion:

$$G^u_{t+1}(c) = \left(1 - \frac{x(v_{Lt} + v_{Ht})}{M^u_t}\right) G^u_t(c) + \frac{(1 - \theta_0 - v_{Ht})s}{M^u_t} G^H_t(c) + \frac{s(\theta_0 - v_{Lt})}{M^u_t} G^L_t(c) + \frac{(1-s)(1-\lambda)(\theta_0 - v_{Lt})}{M^u_t} \frac{G^L_t(c) - G^L_t(\bar{c})}{1 - G^L_t(\bar{c})} 1_{\{c>\bar{c}\}} \tag{6}$$

Note that since G^u_t is a c.d.f., $G^u_t(0) = 0$ and $G^u_t(\tilde{c}_t) = 1$. Assume for a moment that $\bar{c}$ and $\tilde{c}$ are independent of time. Then it becomes clear that the pool of unmatched exporters is worsening over time, because the relative mass of unproductive exporters is increasing over time. This is because endogenous destruction of relations with impatient importers occurs only for unproductive exporters (the last term on the right hand side is present only for $c > \bar{c}$), while exogenous separations – which affect both relations with impatient and with patient importers – are random. Thus, the probability mass of the distribution of unmatched exporters shifts toward the right tail over time. This conclusion continues to hold even if $\bar{c}_t$ decreases over time. Hence, the average cost of unmatched exporters, $E_t(c) = \int_0^{\tilde{c}_t} c dG^u_t$, is increasing in t as long as $\tilde{c}$ does not decrease so much that it more than compensates for the shift in the probability mass to the right tail of G_t^u. We assume that this condition holds and that therefore $E_t(c)$ is increasing in t.

Finally, the industry equilibrium is given by the system of difference equations that describe the evolution of unmatched importers, (4) and (5), as well as the law of motion of the distribution of exporters matched with patient importers $G^H(c)$, the law of motion of the distribution of exporters matched with impatient importers $G_L(c)$ and an equation relating the population distribution of productivity to the distribution of matched and unmatched exporters.[15] The last three equations can be found in the Appendix.

2.4 Comparative Statics

Having described the industry equilibrium, we derive a number of comparative statics results that we will test in the empirical section of the paper. Our main interest is to relate export dynamics to firm characteristics (productivity), industry characteristics (the severity of sectoral contracting frictions), destination characteristics (legal institutions, market size) and their interaction. Thus, we now interpret our model as applying to a world with many export destinations. We investigate the effect of firm, industry and destination characteristics on state dependence of export decisions and on hazard rates. For all comparative statics we assume that the economy is in the steady state, which implies that $\bar{c}$ and $\tilde{c}$ are independent of time.

2.4.1 State dependence

Our model predicts that state dependence, defined as the specific effect of having exported to a destination the previous year on the probability of exporting there the current year, is systematically related to firm and destination characteristics. Econometrically, state dependence is captured by the marginal effect of a change in last period's export status (which is either one, if a firm has exported to a destination in the last period or zero otherwise) on current export status conditional on firm and destination characteristics.

Let Y_t be an indicator variable that equals one if firm f exports to destination k in period t and

[15] Thus, this is a system of 5 difference equations in v_L, v_H, $G^H(c)$, $G^L(c)$ and $G^u(c)$. Equation (6) can be recovered from the other equations.

zero otherwise. Given this definition conditional probabilities of exporting are:[16]

$$P(Y_t = 1|Y_{t-1} = 0, c) = \frac{x(v_H + v_L)}{M^u},$$
$$P(Y_t = 1|Y_{t-1} = 1, c, c \in (0, \bar{c}]) = 1 - s,$$
$$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}, \tilde{c}]) = \frac{(1-s)\left[1 + \lambda \frac{(\theta_0 - v_L)}{(1-\theta_0 - v_H)} \frac{g^L(c)}{g^u(c)}\right]}{1 + \frac{(\theta_0 - v_L)}{(1-\theta_0 - v_H)} \frac{g^L(c)}{g^u(c)}}.$$

Thus, state dependence is defined as:

$$P(Y_t = 1|Y_{t-1} = 1, c, c \in (0, \bar{c}]) - P(Y_t = 1|Y_{t-1} = 0, c, c \in (0, \bar{c}]) = 1 - s - \frac{x(v_H + v_L)}{M^u}, \quad (7)$$
$$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}, \tilde{c}]) - P(Y_t = 1|Y_{t-1} = 0, c, c \in (\bar{c}, \tilde{c}]) =$$
$$\frac{(1-s)\left[1 + \lambda \frac{(\theta_0 - v_L)}{(1-\theta_0 - v_H)} \frac{g^L(c)}{g^u(c)}\right]}{1 + \frac{(\theta_0 - v_L)}{(1-\theta_0 - v_H)} \frac{g^L(c)}{g^u(c)}} - \frac{x(v_H + v_L)}{M^u}.$$

From the above expressions for state dependence we immediately obtain the result that state dependence is larger for exporters with low marginal costs (with $c \in (0, \bar{c}]$) than for high marginal cost ones (with $c \in (\bar{c}, \tilde{c}]$) because importers always honor contracts with sufficiently productive exporters, while there are endogenous separations from exporters with high marginal costs.

Proposition 1: *State dependence is larger for exporters with lower marginal costs.*

Next, we establish how state dependence is affected by the export destinations' market size. We show in the Appendix that state dependence increases in market size of the destination. The reason is that $\bar{c}$ is increasing in market size (A) – a larger market increases the value of a given export relation and therefore makes it easier to sustain cooperation. As a consequence, a given level of c is more likely to lie below the level $\bar{c}$ from which on impatient importers try to violate contracts. Thus, a given relation is more likely to survive from one period to the next. We summarize this result in the following proposition.

Proposition 2: *State dependence is increasing in the market size of the export destination.*

Proof: See Appendix.

We now derive a relation between state dependence and the destinations' legal quality λ. An improvement in legal quality increases $\bar{c}$ and thus makes it more likely that a relation involving an exporter with a given c is not affected by endogenous separation and survives from one period to

[16] The derivations can be found in the Appendix.

the next. This is because a higher λ lowers the probability that renegotiation is successful and makes renegotiation less attractive. As a consequence, impatient importers honor contracts with less productive exporters.[17]

Moreover, the quality of legal institutions only matters for state dependence for those relations that involve less productive exporters – contracts with sufficiently productive exporters are honored by both types of importers independently of institutional quality. These points are summarized by the following proposition:

Proposition 3: *State dependence is increasing in the quality of the export destinations' legal institutions. Moreover, the impact of legal institutions on state dependence is larger for exporters with higher marginal costs.*

Proof: See Appendix.

Finally, we compare the impact of an improvement in legal institutions for two sectors that differ in the extent of their contracting frictions γ. To consider an extreme case, if $\gamma = 0$, importers cannot extract anything from the exporters' share of the surplus. Thus, they always honor contracts independently of legal quality and an increase in λ has no effect on their equilibrium strategies and on state dependence. If, however, γ is large, an improvement in legal quality implies a large reduction of importers' incentives to renegotiate contracts. As a consequence, many relations, for which endogenous separations occurred before the change in λ, are no longer endogenously destroyed and state dependence increases discretely. The following proposition makes this point more generally:

Proposition 4: *The positive impact of legal institutions on state dependence is larger in sectors with larger contracting frictions (sectors with higher levels of γ).*

Proof: See Appendix.

2.4.2 Hazard Rate

A further prediction of our model is on the conditional hazard rate, *i.e.* the probability that a relation ends in period i conditional on the exporter's marginal cost c.

The hazard rate is defined as the ratio between the measure of relations which are dissolved and the measure of relations at risk. The measure of relations of age $i - 1$ at risk between exporters with

[17] In addition, this also increases the probability that a given relation survives, even if the importers' strategy does not change.

cost c, with $c > \bar{c}$, and impatient importers is $v_L x g^u(c)\lambda^{i-1}(1-s)^{i-1}$, while the measure of relations at risk between these exporters and patient importers is $v_H x g^u(c)(1-s)^{i-1}$. At the same time, the measure of relations of age i that are dissolved in period i between exporters with cost c, with $c > \bar{c}$ and impatient importers is $v_L x g^u(c)\lambda^{i-1}(1-s)^{i-1}[(1-s)(1-\lambda)+s]$ and the measure of dissolved relations of age i between those exporters and impatient importers is $v_L x g^u(c)(1-s)^{i-1}s$.

Thus, the hazard conditional on c for $c \leq \bar{c}$ is:

$$H(c, c \leq \bar{c}) = \frac{v_L x g^u(c)(1-s)^{i-1}s + v_H x g^u(c)(1-s)^{i-1}s}{v_L x g^u(c)(1-s)^{i-1} + v_H x g^u(c)(1-s)^{i-1}} = s \tag{8}$$

Similarly, the hazard conditional on c for $c > \bar{c}$ is:

$$\begin{aligned} H(c, c > \bar{c}) &= \frac{v_L x g^u(c)[(1-s)(1-\lambda)+s](1-s)^{i-1}\lambda^{i-1} + v_H x g^u(c)(1-s)^{i-1}s}{v_L x g^u(c)(1-s)^{i-1}\lambda^{i-1} + v_H x g^u(c)(1-s)^{i-1}} \\ &= \frac{v_L[(1-s)(1-\lambda)+s]\lambda^{i-1} + v_H s}{v_L\lambda^{i-1} + v_H} = s + \frac{v_L(1-s)(1-\lambda)\lambda^{i-1}}{v_L\lambda^{i-1} + v_H} \end{aligned} \tag{9}$$

We now state a number of comparative statics results on the hazard rate.

Proposition 5: *The conditional hazard is decreasing in the age of the relation for $c > \bar{c}$.*

Proof: See Appendix

The mechanism behind this result is a composition effect – since relations with impatient importers have a higher probability of separation than those with patient ones, the larger the age of the relation, the smaller becomes the fraction of surviving relations that involve impatient importers.

As can be directly seen from the formula of the conditional hazard, the hazard rate is lower for more productive exporters. This is because importers do not violate contracts with productive exporters and all separations from these exporters are exogenous, while impatient importers try to violate contracts with unproductive exporters, so that there are both exogenous and endogenous separations. Thus, we can state the following proposition:

Proposition 6: *The conditional hazard is increasing in firms' marginal cost.*

We can also establish that the conditional hazard is lower in larger markets. The reason is that in these markets relations with any given exporter have a larger value because demand is larger. Thus, impatient importers are more likely to honor contracts for a given marginal cost of the exporter the larger the market. This reduces the probability of endogenous separation for a given c and therefore decreases the hazard.

Proposition 7: *The conditional hazard is decreasing in the market size of the export destination.*

Proof: See Appendix

The next proposition establishes a relation between the hazard and the destination country's legal institutions.

Proposition 8: *The conditional hazard is decreasing in the quality of the export destination's legal institutions for sufficiently young relations. Moreover, for these relations an increase in the quality of legal institutions leads to a larger decrease in the conditional hazard in sectors with larger contracting problems.*

Proof: See Appendix

The intuition for this proposition is as follows. An increase in λ increases the cutoff, $\bar{c}$, and also reduces the probability of successful contract violation for a given relation for $c > \bar{c}$. However, for sufficiently old relations with $c > \bar{c}$ there is also a composition effect that goes in the opposite direction – more relations with impatient importers survive and this tends to increase the hazard.

To understand the mechanism behind the second part of the proposition note that when γ is zero (importers cannot appropriate any of the exporters' revenue share), institutions have no impact on firms' strategies and thus no effect on the hazard. When γ becomes positive, this is no longer true. In particular, the higher γ, the more likely an exporter is to be affected by endogenous separations for a given marginal cost. As a consequence – since better legal institutions decrease the probability that a given relation lies above the cutoff $\bar{c}$ and also reduce contract violation of importers that are matched with exporters with $c > \bar{c}$ – an increase in λ has a particularly strong negative effect on the hazard in high γ sectors.

3 Empirical Analysis

3.1 Data

We use a panel of 6,594 French manufacturing firms that exist continuously and export at least once in the period from 1993 to 2005. The dataset is administered by the French Statistical Agency (INSEE) and merges two data sources. One is the customs (Douanes) database which allows us to precisely observe the exports of each firm to any potential destination.[18] The customs data include records of the value (measured in euros) of all extra EU shipments and all intra EU trade of French

[18]Regrettably, we do not have information whether trade flows are intra-firm.

firms above a certain value by firm, destination country and year. Because the reporting threshold for intra-EU trade changed several times over the sample period, we exclude EU destinations from our sample to avoid spurious results.[19] We select the destination countries for which we have the additional information we need to carry out our analysis. Thus, the final data set includes 75 countries. The other source is the Bénéfices Réels Normaux (BRN) database, which provides very detailed firm-level data on a variety of balance-sheet measures. This allows us to calculate and control for firm characteristics such as total factor productivity. Each firm is assigned to one of 55 manufacturing sectors using the French NES classification system.[20] Table 1 reports descriptive statistics of firm-level variables for our sample.

We also use several control variables that come from other sources. Data on average real GDP and real GDP per worker for the sample period are from the Penn World Tables (Mark 6.2) and data on distance from Paris are taken from Rose (2004). Furthermore, we use several measures of the quality of legal institutions. First, as our main measure of legal institutions, we employ *rule of law* from Kaufmann, Kraay and Mastruzzi (2006), as provided by Nunn (2007). This is a weighted average of a number of variables (perceptions of the incidence of crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts) that measure individuals' perceptions of the effectiveness and predictability of the judiciary and the enforcement of contracts in each country between 1997 and 1998. The variable ranges from 0 to 1 and is increasing in the quality of institutions. Second, we use *legal quality* from Gwartney and Lawson (2003). This index, which ranges from 1 to 10, measures the legal structure and the security of property rights in each country in 1995. Finally, we make use of a set of variables collected by the World Bank (World Bank (2004)). We use data on *number of procedures* and *official costs* required to collect an overdue debt. *Number of procedures* is the total number of procedures mandated by law or court regulation that demand interaction between the parties or between them and the judge or court officer. All these variables are scaled and transformed

[19]The reporting threshold for intra EU trade changed several times in the sample period. It went from 250,000 FF to 650,500 FF in 2001 and then was changed to 100,000 Euros in 2002. For extra EU trade, the threshold is close to 1000 Euros. We have also done all the empirical analysis including intra-EU trade. Results are not affected and are available on request.

[20]Our data source is the same as the one of Eaton, Kortum and Kramarz (2004) and Eaton, Kortum and Kramarz (2008b). They report 34,035 exporters for the year 1986 that sell to 113 destinations outside France. We have less exporters in our dataset for several reasons. First, we exclude intra-EU trade. Second, we require exporters to exist continuously during the sample period. Third, we have less export destinations. Fourth, we drop exporters for which the sector information was missing and we require firms to be both in the Douanes and in the BRN database and to have info on value added and employment. Finally, we focus on manufacturing and drop a number of manufacturing sectors for which we are not able to construct the sector-specific variables discussed below.

by Nunn (2007) in order to make them increasing in judicial quality.[21] *Official costs* is the sum of attorney fees and court fees during the litigation process, divided by the country's per capita income.[22] Basic statistics for the different institutional quality variables are reported in Table 2.

Moreover, we construct two measures of sectoral relationship-dependence. The first measure uses data collected by Rauch (1999), who classifies the output of different sectors according to its standardization. Rauch assigns the goods produced by each 4-digit-SITC sector to one of the three following categories: traded on an organized exchange, reference priced, or neither. Nunn (2007) argues that this classification is a good measure for the severity of hold-up problems in a sector, since goods that are neither traded on an organized exchange nor reference priced are likely to be tailor-made for a specific partner and have little value outside this relation. The second measure comes from Nunn (2007) and measures the fraction of inputs used by a sector that are neither reference priced nor traded on an organized exchange at the 3-digit ISIC level. This is a measure of relationship-dependence of sectoral inputs rather than outputs, but sectors that use a lot of specific inputs tend to produce also strongly differentiated outputs[23] and Nunn's measure has more variation. For example, most subcategories of both *Textile Products* and *Electrical Equipment NEC* fall into Rauch's category "neither" (this fraction is 0.76 in both sectors with Rauch's classification is 0.76), even though electric equipment is probably more likely to be made specifically for a trade partner than a carpet, so the hold up problem should be more severe in the first case.[24] We convert both measures to the French NES classification. Table 3 lists both measures of relationship-dependence by sector.

3.2 State dependence

In this subsection we describe our econometric methodology to measure state dependence of exporting decisions and we present our empirical results on the correlation between state dependence and firm-, sector- and country-characteristics mentioned in the introduction and derived from our model.

We use a linear probability model, which – given the three-dimensional structure of our panel (firms, time and destinations) – allows us to control for time varying unobserved heterogeneity at the firm- and destination-level without making strict assumptions on the correlation structure between

[21] *number of procedures* is obtained as 60 minus the total number of procedures, thus a higher number indicates less procedures and a more efficient judicial system. This variable ranges from 2 to 49 in our sample.

[22] Nunn's transformation of this measure is given by 6 minus the natural log of official costs so that a higher number indicates lower costs of litigation and a better legal system. The final variable ranges from 1 to 4.5.

[23] The correlation between Rauch's and Nunn's measure in our sample is 0.66.

[24] Nunn's measure for the fraction of differentiated inputs is 0.76 for *Electrical Equipment NEC* against 0.48 for *Textile Products* at the NES level.

the error term and observables.

As a first step we investigate if current export status depends on past export status, even when we control for firm- and destination-specific shocks.

Our basic regression is:

$$Pr(Y_{fkt} = 1|Y_{fkt-1}, X_{fkt}) = E(Y_{fkt}|Y_{fkt-1}, X_{fkt}) = \beta_0 + \beta_1 Y_{fkt-1} + \delta_{ft} + \delta_{kt}. \tag{10}$$

Here Y_{fkt} is a dummy that equals one whenever firm f exports to destination k in period t , whereas δ_{ft} and δ_{kt} are firm-time- and destination-time-specific fixed effects. The coefficient β_1 of equation (10) is a measure of state dependence, since it captures the marginal effect of past export status on the probability that a firm exports to a destination today.[25] Exploiting all the dimensions of our dataset we can take time varying firm-level as well as time varying destination-specific unobserved heterogeneity into account. Firm-level time varying unobserved heterogeneity refers to firm characteristics such as productivity, managerial ability, or firm's strategy which may affect a firm's decision to export. Destination-specific time varying unobserved heterogeneity captures country characteristics like market size, distance, openness policies, movements in the exchange rate, or other demand shifts which may influence the probability of a firm to export to a given country.

To gain intuition for our estimation strategy, it is helpful to use the difference-in-difference approach.[26] Taking differences of equation (10) across firms f for a given destination k we obtain $\Delta_f Y_{fkt} = \beta_1 \Delta_f Y_{fkt-1} + \Delta_f \delta_{ft} + \Delta_f \varepsilon_{fkt}$, where ε_{fkt} is the error term of the original regression. This enables us to control for unobserved effects at the destination-time level. Applying differences across destinations k to this equation gives $\Delta_k \Delta_f Y_{fkt} = \beta_1 \Delta_k \Delta_f Y_{fkt-1} + \Delta_k \Delta_f \varepsilon_{fkt}$, which wipes out unobserved effects at the firm-time level. Hence, state dependence is identified by the cross firm difference in the difference of export status across destinations.[27]

The first column of Table 4 tests for state dependence. Indeed, $\hat{\beta}_1$ is positive and significant at the one-percent level. Having exported to a destination in the previous period increases the probability to export in the current period by 67 percentage points compared to a firm that did not export in the previous period, even when controlling for unobserved effects at the firm-time and destination-time level.

[25] Roberts and Tybout (1997) and Bernard and Jensen (2004) use similar reduced form formulations to test the sunk cost hypothesis.

[26] The regression is implemented by using a double within transformation instead of taking differences.

[27] Note that since we do not rely on the time dimension of the panel for our transformation, the lagged dependent variable does not cause any problems for consistency and we need not use a dynamic panel estimator.

We now specify the empirical model to test our hypotheses regarding the relation between state dependence and the quality of legal institutions, market size and firm productivity.

$$Pr(Y_{fkt} = 1|Y_{fkt-1}, X_{fkt}) = \beta_0 + \beta_1 Y_{fkt-1} + \beta_2 Y_{fkt-1} * Prod_{ft} + \beta_3 Y_{fkt-1} * A_k + \beta_4 Y_{fkt-1} * IQ_k + \delta_{ft} + \delta_{kt} \tag{11}$$

Here $Y_{fkt-1} * IQ_k$ is the interaction between last period's export status and one of the measures of the quality of legal institutions in country k, $Y_{fkt-1} * Prod_{ft}$ is the interaction between last period's export status and firm productivity (measured as the log of value-added per worker) and $Y_{fkt-1} * A_k$ is the interaction between past export status and effective market size proxies – GDP and distance[28] (all in logs). We also control for an interaction between past export status and GDP per capita (in logs) to be sure that our institutional variables do not pick up the effect of that variable on state dependence.

According to Proposition 1, state dependence is higher for more productive firms. Thus, we expect $\beta_2 > 0$. Proposition 2 states that state dependence is increasing in market size, so we expect GDP to have a positive and distance to have a negative impact on state dependence. Finally, Proposition 3 implies that state dependence is increasing in legal quality. Therefore, we expect $\beta_4 > 0$.

Columns (2) to (5) of Table 4 present results for regression (11).[29] Each specification employs a different measure of institutional quality. Turning first to the effect of firm productivity on state dependence, we find that $\hat{\beta}_2$ is always positive and significant at the one percent level. Moving from the 25th (minimum) to the 75th percentile (maximum) of productivity increases the marginal effect of the past export status by 3 percentage points (43 percentage points).[30] As for the interactions of past export status and the market size controls, distance has a significantly (at the one-percent level) negative impact on the effect of past export status, while *(GDP)* has a significantly positive effect (also at the one percent level).

In all specifications, $\hat{\beta}_2$, the coefficient of the interaction term between past export status and the different measures of legal institutions, is positive and significant at the one-percent level. In terms of economic magnitudes, the effect of institutions on state dependence is also sizeable. For example, moving from the 25th percentile of *rule of law* to the 75th percentile increases the effect of past export status on the probability to export in the current period by roughly 2.4 percentage points,

[28]It is straightforward to incorporate transport costs, which have a negative effect on effective market size, into the model.

[29]All standard errors are clustered by firm-year.

[30]$0.03 \approx 0.051 * (4.2 - 3.6)$, $0.43 \approx 0.051(11.7 - (-3.2))$.

while moving from the country with the worst institutions to the one with the best increases the effect of past export status by around 8 percentage points.[31] Note also, that the level of development (measured by *log(GDP per capita))* has a significantly positive impact on state dependence.

In columns (6) to (9) of Table 4 we add interaction terms between the different measures of legal quality and firm productivity. According to Proposition 3 we expect this interaction term to be negative since legal institutions should have a smaller impact on state dependence if exporters are more productive. Indeed, we find that in all specifications the interaction terms are negative and significant at the one-percent level, supporting our hypothesis. The other coefficients remain largely unaffected, apart from the coefficient of past export status, which now turns negative for some specifications. Note, however, that when we evaluate all explanatory variables at their sample mean, past export status still has a large and significant positive coefficient on current export status.

Next, we test the prediction of Proposition 4, which states that the effect of legal quality on state dependence is larger in sectors that are more relationship-dependent. To this end, we specify the following econometric model:

$$Pr(Y_{fkt} = 1|Y_{fkt-1}, X_{fkt}) = \beta_0 + \beta_1 Y_{fkt-1} + \beta_2 Y_{fkt-1} * IQ_k + \beta_3 Y_{fkt-1} * RD_j + \quad (12)$$
$$+\beta_4 Y_{fkt-1} * IQ_k * RD_j + \beta_5 Y_{fkt-1} * X_k + \beta_6 Y_{fkt-1} * X_k * RD_j + \delta_{ft} + \delta_{kt},$$

where $Y_{fkt-1} * RD_j$ is the interaction between last period's export status and our measures of sectoral relationship-dependence and $Y_{fkt-1} * IQ_k * RD_j$ is the triple interaction between last period's export status, legal quality and relationship-dependence. Finally, $Y_{fkt-1} * X_k$ is the interaction between past export status and other country controls and $Y_{fkt-1} * X_k * RD_j$ is the triple interaction between last period's export status, other country controls and relationship-dependence.

This specification implies that $\frac{\partial Pr(Y_{fkt}=1|Y_{fkt-1}=1,X_{fkt})-Pr(Y_{fkt}=1|Y_{fkt-1}=0,X_{fkt})}{\partial IQ_k} = \beta_2 + \beta_4 RD_j$, so we expect $\beta_2 > 0$ and $\beta_4 > 0$. An additional advantage of this specification is that it is less likely to suffer from some form of omitted variable bias than the regressions that only use explanatory variables at the destination level interacted with past export status. Even if there are omitted country-specific variables that are correlated with institutional quality, there is no reason to expect $\beta_4 > 0$, unless this omitted variable has a larger effect in relationship-dependent sectors. β_6 tries to exclude even this possibility, by interacting the sector-specific effect of past export status with other country controls, such as *log(GDP per capita)*.

[31] The 25th percentile (minimum) of *rule of law* is 0.4 (0.2) and the 75th percentile (maximum) is 0.6 (0.9) and $\hat{\beta}_2 = 0.114$, so the change in the effect of past export status is given by $0.114(0.6 - 0 - 4) = 0.0236$ and $0.114(0.9 - 0.2) \approx 0.08$.

Table 5 presents the results for these regressions using both Rauch's and Nunn's measure of relationship-dependence and our two main measures of the quality of legal institutions, *rule of law* and *legal quality*. The first two specifications use *rule of law* and do not control for the triple interaction with other country variables. Again, $\hat{\beta}_2$, that measures the direct effect of institutions on state dependence when RD_j is zero, is positive and strongly significant. Also, $\hat{\beta}_3$, that measures the impact of relationship-dependence on state dependence when *rule of law* is zero, is negative as expected. More importantly, the coefficient of the triple interaction, $\hat{\beta}_4$, is positive and significant at the one percent level. This implies that legal institutions have a larger positive impact on state dependence in more relationship-dependent sectors.

In columns (3) and (4) we add a triple interaction with *log(GDP per capita)* as an additional control variable. While $\hat{\beta}_2$ maintains its positive and significant sign only in column (4), $\hat{\beta}_4$ remains positive and significant at the one percent level in both specifications. Finally, columns (5)-(8) repeat the previous specifications using *legal quality*. Results are robust to using this alternative measure of legal institutions.

We conclude that there is strong evidence in favor of propositions 1-4 and now turn to the predictions on hazard rates.[32]

3.3 Survival analysis

Our theoretical model makes several predictions on the correlations between hazard rates of export relations and firm as well as country characteristics. In order to test them, we use survival analysis methods. An observation is now defined as a spell – the duration of a firm-country export relation. Before going into the details of our econometric strategy, let us discuss two features of the data that we have to take care of: existence of multiple spells and right and left censoring of spells.

First, there are many multiple spells in our sample, *i.e.* the same firm exports to a given country in different time intervals repeatedly and each of these relations may have a different duration. In our analysis we treat each spell as independent, which is consistent with our theoretical analysis.[33]

[32] Instead of using a linear probability model, we have also experimented with estimating a Probit model with a lagged dependent variable. The problem with non-linear models with lagged dependent variables is that it is extremely difficult to control for unobserved heterogeneity. In order to allow for unobserved heterogeneity, the explanatory variables usually need to be strictly exogenous, which is obviously not compatible with a lagged dependent variable. We circumvent this problem by estimating a Probit with lagged export status as an explanatory variable using the Chamberlain approach to unobserved heterogeneity (see Wooldridge (2002) Chapter 15) year by year. Results are similar to the linear probability model and are available on request.

[33] In the model, having previously exported to a destination does not provide any advantage to a firm that wants

Nevertheless, we take care of the multi-spell problem with different robustness checks in the next sub-section.

Second, the original data are censored on both sides. There are right-censored observations because we observe data until 2005 and many relations are still active in that year. There are also left-censored observations since in the first year in our sample we cannot distinguish between relations which start before that year and new ones. We deal with the left-censoring problem by considering only those firms that start exporting in the second year for which we have information in our database or later. We take care of the right-censoring in the regression analysis by adding a dummy variable for the starting date of the relation.

We start out with a description of the duration of trade relations. Table 6 reports the frequency of observations for each possible length of the relations' duration: 77% of all relations last less then 4 years, with one-year relations accounting for slightly more than half of the observations. This confirms that the majority of trade relations have a short duration.

To investigate the predictions of the model on the relation between the hazard, institutional quality and firm productivity (Propositions 6 and 8), we first use a descriptive analysis. Table 7 shows the Kaplan-Meier survival rates for the whole sample, for different quartiles of *rule of law* as well as for different quartiles of value added per worker. This descriptive analysis suggests that for countries within the highest percentiles of institutional quality and for firms within the highest productivity quartiles, the survival rates are significantly higher at any age of the relation. The former finding is also visible in Figure 3 which plots the survival rates for different quartiles of *rule of law*.[34]

In order to test more formally the predictions of the model on the relation between firm productivity and the hazard rate (Proposition 6), market size and the hazard rate (Proposition 7), as well as the relation between legal quality and the hazard rate (Proposition 8), we perform a set of Cox regressions.

The assumption of the Cox proportional hazard model is that the hazard is separable between a function of time, $h(t)$, and a part that depends on a vector of explanatory variables, X. Our specification is the following:

$$h(t, X\beta) = h(t)exp(\beta_0 + \beta_1 Prod_f + \beta_2 A_k + \beta_3 IQ_k + \delta_t + \delta_j), \tag{13}$$

where $Prod_f$ is the firm average of log value added per worker, the vector A_k contains the logs of GDP, GDP per capita and distance. IQ_k is again one of our measures of legal institutions (measured

to re-enter a destination over a firm that tries to export to a destination for the first time, since it has to find a new importer.

[34]Results are robust to using different measures of institutional quality.

in logs); δ_t is a dummy for the starting year of each relation, which is the standard treatment for right-censoring; δ_j takes care of time-invariant sector characteristics that may drive different durations of export relations. Note that since the log of the hazard is linear and the explanatory variables are measured in logs, coefficients can be interpreted as elasticities.

Results for these regressions are reported in Table 8. As predicted, the hazard is strictly decreasing in all the measures of the quality of the legal system (all variables are significant at the one-percent level) and strictly decreasing in firm productivity (also significant at the one percent level). We also find that the market size proxies have the expected sign and are strongly significant.[35] As for the magnitude of our results, we find that an increase of *rule of law* by 100% decreases the hazard by roughly 6%, while a 100% increase in productivity decreases the hazard by around 10%.

Next we turn to the second part of Proposition 8, which states that the negative impact of legal institutions on the hazard should be larger in more relationship-dependent sectors. In order to test this prediction we specify the following hazard:

$$h(t, X\beta) = h(t)exp(\beta_0 + \beta_1 Prod_f + \beta_2 A_k + \beta_3 IQ_k + \beta_4 RD_j * IQ_k + \delta_t + \delta_j) \tag{14}$$

In this case the marginal effect of IQ_k on the log-hazard is $\beta_3 + \beta_4 RD_j$, so we expect $\beta_3 > 0$ and $\beta_4 > 0$. Table 9 presents the results for these regressions using our main measures of legal institutions, *rule of law* and *legal quality* and both Nunn's and Rauch's measure of relationship-dependence. In the first two columns we just use sector and start dummies as additional controls. $\hat{\beta}_1$ is negative and significant at the one-percent level, while $\hat{\beta}_2$ is negative but only significant with Nunn's measure. When adding additional country and firm controls in columns (3) and (4), $\hat{\beta}_1$ remains negative but becomes insignificant, while the interaction term $\hat{\beta}_2$ remains stable and becomes significant at the five percent level for both measures of relationship-dependence. Results remain similar but are somewhat less significant when using *legal quality* instead of *rule of law* (columns (5)-(8)).

Our last prediction on hazard rates is that relations become more stable as they mature, so the hazard should be decreasing with the age of the relation (Proposition 5). Since the Cox-hazard model does not estimate the time dependent part of the hazard, we refer to Figure 3, which plots the estimated hazard derived from (13) against time. The negative slope is apparent.[36] We conclude that

[35]We cluster standard errors at the country-level (in the regressions that focus on country-level dependent variables) and at the firm level (in the regressions that focus on firm-level dependent variables), and we use robust standard errors in those specifications which included both firm and country characteristics.

[36]One may be concerned that trade flows stop because trade is replaced by horizontal FDI (which we do not observe). In that case, however, we would see a hazard rate that is increasing over time instead of decreasing.

the probability for a trade relation to be destroyed indeed decreases with the age of the relation.[37]

3.3.1 Survival analysis: Robustness

Around 60% of export relationships in our data involve multiple spells. As a robustness check we would like to confirm that the hypothesis of spell-independence is not biasing our previous results. Thus, we replicate our analysis using only relationships which involve single spells. The total amount of single spells in our data set is of 49,479 and their length distribution, as well as all other descriptive statistics, are very similar to the total sample. Results for the specifications (13) and (14) using only single spells are reported in Tables 10 and 11. It is apparent that they are indeed very similar to the ones using the full sample, thus confirming that multiple spells are not a problem in our framework.

4 Conclusions

In this paper we have explored the links between exports dynamics, on the one hand, and destination countries' institutional quality, firm productivity and sector-specific contracting frictions, on the other hand. We have developed a model in which exporting requires to find a partner in each market. Incomplete information and imperfect enforcement of contracts give room for reputation and lead to learning by exporters about the reliability of their partners.

This framework leads to several interesting patterns. Matching frictions imply state dependence of exporting decisions in the absence of sunk fixed costs. State dependence is larger and hazard rates are lower in markets with better legal institutions. Moreover, the impact of legal institutions on state dependence and on hazard rates is larger in sectors that are more exposed to hold-up problems. We test these predictions using a large panel of French exporters that provides information on individual firms' exports by destination country. Overall, we find strong support for our model – specifically, export relations are more stable and there is more state dependence in countries with better legal institutions and these effects are larger in sectors with more severe contracting frictions. These facts are difficult to explain with a standard model of firm heterogeneity and sunk costs to export and shed light on the importance of relationship-specificity for explaining the dynamics of trade.

Moreover, our findings lead to clear policy implications. In particular, successful export promotion should aim at limiting informational frictions by providing information about potential partners in

[37] We have also estimated parametric duration models, such as the Weibull model. These models gave very similar results for the impact of institutional quality and productivity on the hazard and estimates implied mostly negative time dependence. Results are available on request.

export destinations and at reducing risks exporters face due to contract incompleteness.

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5 Appendix

Lemma 2: *Let $\tilde{\theta}_{0t}$ be non-decreasing in t. Then given the importers' equilibrium strategies and equilibrium beliefs there is a unique value $\bar{\theta}_t(c) \in [\theta^*(c), 1)$ such that for all t an exporter with marginal cost $c > \bar{c}_t$ accepts any partner whenever she meets an importer and $\tilde{\theta}_{0t} \leq \bar{\theta}(c)$. Moreover, she maintains a partnership if and only if the importer respects the contract. Exporters with $c \leq \bar{c}_t$ accept every partner for any $\tilde{\theta}_{0t} \in [0, 1]$ and maintain a partnership as long as the importer respects the contract given importers' equilibrium strategies.*

Proof:

Let $Pr(0|c)_{it}$ be the subjective probability that the contract is respected for a relation of age i that started in period t given firm's marginal cost c, so that $Pr(0|c \leq \bar{c}_t)_{it} = 1$ and $Pr(0|c > \bar{c}_t)_{it} = (1 - \tilde{\theta}_{it} + \lambda\tilde{\theta}_{it})$.

Then $\tilde{V}_E(\tilde{\theta}_{0t}, c) = \max\{V_E(\tilde{\theta}_{0t}, c), \beta_E W_E(\tilde{\theta}_{0t+1}, c)\}$, where $V_E(\tilde{\theta}_{0t}, c) = \Pi(\tilde{\theta}_{0t}, c) + \beta_E(1-s)Pr(0|c)_{0t} *$ $* V_E(\tilde{\theta}_{1t}, c)$ is the expected value of entering a partnership and $W_E(\tilde{\theta}_{0t+1}, c) = \tilde{V}_E(\tilde{\theta}_{0t+1}, c)x(v_{Ht} + v_{Lt})/(M_t^u) + W_E(\tilde{\theta}_{0t+2}, c)(1 - x(v_{Ht} + v_{Lt})/(M_t^u)$ is the expected value of not entering the partnership in period t and waiting for a new business opportunity in the next period.

By substituting recursively, $V_E(\tilde{\theta}_t, c)$ can be written as:

$$V_E(\tilde{\theta}_{0t}, c) = \Pi(\tilde{\theta}_{0t}, c) + \sum_{i=1}^{\infty} \beta_E^i (1-s)^i \Pi(\tilde{\theta}_{it}, c) \prod_{j=0}^{i-1} Pr(0|c)_{jt}$$

Then $\frac{\partial V_E(\tilde{\theta}_{0t}, c > \bar{c}_t)}{\partial \tilde{\theta}_{0t}} < 0$, since $\frac{\partial \Pi(\tilde{\theta}_{it}, c > \bar{c}_t)}{\partial \tilde{\theta}_{0t}} = \frac{\partial \Pi(\tilde{\theta}_{it}, c > \bar{c}_t)}{\partial \tilde{\theta}_{it}} \frac{\partial \tilde{\theta}_{it}}{\partial \tilde{\theta}_{0t}} < 0$ and $\frac{\partial Pr(0|c > \bar{c}_t)_{jt}}{\tilde{\theta}_{0t}} = \frac{(1 - \tilde{\theta}_{it} + \lambda\tilde{\theta}_{it})}{\partial \tilde{\theta}_{0t}} < 0$. At the same time, $\frac{\partial V_E(\tilde{\theta}_{0t}, c \leq \bar{c}_t)}{\partial \tilde{\theta}_{0t}} = 0$, since no importer cheats on these exporters. Hence, since $\tilde{\theta}_{0t}$ is non-decreasing in t, it is always worth to accept a partner immediately because rejecting a partner and starting a partnership tomorrow has a weakly lower expected value.

Consequently, we can write $\tilde{V}_E(\tilde{\theta}_{0t}, c) = \max\{V_E(\tilde{\theta}_{0t}, c), 0\}$. Now, since by assumption $V_E(\tilde{\theta}_{0t} = 0, c) = \frac{\Pi(\tilde{\theta}_{0t}=0, c)}{1 - \beta_E(1-s)} \geq 0$ for all $c \leq c^*$ and $V_E(\tilde{\theta}_{0t} = 1, c) = \frac{\Pi(\tilde{\theta}_{0t}=1, c)}{1 - \lambda\beta_E(1-s)} < 0$ for all $c > \bar{c}$ and since $V_E(\tilde{\theta}_{0t})$ is strictly decreasing in θ_{0t}, we have that for all $c > \bar{c}$ there is a unique $\bar{\theta}(c)$ such that $\tilde{V}_E(\tilde{\theta}_{0t}, c) \leq 0$ if $\tilde{\theta}_{0t} \geq \bar{\theta}(c)$ and $\tilde{V}_E(\tilde{\theta}_{0t}, c) > 0$ if $\tilde{\theta}_{0t} < \bar{\theta}(c)$.

Thus, exporters never deviate to maintaining the relationship in any period $t + i$ if $\tilde{\theta}_{it} = 1$ and return to their equilibrium strategy in the following period because they would make losses in the deviation period $t + i$, since $\Pi(\tilde{\theta}_{it} = 1, c) < 0$. Moreover, they would also not deviate to ending the relation as long as $\tilde{\theta}_{it} < \bar{\theta}(c)$ because they would forego positive profits.

Similarly, for exporters with $c \leq \bar{c}$, if a renegotiation occurs, they set $\tilde{\theta}_{it} = 1$, $Pr(0|c \leq \bar{c}_t) = 0$ and expect profits $V_E(\tilde{\theta}_{it}=1,c)=\frac{\Pi(\tilde{\theta}_{it}=1,c)}{1-\lambda\beta_E(1-s)}<0$. Hence exporters stay in a partnership as long as there is no renegotiation.

Lemma 5: *Let $\tilde{\theta}_{0t}$ be non-decreasing in t and let $E_t(c)$ be non-decreasing in t. Then, given the equilibrium strategies and beliefs, importers initially accept any partner.*

Proof:

Impatient importers face the following problem. Let $\tilde{V}_L(\tilde{\theta}_{0t})=\max\{V_L(\tilde{\theta}_{0t}),\beta_L W_L(\tilde{\theta}_{0t+1},c)\}$, where $V_L(\tilde{\theta}_{0t})=[\lambda(1-\alpha)+(1-\lambda)(1-\alpha+\alpha\gamma)]\ E(Rev(\tilde{\theta}_{0t},c)|\bar{c}_t<c\leq\tilde{c}_t)(1-G_t^u(\bar{c}_t))+(1-\alpha)E(Rev(c)|c\leq\bar{c})G_t^u(\bar{c}_t)-(1-\alpha)f\ +\beta_L(1-s)[G_t^u(\bar{c}_t)E(V_L(\tilde{\theta}_{1t},c)|c\leq\bar{c}_t)+\lambda(1-G_t^u(\bar{c}_t))E(V(\tilde{\theta}_{1t},c)|c>\bar{c}_t)]$ is the expected value of entering a partnership in period t and $W_L(\tilde{\theta}_{0t+1},c)=x\tilde{V}_L(\tilde{\theta}_{0t+1})+(1-x)W_L(\tilde{\theta}_{0t+2})$ is the expected value of not entering the partnership in period t and waiting for a new business opportunity in the next period. Then it is straightforward to show that $\tilde{V}_L(\tilde{\theta}_{0t})$ is decreasing in t. The first reason is that $\tilde{\theta}_{0t}$ is weakly increasing in t, which reduces export revenues $Rev(\tilde{\theta}_{0t},c)$ for a given c . The second reason is that $E_t(c)$ is weakly increasing in t and this reduces expected revenues as well. Finally, we show in the section on industry equilibrium that the probability to match with an exporter with $c<\bar{c}$, $G_t^u(\bar{c})$, is decreasing in t. Hence, it is always optimal to accept a given partner.

Similarly, for a patient importer we have $\tilde{V}_H(\tilde{\theta}_{0t})=\max\{V_H(\tilde{\theta}_{0t}),\beta_H W_H(\tilde{\theta}_{0t+1})\}$, where $V_H(\tilde{\theta}_{0t})=(1-\alpha)[E(Rev(\tilde{\theta}_{0t},c))-f]+\beta_H(1-s)E(V_H(\tilde{\theta}_{1t},c))$ is the expected value of entering a partnership and $W_H(\tilde{\theta}_{0t+1})=x\tilde{V}_H(\tilde{\theta}_{0t+1})+(1-x)W_H(\tilde{\theta}_{0t+2})$ is the expected value of not entering the partnership in period t and waiting for a new business opportunity in the next period. Patient importers accept any partner for the same reason as impatient ones. Waiting does not pay off because the average revenue of exporters is weakly decreasing in t both because $\tilde{\theta}_{0t}$ is weakly decreasing in t and the pool of available exporters weakly deteriorates over time.

Lemma 6: *Given the equilibrium strategies and beliefs and if β_L is sufficiently large, impatient importers try to violate contracts if and only if $c>\bar{c}_t$.*

Proof:

The strategy of impatient importers is:

1. to honor contracts for $c\leq\ddot{c}$ given that exporters believe that contracts are honored. At $\ddot{c}$ they are indifferent between violating and honoring contracts given these beliefs. Thus, we assume that impatient importers stick to honoring them.

2. to violate contracts for $c>\bar{c}$ given that exporters believe that contracts are violated. At $\bar{c}$

they are indifferent between violating contracts and honoring them given these beliefs. Thus, we assume that impatient importers deviate to honoring them.

Proof of 1: Consider a deviation to violating a contract in period t, and playing the equilibrium strategy in all other periods given that exporters play their equilibrium strategy and their equilibrium beliefs.[38] Such a deviation is not profitable whenever $V_t(r,c) \geq \lambda(1-\alpha)Rev_t(c) + (1-\lambda)(1-\alpha+\alpha\gamma)Rev_t(c) - (1-\alpha)f + \beta_L(1-s)\lambda V_{t+1}(r,c)$. Since $V_t(r,c) = (1-\alpha)(Rev_t(c) - f)$, we can write the previous condition as $\beta_L(1-s)V_{t+1}(r,c) \geq \alpha\gamma Rev_t(c)$. Because $V_{t+1}(r,c) = \frac{(1-\alpha)(Rev(c)-f)}{1-\beta_L(1-s)}$ and using the expression $Rev(c) = \left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} Ac^{-(\varepsilon-1)}$, we can express this condition as $c^{\varepsilon-1} \leq \ddot{c}^{\varepsilon-1} = \left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A[\frac{\beta_L(1-s)(1-\alpha+\alpha\gamma)-\alpha\gamma}{\beta_L(1-s)(1-\alpha)f}]$

Note that $\ddot{c}$ is independent of λ and that $\ddot{c} > 0$ if and only if $\beta_L > \frac{\alpha\gamma}{(1-s)(1-\alpha+\alpha\gamma)}$.

Proof of 2: Consider a deviation to honoring the contract in period t and playing the equilibrium strategy in all other periods given that exporters play their equilibrium strategy and have their equilibrium beliefs. Such a deviation is not profitable whenever $V_t(v,c) \geq (1-\alpha)(Rev_t(c) - f) + \beta_L(1-s)V_{t+1}(v,c)$. Since $V_t(v,c) = (1-\lambda)(1-\alpha+\alpha\gamma)Rev_t(c) + \lambda(1-\alpha)Rev_t(c) - (1-\alpha)f + \beta_L(1-s)\lambda V_{t+1}(v,c)$, we have that $\alpha\gamma Rev_t(c) \geq \beta_L(1-s)V_{t+1}(v,c)$. Thus, $V_{t+1}(c) = \sum_{i=0}^{\infty} \beta_L^i (1-s)^i \lambda^i \{[(1-\alpha) + (1-\lambda)\alpha\gamma]Rev_{t+1+i} - (1-\alpha)f\}$ and $Rev_{t+1+i}(c) = \left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-1}c^{-(\varepsilon-1)}$.

Substituting this, the previous condition becomes $\alpha\gamma\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-1}c^{-(\varepsilon-1)} \geq \beta(1-s)\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A[(1-\alpha)+(1-\lambda)\alpha\gamma]\sum_{i=0}^{\infty}\beta_L^i(1-s)^i\lambda^i[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-1} - \frac{\beta_L(1-s)(1-\alpha)f}{1-\beta_L(1-s)\lambda}$.

Solving for c, we obtain

$$c^{\varepsilon-1} \geq \bar{c}^{\varepsilon-1} = \left[\frac{1-\beta_L(1-s)\lambda}{\beta_L(1-s)(1-\alpha)f}\right]\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A*$$
$$\left[\beta_L(1-s)[(1-\alpha)+(1-\lambda)\alpha\gamma]\sum_{i=0}^{\infty}\beta_L^i(1-s)^i\lambda^i[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-1} - \alpha\gamma[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-1}\right].$$

Note that a sufficient condition for the term in brackets to be positive can be found by setting $\tilde{\theta}_{t+1+i} = \tilde{\theta}_t$. Sufficient is $\beta_L > \frac{\alpha\gamma}{(1-s)(1-\alpha+\alpha\gamma)}$, which is the same condition as for $\ddot{c}$.

Proof that $\bar{c} \leq \ddot{c}$:

It is easy to show that $\bar{c}(\lambda = 0) < 0$ and $\bar{c}(\lambda = 1) = \ddot{c}$. It remains to show that $\bar{c}(\lambda < 1) < \bar{c}(\lambda = 1) = \ddot{c}$.

First, we need to show that $\bar{c}$ is decreasing in $\tilde{\theta}$. Ignoring the constant before the term in square brackets, we have

[38] This is the one stage deviation principle for dynamic games. This principle applies also to games with incomplete information (see Hendon, Jacobsen and Sloth (1996)).

$\frac{\partial \bar{c}}{\partial \tilde{\theta}_t} = \beta_L(1-s)[1-\alpha+(1-\lambda)\alpha\gamma]\sum_{i=0}^{\infty}\beta^i(1-s)^i\lambda^i(\varepsilon-1)[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-2}\gamma(1-\lambda)\left(-\frac{\partial\tilde{\theta}_{t+1+i}}{\partial\tilde{\theta}_t}\right)-$ $\alpha\gamma(\varepsilon-1)[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-2}\gamma(1-\lambda)(-1)$.

Since $\frac{\partial\tilde{\theta}_{t+1+i}}{\partial\tilde{\theta}_t} = \frac{\lambda^{i+1}(1-\tilde{\theta}_t)}{[(\lambda^{i+1}-1)\tilde{\theta}_t+1]^2} > 0$, the above expression is smaller than $-\beta_L(1-s)[1-\alpha+(1-\lambda)\alpha\gamma](\varepsilon-1)[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-2}\gamma(1-\lambda)+\alpha\gamma(\varepsilon-1)[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-2}\gamma(1-\lambda)$

This expression is negative whenever $\beta_L > \frac{\alpha\gamma}{(1-s)[1-\alpha+(1-\lambda)\alpha\gamma]}$. Hence, this is a sufficient condition for $\bar{c}$ to be decreasing in $\tilde{\theta}$.

Therefore, we have that for any $\lambda > 0$: $\bar{c}(\lambda,\tilde{\theta}_t) < \bar{c}(\lambda,\tilde{\theta}_t = 0) = \bar{c}(\lambda = 0,\tilde{\theta}_t \geq 0) = \ddot{c}$. Since $\ddot{c}$ does not depend on λ and $\tilde{\theta}$, it follows that for any $\tilde{\theta} > 0$: $\bar{c}(\lambda < 1,\tilde{\theta}_t) < \bar{c}(\lambda = 1,\tilde{\theta}_t) = \ddot{c}$.

Lemma 7: *Given equilibrium strategies and beliefs patient importers always honor their contracts.*

Proof:

We show that in equilibrium patient importers honor their contracts with all types of exporters, that is, there exists a $\breve{c}_t > \bar{c}_t$ such that for all $c \leq \breve{c}_t$ we have that profits from honoring the contract forever are larger than those of a one period deviation from the equilibrium strategy. The proof is analogous to Lemma 5. It is straightforward to show that $\breve{c}_t > \bar{c}_t$. Since $\ddot{c}_t$ is increasing in β and $\beta_H > \beta_L$, we have that $\breve{c}_t > \ddot{c}_t \geq \bar{c}_t$. Moreover, we assume that parameters are such that $\breve{c}_t > \tilde{c}_t$, so that patient importers honor contracts with all exporters that enter.

Lemma 8: θ_t *is weakly increasing in* t.

Proof:

Note that in order to show that θ_t is weakly increasing in t it is sufficient to show that $\frac{v_{Lt}}{v_{Ht}}$ is weakly increasing in t.

Hence, we need to show that $\frac{v_{Lt+1}}{v_{Ht+1}} \equiv \frac{(1-x)v_{Lt}+[s+(1-s)(1-\lambda)Pr(c_t)](\theta_0-v_{Lt})}{(1-x)v_{Ht}+s(1-\theta_0-v_{Ht})} \geq \frac{v_{Lt}}{v_{Ht}}$. It is easy to show that this inequality is satisfied whenever $\frac{\theta_0}{1-\theta_0} \geq \frac{v_{Lt}}{v_{Ht}}$. We show next that this is always the case.

Suppose, on the contrary, that $\frac{\theta_0}{1-\theta_0} < \frac{v_{Lt}}{v_{Ht}}$. Then we must have that $(1-\theta_0)v_{Lt}[1-x-(1-s)(1-\lambda)Pr(c_t)]+\theta_0 v_{Ht}(x+s-1) > \theta_0(1-\theta_0)[s-(1-s)(1-\lambda)Pr(c_t)]$. Since $v_{Lt} \leq \theta_0$ and $v_{Ht} \leq (1-\theta_0)$ it holds that $(1-\theta_0)\theta_0[s-(1-s)(1-\lambda)Pr(c_t)] \geq (1-\theta_0)v_{Lt}[1-x-(1-s)(1-\lambda)Pr(c_t)]+\theta_0 v_{Ht}(x+s-1)$. Hence we have that $(1-\theta_0)\theta_0[s-(1-s)(1-\lambda)Pr(c_t)] > (1-\theta_0)\theta_0[s-(1-s)(1-\lambda)Pr(c_t)]$, which contradicts the initial assumption. Thus, $\frac{\theta_0}{1-\theta_0} \geq \frac{v_{Lt}}{v_{Ht}}$ must hold, which implies that $\frac{v_{Lt}}{v_{Ht}}$ is weakly increasing in t.

Lemma A1: *$\bar{c}$ is increasing in A.*

Proof:

The proof is straightforward from inspecting the expression for $\bar{c}$. First, there is a direct positive effect of A on $\bar{c}$. Moreover, there is an indirect effect: an increase in A implies an increase in $G^u(\bar{c})$ (see Lemma A.10) and this implies a drop in v_L. To see this, note that v_L can be written as $\frac{\theta_{0SS}s^2+\theta_0(1-s)(1-\lambda)s}{x[s+(1-s)(1-\lambda)G^u(\bar{c})]+s^2+(1-\lambda)(1-s)s}$. Since $G^u(\bar{c})$ increases in A because $\bar{c}$ increases in A, it follows that v_L is decreasing in A. The decrease in v_L implies a drop in θ_{SS} and thus in $\tilde{\theta}$. This also increases $\bar{c}$ for sufficiently large β_L.

Lemma A2: *$\bar{c}$ is increasing in λ.*

Proof:

We show that $\bar{c}$ is monotonically increasing in λ ($\lambda > \lambda' \Leftrightarrow \bar{c}(\lambda) > \bar{c}(\lambda')$): Consider the expression for $\bar{c}$:

$$\bar{c}^{\varepsilon-1} = \left[\frac{1-\beta_L(1-s)\lambda}{\beta_L(1-s)(1-\alpha)f}\right]\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A$$
$$\left[\beta_L(1-s)[(1-\alpha)+(1-\lambda)\alpha\gamma]\sum_{i=0}^{\infty}\beta_L^i(1-s)^i\lambda^i[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-1} - \alpha\gamma[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-1}\right].$$

Note that $\tilde{\theta}_{t+1+i}(\lambda) = \frac{\lambda^{i+1}\theta_{SS}(\lambda)}{(\lambda^{i+1}-1)\theta_{SS}(\lambda)+1}$ is decreasing in λ (θ_{SS} is decreasing in λ – see Proposition 3) and converges to zero as i goes to infinity. Consider the terms in the infinite sum in the expression for $\bar{c}$: $\beta^{i+1}(1-s)^{i+1}\lambda^{i+1}[1-\tilde{\theta}_{t+1+i}(\lambda)\gamma(1-\lambda)]^{\varepsilon-1} > \beta^{i+1}(1-s)^{i+1}\lambda'^{i+1}[1-\tilde{\theta}_{t+1+i}(\lambda')\gamma(1-\lambda')]^{\varepsilon-1}$. Hence, the first term is larger than the second for any i and the distance between the terms becomes smaller as i increases. Hence, a sufficient condition for $\bar{c}$ to be increasing in λ is (setting $\tilde{\theta}_{t+1+i} = 0$):

$$\left[\frac{1-\beta_L(1-s)\lambda}{\beta_L(1-s)(1-\alpha)f}\right]\left\{\frac{\beta_L(1-s)[1-\alpha+(1-\lambda)\alpha\gamma]}{1-\beta_L(1-s)\lambda} - \alpha\gamma[1-\theta_{SS}(\lambda)\gamma(1-\lambda)]^{\varepsilon-1}\right\} >$$
$$\left[\frac{1-\beta_L(1-s)\lambda'}{\beta_L(1-s)(1-\alpha)f}\right]\left\{\frac{\beta_L(1-s)[1-\alpha+(1-\lambda')\alpha\gamma]}{1-\beta_L(1-s)\lambda'} - \alpha\gamma[1-\theta_{SS}(\lambda')\gamma(1-\lambda')]^{\varepsilon-1}\right\}$$

Rearranging and simplifying, we obtain

$$[1-\beta_L(1-s)\lambda']\alpha\gamma[1-\theta_{SS}(\lambda')\gamma(1-\lambda')]^{\varepsilon-1} - [1-\beta_L(1-s)\lambda]\alpha\gamma[1-\theta_{SS}(\lambda)\gamma(1-\lambda)]^{\varepsilon-1} >$$
$$\beta_L(1-s)(\lambda-\lambda')\alpha\gamma.$$

A sufficient condition for this condition to hold is: $[1-\theta_{SS}(\lambda')\gamma(1-\lambda')]^{\varepsilon-1}\beta_L(1-s)(\lambda-\lambda') > \beta_L(1-s)\alpha\gamma(\lambda-\lambda')$, or, rearranging: $\theta_{SS} < \frac{1-(\alpha\gamma)^{1/(\varepsilon-1)}}{(1-\lambda)\gamma}$.

Lemma A3: *$\bar{c}$ is decreasing in γ.*

Proof:

We want to show: $\gamma > \gamma' \Leftrightarrow \bar{c}(\gamma) < \bar{c}(\gamma')$.

We have that

$$\bar{c}(\gamma)^{\varepsilon-1} = \left[\frac{1-\beta_L(1-s)\lambda}{\beta_L(1-s)(1-\alpha)f}\right]\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A$$
$$\left[\beta_L(1-s)[(1-\alpha)+(1-\lambda)\alpha\gamma]\sum_{i=0}^{\infty}\beta_L^i(1-s)^i\lambda^i[1-\tilde{\theta}_{t+1+i}\gamma(1-\lambda)]^{\varepsilon-1} - \alpha\gamma[1-\tilde{\theta}_t\gamma(1-\lambda)]^{\varepsilon-1}\right]$$

and

$$\bar{c}(\gamma')^{\varepsilon-1} = \left[\frac{1-\beta_L(1-s)\lambda}{\beta_L(1-s)(1-\alpha)f}\right]\left(\frac{\varepsilon-1}{\varepsilon}\alpha\right)^{\varepsilon-1} A$$
$$\left[\beta_L(1-s)[(1-\alpha)+(1-\lambda)\alpha\gamma']\sum_{i=0}^{\infty}\beta_L^i(1-s)^i\lambda^i[1-\tilde{\theta}_{t+1+i}\gamma'(1-\lambda)]^{\varepsilon-1} - \alpha\gamma'[1-\tilde{\theta}_t\gamma'(1-\lambda)]^{\varepsilon-1}\right].$$

We also know that $\tilde{\theta}_{t+1+i}(\gamma) = \frac{\lambda^{i+1}\theta_{SS}(\gamma)}{(\lambda^{i+1}+1)\theta_{SS}(\gamma)+1}$ and that $\theta_{SS}(\gamma)$ is increasing in γ since v_L is increasing in γ.

Therefore, the term $[1-\tilde{\theta}_{t+1+i}(\gamma')\gamma'(1-\lambda)]^{\varepsilon-1} > [1-\tilde{\theta}_{t+1+i}(\gamma)\gamma(1-\lambda)]^{\varepsilon-1}$ and the distance between the terms converges to zero as i goes to infinity. Hence, a sufficient condition for $\bar{c}(\gamma) < \bar{c}(\gamma')$ is:

$\frac{(1-s)[1-\alpha+(1-\lambda)\alpha\gamma]}{1-\beta_L(1-s)\lambda} - \alpha\gamma[1-\theta_{SS}(\gamma)\gamma(1-\lambda)]^{\varepsilon-1} < \frac{(1-s)[1-\alpha+(1-\lambda)\alpha\gamma']}{1-\beta_L(1-s)\lambda} - \alpha\gamma'[1-\theta_{SS}(\gamma')\gamma'(1-\lambda)]^{\varepsilon-1}$

$\Leftrightarrow (1-s)(1-\lambda)\alpha(\gamma-\gamma') < [\alpha\gamma[1-\theta_{SS}(\gamma)\gamma(1-\lambda)]^{\varepsilon-1} - \alpha\gamma'[1-\theta_{SS}(\gamma')\gamma'(1-\lambda)]^{\varepsilon-1}][1-\beta_L(1-s)\lambda]$

Which can also be written as:

$\beta_L(1-s)\lambda < 1 - \frac{(1-s)(1-\lambda)\alpha(\gamma-\gamma')}{\alpha\gamma[1-\theta_{SS}(\gamma)\gamma(1-\lambda)]^{\varepsilon-1} - \alpha\gamma'[1-\theta_{SS}(\gamma')\gamma'(1-\lambda)]^{\varepsilon-1}}$.

This is strictly smaller than $1 - \frac{(1-s)(1-\lambda)\alpha(\gamma-\gamma')}{\alpha[\gamma-\gamma'][1-\theta_{SS}(\gamma')\gamma'(1-\lambda)]^{\varepsilon-1}}$.

Therefore a sufficient condition for monotonicity is $\beta_L(1-s)\lambda < 1 - \frac{(1-s)(1-\lambda)}{[1-\theta_{SS}\gamma'(1-\lambda)]^{\varepsilon-1}}$ or $\beta_L < 1/[(1-s)\lambda] - \frac{(1-s)(1-\lambda)}{\lambda[1-\theta_{SS}\gamma'(1-\lambda)]^{\varepsilon-1}}$.

Lemma A4: *$\tilde{c}$ is increasing in A.*

Proof:

Note that $\tilde{c}$ is defined by:

$$V_E(\tilde{c}_t, \tilde{\theta}_{0t}) = \Pi(\tilde{c}_t, \tilde{\theta}_{0t}) + \sum_{i=1}^{\infty} (\beta_E(1-s))^i \Pi(\tilde{c}_t, \tilde{\theta}_{it}) \prod_{j=0}^{i-1} (1 - \tilde{\theta}_{jt} + \tilde{\theta}_{jt}\lambda) = 0.$$

We have that $\Pi(\tilde{c}) = \left(\frac{\alpha}{\varepsilon}\right)\left(\alpha\frac{(\varepsilon-1)}{\varepsilon}\right)^{\varepsilon-1}[1-\tilde{\theta}(1-\lambda)\gamma]^{\varepsilon}c^{1-\varepsilon}A - \alpha f$.

Thus, $\Pi(\tilde{c})$ increases in A because of the direct effect of A and because $\tilde{\theta}$ decreases in A (see Lemma A.1).

Lemma A5: *$\tilde{c}$ is increasing in λ.*

Proof:

Note that $\tilde{c}$ is defined by:

$$V_E(\tilde{c}_t, \tilde{\theta}_{0t}) = \Pi(\tilde{c}_t, \tilde{\theta}_{0t}) + \sum_{i=1}^{\infty} (\beta_E(1-s))^i \Pi(\tilde{c}_t, \tilde{\theta}_{it}) \prod_{j=0}^{i-1} (1 - \tilde{\theta}_{jt} + \tilde{\theta}_{jt}\lambda) = 0.$$

We have that $\Pi(\tilde{c}) = \left(\frac{\alpha}{\varepsilon}\right)\left(\alpha\frac{(\varepsilon-1)}{\varepsilon}\right)^{\varepsilon-1}[1-\tilde{\theta}(1-\lambda)\gamma]^{\varepsilon}c^{1-\varepsilon}A - \alpha f$.

Hence, $\frac{\partial \Pi(\tilde{c})}{\partial \lambda} = \left(\frac{\alpha}{\varepsilon}\right)\left(\alpha\frac{(\varepsilon-1)}{\varepsilon}\right)^{\varepsilon-1}c^{1-\varepsilon}A\varepsilon[1-\tilde{\theta}(1-\lambda)\gamma]^{\varepsilon-1}[\tilde{\theta}\gamma - \frac{\partial\tilde{\theta}}{\partial\lambda}(1-\lambda)\gamma]$.

Here, $\tilde{\theta}\gamma$ is the direct effect of higher λ on profits through less contract violations and $\frac{\partial\tilde{\theta}}{\partial\lambda}(1-\lambda)\gamma$ is the indirect effect through change in beliefs.

Note that $\frac{\partial\tilde{\theta}_i}{\partial\lambda} = \frac{i\lambda^{i-1}\theta_{SS}(1-\theta_{SS}) + \frac{\partial\theta_{SS}}{\partial\lambda}\lambda^i}{[(\lambda^i-1)\theta_{SS}+1]^2}$. $i\lambda^{i-1}\theta_{SS}(1-\theta_{SS})$ is the positive effect of λ on beliefs, because of lower learning speed, while $\frac{\partial\theta_{SS}}{\partial\lambda} < 0$ is the negative effect on beliefs through lower steady state value of θ. We assume that the second effect dominates the first one, so that the sign of the derivative is negative.

Moreover, $\frac{\partial\prod_{j=0}^{i-1}(1-\tilde{\theta}_{jt}+\tilde{\theta}_{jt}\lambda)}{\partial\lambda} > 0$, since $\frac{\partial(1-\tilde{\theta}_{jt}+\tilde{\theta}_{jt}\lambda)}{\partial\lambda} = \tilde{\theta}_j - \frac{\partial\tilde{\theta}_j}{\partial\lambda}(1-\lambda) > 0$.

Lemma A6: *$\tilde{c}$ is decreasing in γ.*

Proof:

Since $\Pi(\tilde{c}) = \left(\frac{\alpha}{\varepsilon}\right)\left(\alpha\frac{(\varepsilon-1)}{\varepsilon}\right)^{\varepsilon-1}[1-\tilde{\theta}(1-\lambda)\gamma]^{\varepsilon}c^{1-\varepsilon}A - \alpha f$, we have that $\frac{\partial\Pi(\tilde{c})}{\partial\gamma} = \left(\frac{\alpha}{\varepsilon}\right)\left(\alpha\frac{(\varepsilon-1)}{\varepsilon}\right)^{\varepsilon-1}c^{1-\varepsilon}A\varepsilon *$ $*[1-\tilde{\theta}(1-\lambda)\gamma]^{\varepsilon-1}[-\tilde{\theta}(1-\lambda) - \frac{\partial\tilde{\theta}}{\partial\gamma}(1-\lambda)\gamma] < 0$. This follows, since $\frac{\partial\tilde{\theta}}{\partial\gamma} = \frac{\lambda^i\frac{\partial\theta_{SS}}{\partial\gamma}}{[(\lambda^i-1)\theta_{SS}+1]^2} > 0$. Moreover, $\frac{\partial\prod_{j=0}^{i-1}(1-\tilde{\theta}_{jt}+\tilde{\theta}_{jt}\lambda)}{\partial\gamma} < 0$, since $\frac{\partial(1-\tilde{\theta}_{jt}+\tilde{\theta}_{jt}\lambda)}{\partial\gamma} = -\frac{\partial\tilde{\theta}_j}{\partial\gamma}(1-\lambda) < 0$.

Steady State Distribution of Exporters

Let $G^u(c)$, $G^L(c)$ and $G^H(c)$ be, respectively, the distributions of exporters which are unmatched, matched with patient importers and matched with impatient importers. In the steady state, the distribution of exporters matched with patient importers is described by $G^H(c) = sG^u(c) + (1 -$

$s)G^H(c)$. Thus $G^u(c) = G^H(c)$, which is logical at the steady state because all separations are exogenous.

The distribution of exporters matched with impatient importers is described as follows. There are 4 different groups: 1) exporters which have been replaced after exogenous separation: proportion s and distribution $G^u(c)$; 2) exporters which were not exogenously separated with proportion $(1-s)$. Out of those $(1-s)G^L(\bar{c})$ have $c \le \bar{c}$ and $(1-s)(1-G^L(\bar{c}))$ have $c > \bar{c}$; 3) those which were replaced after endogenous separation: $(1-s)(1-G^L(\bar{c}))(1-\lambda)$ with distribution $G^u(c)$; 4) those which were not endogenously separated: proportion $(1-s)(1-G^L(\bar{c}))\lambda$.

We further distinguish between $c \le \bar{c}$ and $c > \bar{c}$:

For exporters with $c \le \bar{c}$ we have $G^L(c) = sG^u(c) + (1-s)G^L(c) + (1-s)(1-G^L(\bar{c}))(1-\lambda)G^u(c)$, while for exporters with $c > \bar{c}$: $G^L(c) = sG^u(c) + (1-s)G^L(\bar{c}) + (1-s)(1-G^L(\bar{c}))(1-\lambda)G^u(c) + (1-s)\lambda(G^L(c) - G^L(\bar{c}))$. Hence, $G^L(z)$ is different from $G^u(z)$ because impatient importers get rid of the less efficient exporters.

Finally, we can write the population distribution as a weighted average of the distribution of the three types of exporters:

$$\begin{aligned} MG(\bar{c}) =& (\theta_0 - v_L)G^L(\bar{c}) + (1-\theta_0 - v_H)G^H(\bar{c}) + M^uG^u(\bar{c}) \\ =& (\theta_0 - v_L)G^L(\bar{c}) + (M^u + 1 - \theta_0 - v_H)G^u(\bar{c}) \end{aligned} \tag{15}$$

At $\bar{c}$ we can express $G^H(\bar{c}) = G^u(\bar{c})$, $G^L(\bar{c}) = \frac{G^u(\bar{c})[s+(1-s)(1-\lambda)]}{s+(1-s)(1-\lambda)G^u(\bar{c})}$, $v_L = \frac{\theta_0[s+(1-s)(1-\lambda)(1-G^L(\bar{c}))]}{x+s+(1-\lambda)(1-s)(1-G^L(\bar{c}))}$, $M^u = MG(\tilde{c}) - (1 - v_H - v_L)$.

Substituting this into (15), we obtain a quadratic equation in $G^u(\bar{c})$, that implicitly defines $G^u(\bar{c})$:

$$MG(\bar{c})\Phi = [G^u(\bar{c})]^2 \{\Omega[MG(\tilde{c}) - \theta_0]\} + G^u(\bar{c}) \{\Omega\theta_0 + MG(\tilde{c})\Phi - MG(\bar{c})\Omega\}, \tag{16}$$

where $\Phi = (x+s)s + (1-s)(1-\lambda)s$ and $\Omega = (1-s)(1-\lambda)x$.

Lemma A8: *$G^u(c)$ is increasing in λ.*

Proof:

Implicitly differentiating (16) and rearranging, we can write
$\frac{\partial G^u(\bar{c})}{\partial \lambda} = \left\{ \left[\frac{\partial G(\bar{c})}{\partial \lambda} - \frac{\partial G(\tilde{c})}{\partial \lambda} G_u(\bar{c}) \right] B + D \right\} / E,$
where
$E = \Omega[2G^u(\bar{c})(MG(\tilde{c}) - \theta_0) - (MG(\bar{c}) - \theta_0)] + \Phi MG(\tilde{c}),$
$B = MG_u(\bar{c})\Omega + M\Phi,$

$D = (1-s)sM[G^u(\bar{c})G(\tilde{c}) - G(\bar{c})] + (1-s)xG^u[G^u(MG(\tilde{c})-\theta_0) - (MG(\bar{c})-\theta_0)].$

This derivative is positive provided that the following sufficient conditions hold. A sufficient condition for $E > 0$ and $D > 0$ is $G^u(\bar{c}) > \frac{G(\bar{c})}{G(\tilde{c})}$, implying that the fraction of unmatched exporters that lie below the contract violation cutoff must be sufficiently larger than the fraction of firms in the population distribution below this cutoff. Sufficient for $\left[\frac{\partial G(\bar{c})}{\partial \lambda} - \frac{\partial G(\tilde{c})}{\partial \lambda}G_u(\bar{c})\right] > 0$ is $g(\bar{c})\frac{\partial \bar{c}}{\partial \lambda} > g(\tilde{c})\frac{\partial \tilde{c}}{\partial \lambda}G^u(\bar{c})$, implying that the contract violation cutoff $\bar{c}$ must be sufficiently responsive to a change in λ compared to the entry cutoff $\tilde{c}$.

Lemma A9: *$G^u(c)$ is decreasing in γ*

Proof:

Implicitly differentiating (16) and rearranging, we obtain:

$\frac{\partial G^u(\bar{c})}{\partial \gamma} = \left\{\left[\frac{\partial G(\bar{c})}{\partial \gamma} - \frac{\partial G(\tilde{c})}{\partial \gamma}G_u(\bar{c})\right]B\right\}/E$

A sufficient condition for the derivative to be negative is that $\left[\frac{\partial G(\bar{c})}{\partial \gamma} - \frac{\partial G(\tilde{c})}{\partial \gamma}G^u(\bar{c})\right] < 0$. Thus, we assume that $|g(\bar{c})\frac{\partial \bar{c}}{\partial \gamma}| > |g(\tilde{c})\frac{\partial \tilde{c}}{\partial \gamma}G^u(\bar{c})|$.

Lemma A10: *$G^u(c)$ is increasing in A.*

Proof:

Implicitly differentiating (16) and rearranging, we can also write

$\frac{\partial G^u(\bar{c})}{\partial A} = \left\{\left[\frac{\partial G(\bar{c})}{\partial A} - \frac{\partial G(\tilde{c})}{\partial A}G^u(\bar{c})\right]B\right\}/E$

A sufficient condition for the derivative to be positive is that $\left[\frac{\partial G(\bar{c})}{\partial A} - \frac{\partial G(\tilde{c})}{\partial A}G^u(\bar{c})\right] > 0$. Thus, we assume that $g(\bar{c})\frac{\partial \bar{c}}{\partial A} > g(\tilde{c})\frac{\partial \tilde{c}}{\partial A}G^u(\bar{c})$.

Derivation of State Dependence

We have that

$$\begin{aligned}
P(Y_t = 1|Y_{t-1} = 0) =& \frac{x(v_H + v_L)}{M^u}, \\
P(Y_t = 1|Y_{t-1} = 1, c \leq \bar{c}) =& 1 - s, \\
P(Y_t = 1|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}) =& P(Y_t = 1 \;\&\; H|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}) \\
& + P(Y_t = 1 \;\&\; L|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}) \\
=& P(Y_t = 1|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}, H)P(H|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}) \\
& + P(Y_t = 1|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}, L)P(L|Y_{t-1} = 1, \bar{c} \leq c \leq \tilde{c}),
\end{aligned}$$

and that

$$P(Y_t = 1|Y_{t-1} = 1, c, \bar{c} \le c \le \tilde{c}, H) = 1 - s,$$

$$P(Y_t = 1|Y_{t-1} = 1, c, \bar{c} \le c \le \tilde{c}, L) = 1 - (s + (1-s)(1-\lambda)),$$

$$P(H|Y_{t-1} = 1, c, \bar{c} \le c \le \tilde{c}) = \frac{P(c, \bar{c} \le c \le \tilde{c}|Y_{t-1} = 1, H)P(H|Y_{t-1} = 1)}{P(c, \bar{c} \le c \le \tilde{c}|Y_{t-1} = 1)},$$

$$P(c, \bar{c} \le c \le \tilde{c}|Y_{t-1} = 1, H) = g^u(c),$$

$$P(H|Y_{t-1} = 1) = \frac{1 - \theta_0 - v_H}{1 - v_L - v_H},$$

$$P(c, \bar{c} \le c \le \tilde{c}|Y_{t-1} = 1) = \frac{\theta_0 - v_L}{1 - v_L - v_H} g^L(c) + \frac{1 - \theta_0 - v_H}{1 - v_L - v_H} g^u(c).$$

Hence,

$$P(H|Y_{t-1} = 1, c, \bar{c} \le c \le \tilde{c}) = \frac{g^u(c)(1 - \theta_0 - v_H)}{g^L(c)(\theta_0 - v_L) + g^u(c)(1 - \theta_0 - v_H)},$$

and similarly,

$$P(L|Y_{t-1} = 1, c, \bar{c} \le c \le \tilde{c}) = \frac{g^L(c)(\theta_0 - v_L)}{g^L(c)(\theta_0 - v_L) + g^u(c)(1 - \theta_0 - v_H)}.$$

Thus,

$$P(Y_t = 1|Y_{t-1} = 1, \bar{c} \le c \le \tilde{c}) = (1-s)\frac{g^u(c)(1 - \theta_0 - v_H)}{g^L(c)(\theta_0 - v_L) + g^u(c)(1 - \theta_0 - v_H)} +$$
$$[1 - (s + (1-s)(1-\lambda))]\frac{g^L(c)(\theta_0 - v_L)}{g^L(c)(\theta_0 - v_L) + g^u(c)(1 - \theta_0 - v_H)}.$$

Simplifying, we obtain

$$P(Y_t = 1|Y_{t-1} = 1, \bar{c} \le c \le \tilde{c}) = \frac{(1-s)[1 + \lambda L]}{1 + L},$$

where $L \equiv \frac{(\theta_0 - v_L)}{(1 - \theta_0 - v_H)} \frac{g^L(c)}{g^u(c)}$.

Since for $c \ge \bar{c}$:

$$G^L(c) = sG^u(c) + (1-s)G^L(\bar{c}) + (1-s)(1 - G^L(\bar{c}))(1-\lambda)G^u(c) + (1-s)\lambda(G^L(c) - G^L(\bar{c})),$$

we obtain for $c \ge \bar{c}$

$$g^L(c) = sg^u(c) + (1-s)(1 - G^L(\bar{c}))(1-\lambda)g^u(c) + (1-s)\lambda g^L(c).$$

Hence:

$$\frac{g^L(c)}{g^u(c)} = \frac{s + (1-s)(1-\lambda)(1 - G^L(\bar{c}))}{1 - (1-s)\lambda}$$

Proposition 2: *State dependence is increasing in the market size of the export destination.*

Proof:

We have shown in Lemmata A.1 and A.4 that $\bar{c}$ and $\tilde{c}$ are increasing in market size (A). Let us compare two destinations, k and k', with $A_k > A'_k$. Without loss of generality, assume that the following ordering holds: $\bar{c}_{k'} < \bar{c}_k < \tilde{c}_{k'} < \tilde{c}_k$. Then we can compare state dependence across intervals. Firms with $c \in (0, \bar{c}_{k'}]$ face only exogenous separations in both countries, thus:
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (0, \bar{c}_{k'}]) - P(Y_t = 1|Y_{t-1} = 0, c, c \in (0, \bar{c}_{k'}]) = 1 - s - \frac{x(v_H+v_L)}{M^u}$ for k, k'.
Firms with $c \in (\bar{c}_{k'}, \bar{c}_k]$ experience both endogenous and exogenous separations in the small country k', while they face only exogenous separations in the large country k:
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_{k'}, \bar{c}_k]) - P(Y_t = 1|Y_{t-1} = 0, c, c(\bar{c}_{k'}, \bar{c}_k]) = 1 - s - \frac{x(v_H+v_L)}{M^u}$ for k,
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_{k'}, \bar{c}_k]) - P(Y_t = 1|Y_{t-1} = 0, c, c(\bar{c}_{k'}, \bar{c}_k]) = \frac{(1-s)[1+\lambda L]}{1+L} - \frac{x(v_H+v_L)}{M^u}$ for k'.
Firms with $c \in (\bar{c}_k, \tilde{c}_{k'}]$ have endogenous and exogenous separations in both countries:
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_k, \tilde{c}_{k'}]) - P(Y_t = 1|Y_{t-1} = 0, c, c(\bar{c}_k, \tilde{c}_{k'}]) = \frac{(1-s)[1+\lambda L]}{1+L} - \frac{x(v_H+v_L)}{M^u}$ for k, k'.
Finally, firms with $c > \tilde{c}_{k'}$ do not export to the small country and thus state dependence cannot be compared across countries for those firms. As we can see from the above expressions, for any c state dependence is either similar in both markets or discretely larger in the bigger market.

While we do not think that general equilibrium effects that impact on state dependence indirectly through changes in $G(\tilde{c})$, $G^u(\bar{c})$ and v_L are particularly relevant, we also show that the model is consistent with state dependence to be increasing in market size in a given interval.

Note that

$$\frac{\partial P(Y_t = 1|Y_{t-1} = 1, c, \bar{c} \leq c \leq \tilde{c})}{\partial A} = \frac{(\lambda - 1)(1 - s)}{[1 + L]^2} \frac{\partial L}{\partial A}.$$

The sign of this derivative is ambiguous because $(\lambda - 1) < 0$ and $\frac{\partial L}{\partial A} = \frac{\partial\left(\frac{\theta_0 - v_L}{1-\theta_0-v_H}\right)}{\partial A} \frac{g^L(c)}{g^u(c)} + \frac{\partial\left(\frac{g^L(c)}{g^u(c)}\right)}{\partial A} \frac{(\theta_0 - v_L)}{(1-\theta_0-v_H)} >< 0$ since $\frac{(\theta_0-v_L)}{(1-\theta_0-v_H)}$ is increasing in A (since v_L decreases in A) and $\frac{g^L(c)}{g^u(c)}$ is decreasing in A, since $G^L(\bar{c}) = \frac{[s+(1-s)(1-\lambda)]}{[s/G^u(\bar{c})+(1-s)(1-\lambda)]}$ increases in A (because $G^u(\bar{c})$ is increasing in A) and thus $1 - G^L(\bar{c})$ decreases in A. The total effect depends on which of the two effects is stronger.

Also

$$\frac{\partial P(Y_t = 1|Y_{t-1} = 0, c, \bar{c} \leq c \leq \tilde{c})}{\partial A} = \frac{\partial\left(\frac{x(v_H+v_L)}{MG(\tilde{c})-1+v_H+v_L)}\right)}{\partial A}$$

is decreasing in A, since v_L is decreasing in A and $G(\tilde{c})$ is increasing in A.

Proposition 3: *State dependence is increasing in the quality of the export destinations' legal institutions. Moreover, the impact of legal institutions on state dependence is larger for exporters with higher marginal costs.*

Proof:

We compare two destinations k and k' with $\lambda_k < \lambda_{k'}$. We have already shown that $\bar{c}$ and $\tilde{c}$ increase in λ. Thus, without loss of generality, assume that $\bar{c}_{k'} < \bar{c}_k < \tilde{c}_{k'} < \tilde{c}_k$.

Firms with $c \in (0, \bar{c}_{k'}]$ face only exogenous separations in both destinations. Thus,
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (0, \bar{c}_{k'}]) - P(Y = 1|Y_{-1} = 0, c, c \in (0, \bar{c}_{k'}]) = 1 - s - \frac{x(v_H+v_L)}{M^u}$ for k, k'

Firms with $c \in (\bar{c}_{k'}, \tilde{c}_{k'}]$ face both endogenous and exogenous separations in the country with low λ, while they only face exogenous separations in the destination with high λ.
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_{k'}, \tilde{c}_{k'}]) - P(Y_t = 1|Y_{t-1} = 0, c, c \in (\bar{c}_{k'}, \tilde{c}_{k'}]) = \frac{(1-s)[1+\lambda L]}{1+L} - \frac{x(v_H+v_L)}{M^u}$ for k',
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_{k'}, \bar{c}_k]) - P(Y = 1|Y_{-1} = 0, c, c \in (\bar{c}_{k'}, \bar{c}_k]) = 1 - s - \frac{x(v_H+v_L)}{M^u}$ for k.

Finally, firms with $c \in (\bar{c}_k, \tilde{c}_{k'}]$ experience endogenous and exogenous separations in both countries.
$P(Y_t = 1|Y_{t-1} = 1, c, c \in (\bar{c}_k, \tilde{c}_{k'}]) - P(Y = 1|Y_{-1} = 0, c, c \in (\bar{c}_k, \tilde{c}_{k'}]) = \frac{(1-s)[1+\lambda L]}{1+L} - \frac{x(v_H+v_L)}{M^u}$ for k, k'.

Furthermore, state dependence cannot be compared across countries for firms with $c > \tilde{c}_{k'}$.

For the impact of λ on state dependence within a given interval, note that

$$\frac{\partial P(Y = 1|Y_{-1} = 1, c, \bar{c} \leq c \leq \tilde{c})}{\partial \lambda} = \frac{(1-s)[(\lambda - 1)\frac{\partial L}{\partial \lambda} + L(1+L)]}{[1+L]^2} > 0.$$

Thus, there is a direct effect of higher λ: a given relation is more likely not to be destroyed. There is also a composition effect: $\frac{\partial L}{\partial \lambda} = \frac{\partial\left(\frac{\theta_0 - v_L}{1-\theta_0-v_H}\right)}{\partial \lambda}\frac{g^L(c)}{g^u(c)} + \frac{\partial\left(\frac{g^L(c)}{g^u(c)}\right)}{\partial \lambda}\frac{(\theta_0 - v_L)}{(1-\theta_0-v_H)}$. This effect is ambiguous since $\frac{(\theta_0-v_L)}{(1-\theta_0-v_H)}$ is increasing in λ because v_L is decreasing in λ and the sign of $\frac{\partial g^L(c)/g^u(c)}{\partial \lambda} = \frac{(1-s)[sG^L(\bar{c}) - (1-(1-s)\lambda)(1-\lambda)g^L(\bar{c})]}{[1-(1-s)\lambda]^2}$ is ambiguous. This is because on the one hand, more relations survive and this increases the mass of exporters matched to impatient importers. On the other hand, $\bar{c}$ shifts up and this decreases the probability of contract violations. We assume that the overall effect is positive.

Proof of claim that $\frac{\partial v_L}{\partial \lambda} < 0$:
v_L can be written as $\frac{\theta_0 s^2 + \theta_0(1-s)(1-\lambda)s}{x[s+(1-s)(1-\lambda)G^u(\bar{c})] + s^2 + (1-\lambda)(1-s)s}$. Thus, we have that

$$\frac{\partial v_L}{\partial \lambda} = \frac{[G^u(\bar{c}) - 1]\theta_0 xs(1-s)[s - (1-s)(1-\lambda)] - \frac{\partial G^u(\bar{c})}{\partial \lambda}\theta_0 s(1-s)(1-\lambda)[s + (1-s)(1-\lambda)]}{\{x[s + (1-s)(1-\lambda)G^u] + s^2 + (1-\lambda)(1-s)s\}^2}.$$

Therefore, a sufficient condition for the expression to be negative is $s > (1-s)(1-\lambda)$. Since $\frac{\partial G^u(\bar{c})}{\partial \lambda} > 0$ we have that $\frac{\partial v_L}{\partial \lambda} < 0$.

Also,

$$\frac{\partial P(Y=1|Y_{-1}=0)}{\partial \lambda} = \frac{\partial \frac{x(v_H+v_L)}{M^u}}{\partial \lambda} < 0,$$

since

$$\frac{\partial \frac{x(v_H+v_L)}{M^u}}{\partial \lambda} = \frac{\partial \left(\frac{x(v_H+v_L)}{G(\tilde{c})M-1+v_H+v_L}\right)}{\partial \lambda} = \frac{\frac{\partial v_L}{\partial \lambda} x[G(\tilde{c})M-1] - x(v_H+v_L)M\frac{\partial G(\tilde{c})}{\partial \lambda}}{[G(\tilde{c})M-1+v_H+v_L]^2} < 0.$$

These observations imply that state dependence is also increasing in λ within a given interval.

For the second part of the proposition, note that λ only matters for state dependence via its impact on the probability to survive as long as $c > \bar{c}_{k'}$, else λ only affects the probability to find a partner. Thus, λ has a larger impact on state dependence for less productive firms.

Proposition 4: *The positive impact of legal institutions on state dependence is larger in sectors with larger contracting frictions (sectors with higher levels of γ).*

Proof:

We compare the impact of a small improvement in legal institutions (from $\lambda_{k'}$ to λ_k) for two sectors that differ in the extent of their contracting frictions. Suppose that we compare state dependence for two sectors: sector j' with large contracting frictions (high γ) and sector j with low contracting frictions (low γ). We have shown that $\bar{c}$ and $\tilde{c}$ are both increasing functions of λ and decreasing functions of γ. Hence, we have that $\bar{c}_{k'} < \bar{c}_k$ and $\tilde{c}_{k'} < \tilde{c}_k$. We also have that $\bar{c}_{j'} < \bar{c}_j$ and $\tilde{c}_{j'} < \tilde{c}_j$. Suppose that the ordering of cutoffs is such that $\bar{c}_{j'k'} < \bar{c}_{j'k} < \tilde{c}_{j'k'} < \bar{c}_{jk'}$.[39]

For firms with c below $\bar{c}_{j'k'}$ the impact of a change in λ is the direct effect of λ on state dependence: $\frac{\partial P(Y_t=1|Y_{t-1}=1,c,c\in(0,\bar{c}_{j'k'}])}{\partial \lambda} - \frac{P(Y_t=1|Y_{t-1}=0)}{\partial \lambda} = -\frac{\partial \frac{x(v_H+v_L)}{M^u}}{\partial \lambda} > 0$ for j, j'

For firms in the interval $[\bar{c}_{j'k'}, \bar{c}_{j'k}]$ that produce in the high γ sector j', an improvement in λ moves them from a situation with endogenous separations to one with only exogenous separations and they experience a large and discrete increase in state dependence. Thus, before the increase in λ state dependence is:

$P(Y_t = 1|Y_{t-1} = 1, c, j', c \in [\bar{c}_{j'k'}, \bar{c}_{j'k}]) - P(Y_t = 1|Y_{t-1} = 0, c, j', c \in [\bar{c}_{j'k'}, \bar{c}_{j'k}]) = \frac{(1-s)[1+\lambda L]}{1+L} - \frac{x(v_H+v_L)}{M^u}$.

While after the increase in λ state dependence becomes:

[39] Other orderings of the cutoffs that give less clearcut predictions are also possible. We focus on this ordering because it is consistent with the results from our empirical test.

$P(Y_t = 1|Y_{t-1} = 1, c, j', c \in [\bar{c}_{j'k'}, \bar{c}_{j'k}]) - P(Y_t = 1|Y_{t-1} = 0, c, c \in [\bar{c}_{j'k'}, \bar{c}_{j'k}]) = 1 - s - \frac{x(v_H+v_L)}{M^u}$.

Differently, for those firms in the interval $[\bar{c}_{j'k'}, \bar{c}_{j'k}]$ that produce in the low γ sector, the only impact of a change in λ on state dependence is the direct impact, which is much smaller:

$\frac{\partial P(Y_t=1|Y_{t-1}=1,c,j,c\in[\bar{c}_{j'k'},\bar{c}_{j'k}]}{\partial\lambda} - \frac{P(Y_t=1|Y_{t-1}=0)}{\partial\lambda} = -\frac{\partial\frac{x(v_H+v_L)}{M^u}}{\partial\lambda} > 0.$

Moreover, if the firm is located in the interval $[\bar{c}_{j'k}, \tilde{c}_{j'k'}]$, in the high γ sector j', there are endogenous separations before and after the change in λ, while in the low γ sector j all separations are exogenous both before and after the change in λ.

Thus, for j':

$\frac{\partial P(Y_t=1|Y_{t-1}=1,c,j',c\in(\bar{c}_{j'k},\tilde{c}_{j'k'}])}{\partial\lambda} - \frac{P(Y_t=1|Y_{t-1}=0)}{\partial\lambda} = \frac{\partial\left(\frac{(1-s)[1+\lambda L]}{1+L}\right)}{\partial\lambda} - \frac{\partial\frac{x(v_H+v_L)}{M^u}}{\partial\lambda} > 0,$

while for j:

$\frac{\partial P(Y_t=1|Y_{t-1}=1,c,j,c\in(\bar{c}_{j'k},\tilde{c}_{j'k'}])}{\partial\lambda} - \frac{P(Y=1|Y_{-1}=0)}{\partial\lambda} = -\frac{\partial\frac{x(v_H+v_L)}{M^u}}{\partial\lambda} > 0.$

Finally, for $c > \tilde{c}_{jk}$ state dependence cannot be compared because no such firm would export to both destinations. We conclude that the impact of λ on state dependence is always weakly larger in the sector with larger contracting frictions.

Proposition 5: *The hazard is decreasing in the age of the relation.*

Proof:

For $c > \bar{c}$ $H(c, c > \bar{c}) = s + \frac{v_L(1-\lambda)(1-s)}{v_L+\frac{v_H}{\lambda^{i-1}}}$. Since λ^{i-1} is decreasing in i, $H(c, c > \bar{c})$ is decreasing in i.

Proposition 7: *The conditional hazard is decreasing in destination country's market size.*

Proof:

Since $\bar{c}$ and $\tilde{c}$ is increasing in A, for a given c compare two destinations with $A_k > A_{k'}$. Thus, without loss of generality assume that $\bar{c}_{k'} < \bar{c}_k < \tilde{c}_{k'} < \tilde{c}_k$.

Then for $c < \bar{c}_{k'}$:

$H(c) = s$ for k, k'.

For $c \in (\bar{c}_{k'}, \bar{c}_k)$:

$H(c) = s + \frac{v_L(1-\lambda)(1-s)\lambda^{i-1}}{v_L\lambda^{i-1}+v_H}$ for k',

$H(c) = s$ for k.

For $c \geq \bar{c}_k$:

$H(c) = s + \frac{v_L(1-\lambda)(1-s)\lambda^{i-1}}{v_L\lambda^{i-1}+v_H}$ for k, k'.

Moreover, within an interval note that v_L is decreasing in A and thus $\frac{\partial H(c,c>\bar{c})}{\partial A} < 0$.

Proposition 8: *The conditional hazard is decreasing in the quality of the legal system for sufficiently young relations. Moreover, for those relations an increase in the quality of the legal system leads to a larger decrease in the conditional hazard in sectors with larger contracting problems.*

Proof:

Proof of part 1: Since $\bar{c}$ and $\tilde{c}$ are increasing in λ, for a given c compare two destinations with $\lambda_k > \lambda_{k'}$. Without loss of generality, assume that $\bar{c}_{k'} < \bar{c}_k < \tilde{c}_{k'} < \tilde{c}_k$.

Then for $c < \bar{c}_{k'}$:

$H(c) = s$ for k, k'.

For $c \in (\bar{c}_{k'}, \bar{c}_k)$:

$H(c) = s + \frac{v_L(1-\lambda)(1-s)\lambda^{i-1}}{v_L\lambda^{i-1}+v_H}$ for k',

$H(c) = s$ for k.

For $c \geq \bar{c}_k$:

$H(c) = s + \frac{v_L(1-\lambda)(1-s)\lambda^{i-1}}{v_L\lambda^{i-1}+v_H}$ for k, k'.

Moreover, within an interval note that $H(c, c > \bar{c})$ is decreasing in λ for age i sufficiently small.

For $i = 1$, $H(c) = s + \frac{v_L(1-s)(1-\lambda)}{v_L+v_H}$, and

$\frac{\partial H}{\partial \lambda} = -(1-s)\frac{v_L}{v_L+v_H} < 0$.

Proof of part 2:

We compare the impact of a small improvement in legal institutions (from $\lambda_{k'}$ to λ_k) for two sectors that differ in the extent of their contracting frictions. Suppose that we compare state dependence for two sectors: sector j' with large contracting frictions (high γ) and sector j with low contracting frictions (low γ). We have shown that $\bar{c}$ and $\tilde{c}$ are both decreasing functions of γ. Hence, we have that $\bar{c}_{j'} < \bar{c}_j$ and $\tilde{c}_{j'} < \tilde{c}_j$. Moreover, $\bar{c}$ and $\tilde{c}$ are increasing in λ. Suppose that the ordering of cutoffs is such that $\bar{c}_{j'k'} < \bar{c}_{j'k} < \tilde{c}_{j'k'} < \bar{c}_{jk'} < \bar{c}_{jk}$.[40]

For $c < \bar{c}_{j'k'}$: there is no effect of a change in λ in sectors j and j', since $H(c, c < \bar{c}_{j'k'}) = s$.

For $c \in [\bar{c}_{j'k'}, \bar{c}_{j'k})$: in sector j' H changes from $H(c) = s + \frac{v_L(1-\lambda)(1-s)\lambda^{i-1}}{v_L\lambda^{i-1}+v_H}$ to $H(c) = s$. In sector j there is no effect on the hazard.

For $c \in [\bar{c}_{j'k}, \tilde{c}_{j'k'})$: in sector j', and for i sufficiently small ($i = 1$), H changes by $\frac{\partial H}{\partial \lambda} = -\frac{(1-s)v_L}{v_L+v_H} < 0$. In sector j the hazard does not change.

[40] Other orderings of the cutoffs that give less clearcut predictions are also possible, in particular, we require $\bar{c}_{j'k} < \bar{c}_{jk'}$ and $\tilde{c}_{j'k'} < \bar{c}_{jk'}$ for our prediction to hold unambiguously. We focus on this ordering because it is consistent with the results from our empirical test.

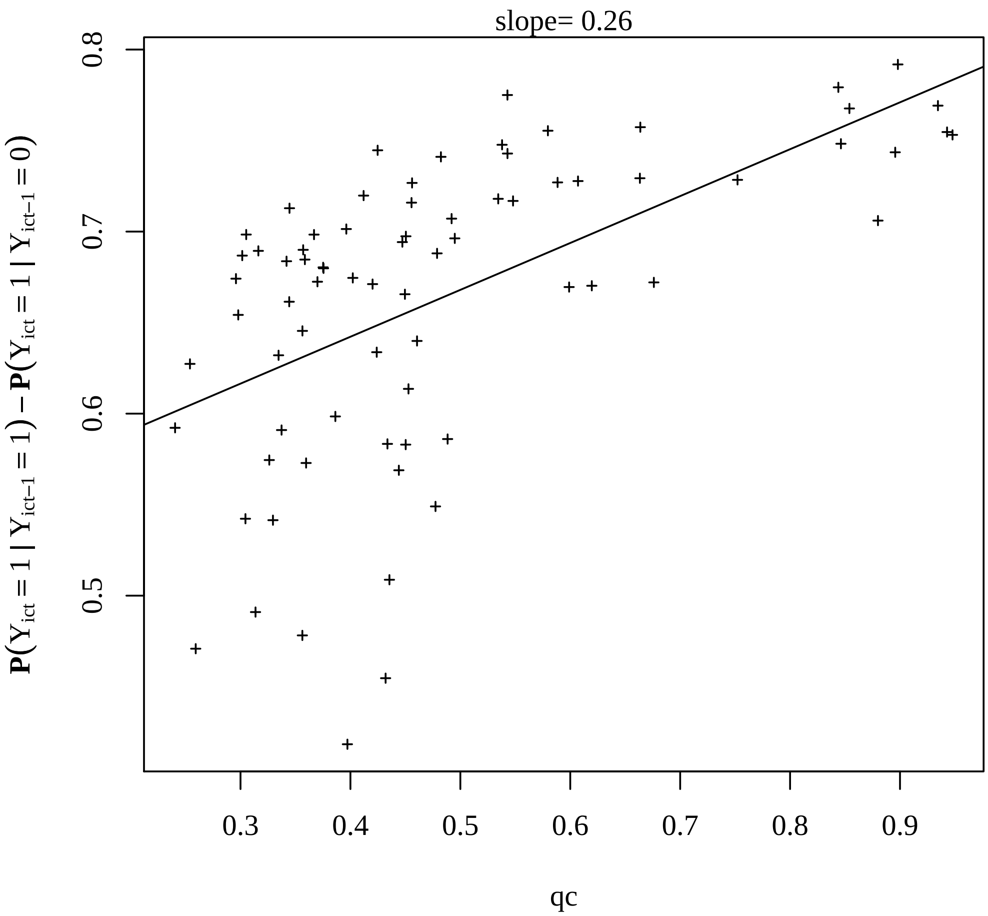

Figure 1: State dependence to be explained by legal institutions. The figure shows correlation between the estimated marginal effect of past export status on current export decisions with *rule of law*.

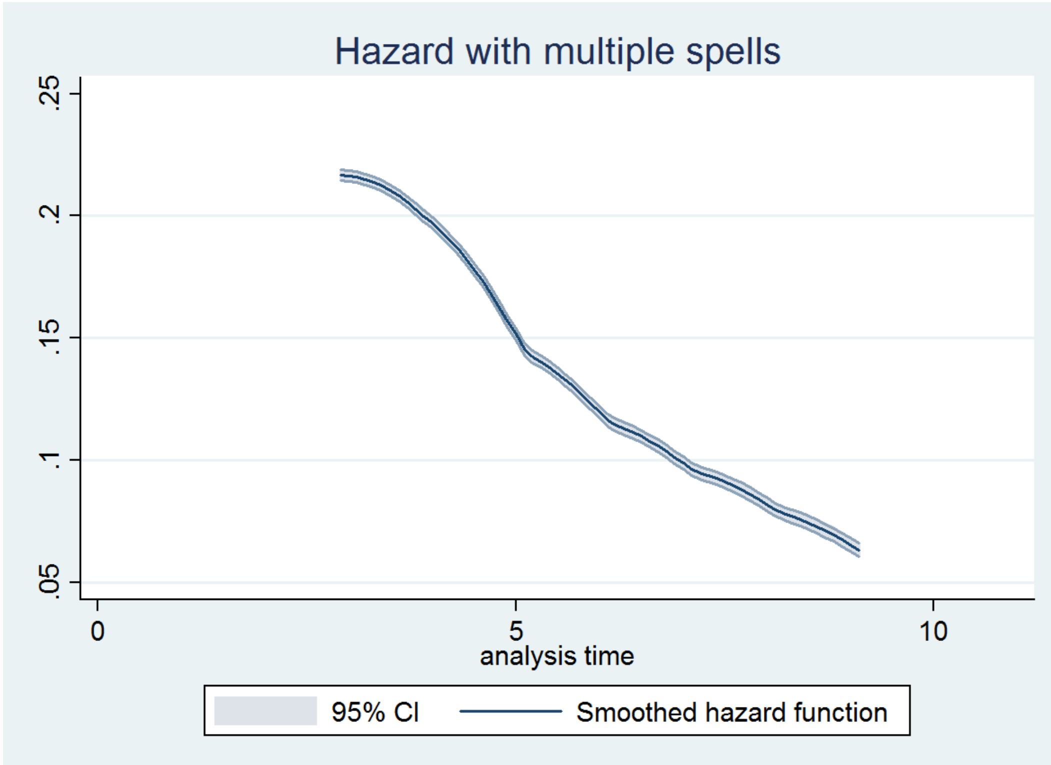

Figure 2: Hazard rate: Nonparametric estimate

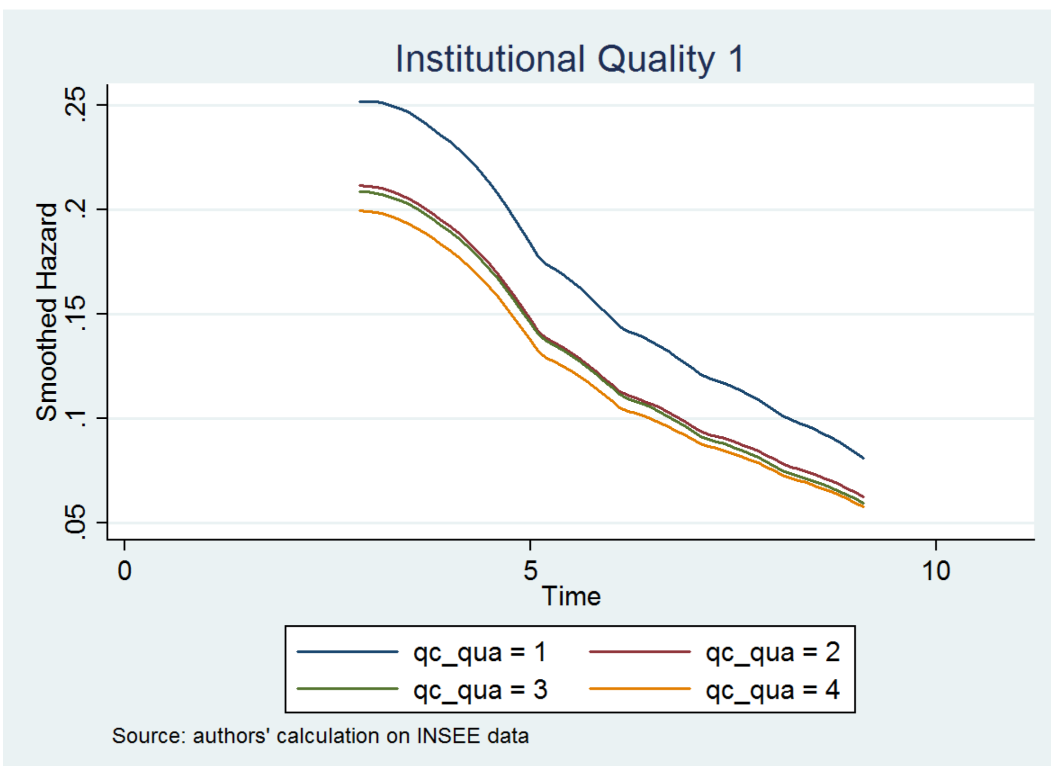

Figure 3: Hazard rate by institutional quality quartile

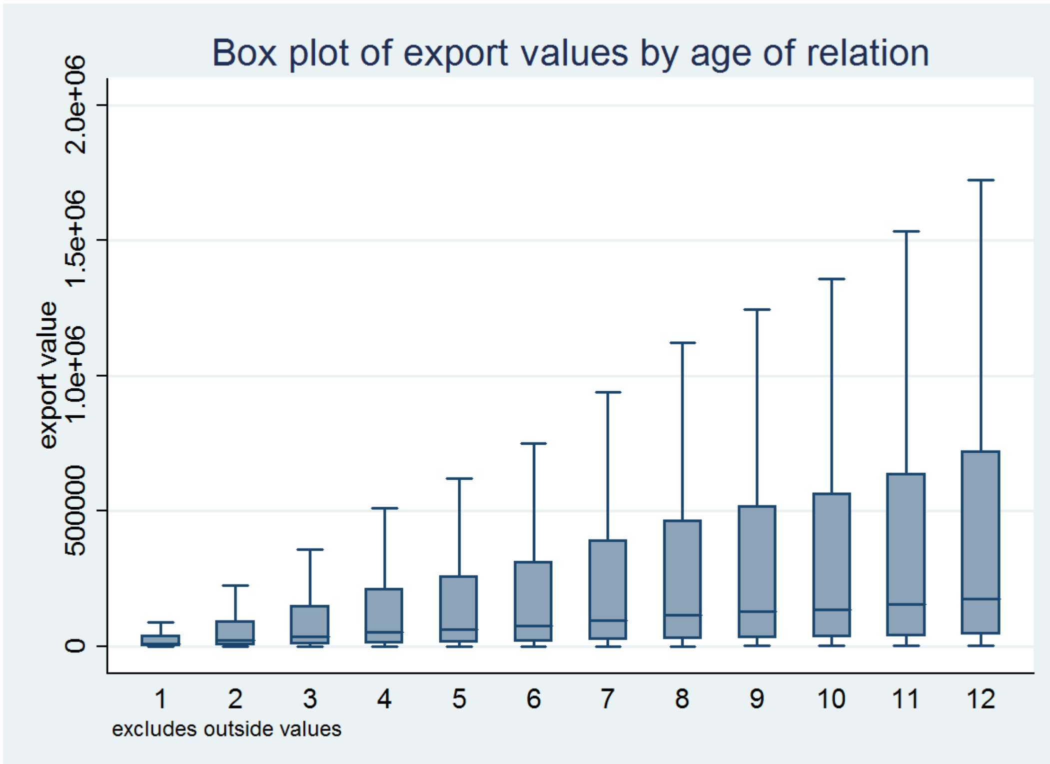

Figure 4: Export values by relation age

Table 1: Summary statistics I: firm variables

	Level	N	Mean	SD	Min	25th Pct.	Med.	75th Pct.	Max
export value (log)	firm - year - country	503,336	10.6	2.2	0	8.9	10.4	12.0	21.1
export value (log)	firm - year	63,040	12.2	2.6	1.9	10.3	12.2	14.1	21.4
export value (log)	firm	6,594	13.9	3.1	4.8	11.8	14.1	16.1	23.5
number of countries	firm - year	63,040	8.0	9.7	1	2	4	10	75
number of countries	firm	6,594	14.6	14.7	1	3	9	21	75
productivity (log)	firm - year	63,040	3.9	0.5	-3.2	3.6	3.9	4.2	11.7

Sample without EU countries (75 countries)						
	Mean	SD	Min	25th Pct.	75th Pct.	Max
rule of law	0.5	0.2	0.2	0.4	0.6	0.9
number procedures	28.4	11.9	2	19	37	49
cost	2.9	0.7	1.1	2.4	3.4	4.6
legal	5.3	1.5	2.4	4.5	5.8	9.2
GDP (log)	8.2	1.1	6.5	7.2	8.8	10.3
GDP p.c. (log)	-1.6	1.8	-6.1	-2.6	-0.4	4.4
distance (log)	8.2	0.6	6.8	7.9	8.7	9.4

Table 2: Summary statistics II: country variables

NES sector name	Rauch	Nunn
Production, processing and preserving of meat and meat products	0.00	0.36
Man. of dairy products	0.00	0.36
Man. of beverages	0.33	0.73
Man. of grain mill products, starch products, prepared animal feeds	0.50	0.33
Man. of other food products	0.33	0.35
Man. of tobacco products	0.00	0.32
Man. of wearing apparel; dressing and dyeing of fur	0.90	0.73
Man. of leather and leather products and footwear	0.63	0.57
Publishing, printing and reproduction of recorded media	0.56	0.73
Man. of pharmaceuticals, medicinal chemicals and botanical products	0.50	0.69
Man. of soap and detergents, perfumes and toilet preparations	0.50	0.52
Man. of furniture	1.00	0.52
Man. of jewelery and musical instruments	1.00	0.60
Man. of sports goods, games, toys and others n.e.c	0.73	0.56
Man. of domestic appliances	0.75	0.68
Man. of television and radio receivers, sound or video recording	1.00	0.82
Man. of optical instruments, photographic equipment, watches and clocks	0.89	0.83
Man. of motor vehicles, bodies and trailers	1.00	0.79
Man. of parts and accessories for motor vehicles	0.50	0.67
Building and repairing of ships and boats	0.57	0.75
Man. of railway and tramway locomotives and rolling stock	0.67	0.68
Man. of aircraft and spacecraft	1.00	0.89
Man. of motorcycles, bicycles and other transport equipment n.e.c	0.57	0.84
Man. of structural metal products	1.00	0.53
Man. of tanks, containers of metal, central heating radiators, boilers, steam generators	1.00	0.61
Man. of machinery for the production and use of mechanical power	0.44	0.82
Man. of other general purpose machinery	0.71	0.78
Man. of agricultural and forestry machinery	1.00	0.63
Man. of machine tools	0.89	0.84
Man. of other special purpose machinery	0.85	0.80
Man. of weapons and ammunition	1.00	0.68
Man. of office machinery and computers	1.00	0.85
Man. of electric motors, generators and transformers	1.00	0.82
Man. of television and radio transmitters and apparatus for line telephony and line telegraphy	1.00	0.82
Man. of medical and surgical equipment and orthopaedic appliances	1.00	0.78
Man. of industrial process control equipment, instruments for measuring, navigating	1.00	0.84
Man. of glass and glass products	0.85	0.58
Man. of other non-metallic mineral products	0.57	0.43
Preparation and spinning of textile fibers, weaving and finishing of textiles	0.50	0.38
Man. of textile articles, except apparel	0.86	0.48
Man. of knitted and crocheted fabrics and articles	1.00	0.38
Man. of wood and wood products	0.57	0.52
Man. of pulp, paper and paperboard	0.25	0.38
Man. of articles of paper and paperboard	0.17	0.46
Man. of basic inorganic chemicals	0.00	0.27
Man. of basic organic chemicals	0.15	0.27
Man. of agro-chemical products, paints and other chemical products	0.89	0.50
Man. of man-made fibers	0.00	0.33
Man. of rubber products	0.60	0.58
Man. of plastic products	0.67	0.37
First processing of iron and steel	0.00	0.44
Man. of basic precious and non-ferrous metals	0.06	0.23
Casting of metals	0.00	0.27
Industrial services for treatment of metals	0.43	0.38
Man. of fabricated metal products	0.90	0.62
Recycling	0.80	0.39
Man. of electrical equipments and apparatus n.e.c.	0.86	0.76
Man. of electronic valves, tubes and other electronic components	1.00	0.82

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Table 3: Sector characteristics.

Fraction of final goods (Rauch)/ intermediate inputs (Nunn) not sold in organized exchanges and not reference priced by NES sector.

variables	1	2	3	4	5	6	7	8	9
Y_{ikt-1}	0.641***	0.096***	0.031***	0.005	0.050***	0.007	-0.050***	-0.105***	-0.068**
	(0.0009)	(0.014)	(0.013)	(0.013)	(0.013)	(0.027)	(0.019)	(0.030)	(0.022)
**rule of law*		0.118***				0.269***			
		(0.006)				(0.025)			
**number procedures*			0.0009***				0.0034***		
			(0.00007)				(0.0004)		
**cost*				0.014***				0.048***	
				(0.001)				(0.008)	
**legal*					0.009***				0.028***
					(0.0006)				(0.002)
**log(VA/worker)*		0.051***	0.051***	0.051***	0.051***	0.073***	0.071***	0.078***	0.081***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.007)	(0.005)
**log(GDP)*		0.017***	0.014***	0.015***	0.016***	0.017***	0.014***	0.015***	0.015***
		(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0004)
**log(GDP p.c.)*		0.014***	0.031***	0.030***	0.024***	0.014***	0.031***	0.030***	0.024***
		(0.001)	(0.0009)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
**log(distance)*		-0.022***	-0.020***	-0.019***	-0.021***	-0.022***	-0.020***	-0.018***	-0.021***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)
**rule of law* log(VA/worker)*						-0.037***			
						(0.005)			
**number procedures*log(VA/worker)*							-0.0006***		
							(9e-5)		
**cost *log(VA/worker)*								-0.008***	
								(0.001)	
**legal*log(VA/worker)*									-0.005***
									(0.0006)
N	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300
Country-time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm-time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time
R^2	0.52	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53

Table 4: State dependence: Linear probability model.

Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.

variables	1	2	3	4	5	6	7	8
Y_{ikt-1}	0.653***	0.608***	0.459***	0.43***	0.640***	0.596***	0.495***	0.421***
	(0.008)	(0.006)	(0.031)	(0.022)	(0.009)	(0.007)	(0.026)	(0.019)
**rule of law*	0.091***	0.143***	-0.036*	0.023***				
	(0.011)	(0.008)	(0.021)	(0.015)				
**legal*					0.011***	0.016***	0.001'	0.002
					(0.001)		(0.002)	(0.001)
**Nunn*	-0.222***		-0.28***		-0.228***		-0.375***	
	(0.013)		(0.047)		(0.014)		(0.041)	
**Rauch*		-0.138***		-0.223***		-0.147***		-0.242***
		(0.008)		(0.031)		(0.009)		(0.027)
**rule of law*Nunn*	0.196***		0.149***					
	(0.018)		(0.033)					
**rule of law*Rauch*		0.105***		0.05**				
		(0.011)		(0.021)				
**legal*Nunn*					0.02***		0.076***	
					(0.002)		(0.003)	
**legal*Rauch*						0.012***		0.005**
						(0.001)		(0.002)
**log(GDP p.c.)*			0.031***	0.028***			0.024***	0.029***
			(0.005)	(0.003)			(0.004)	(0.003)
**log(GDP p.c.)*Nunn*			0.01				0.026***	
			(0.007)				(0.006)	
**log(GDP p.c.)*Rauch*				0.013***				0.016***
				(0.005)				(0.004)
N	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300	5,901,300
Country-time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-time FE	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time	firm-time
$R^2(within)$	0.468	0.468	0.468	0.468	0.468	0.468	0.468	0.468

Table 5: State dependence: linear probability model, sector regressions.

Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.

length of the spell	percentage
1	55.9
2	16.7
3	8.0
4	5.0
5	3.6
6	2.6
7	2.1
8	1.6
9	1.4
10	1.2
11	1.0
12	0.9

Table 6: Frequency of spells

length of the spell	whole sample	by legal quality quartiles				by productivity quartiles			
		1	2	3	4	1	2	3	4
1	0.49	0.44	0.49	0.52	0.52	0.45	0.48	0.50	0.54
2	0.34	0.29	0.35	0.37	0.38	0.30	0.33	0.36	0.40
3	0.27	0.21	0.28	0.30	0.31	0.23	0.26	0.29	0.32
4	0.23	0.17	0.23	0.25	0.26	0.19	0.21	0.24	0.28
5	0.20	0.14	0.21	0.21	0.23	0.16	0.18	0.21	0.24
6	0.18	0.13	0.18	0.19	0.21	0.14	0.16	0.19	0.22
7	0.16	0.11	0.17	0.18	0.19	0.13	0.15	0.17	0.20
8	0.15	0.10	0.15	0.16	0.18	0.11	0.14	0.16	0.18
9	0.14	0.09	0.14	0.15	0.16	0.11	0.13	0.15	0.17
10	0.13	0.08	0.13	0.14	0.16	0.10	0.12	0.14	0.17
11	0.12	0.08	0.13	0.14	0.15	0.09	0.11	0.14	0.16
12	0.12	0.08	0.13	0.14	0.15	0.09	0.11	0.14	0.16

All statistics are significant at the 1% level.

Table 7: Kaplan-Meier survival rates by quartiles

variables	1	2	3	4
log(rule of law)	-0.04			
	(0.027)			
log(number procedures)		-0.03***		
		(0.005)		
log(legal)			-0.05***	
			(0.014)	
log(cost)				-0.05***
				(0.006)
log(VA/worker)	-0.10***	-0.10***	-0.10***	-0.10***
	(0.007)	(0.007)	(0.007)	(0.007)
log(distance)	0.06***	0.06***	0.06***	0.05***
	(0.005)	(0.005)	(0.005)	(0.005)
log(GDP)	-0.05***	-0.04***	-0.05***	-0.05***
	(0.002)	(0.002)	(0.002)	(0.002)
log(GDP p.c.)	-0.05***	-0.05***	-0.05***	-0.03***
	(0.006)	(0.004)	(0.005)	(0.005)
N	79,549	79,549	79,549	79,549
Robust	YES	YES	YES	YES
Start	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES

Table 8: Duration: Cox regressions.

Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.

variables	1	2	3	4	5	6	7	8
log(rule of law)	-0.12***	-0.15***	0.03	0.01				
	(0.04)	(0.03)	0.04	0.03				
*log(rule of law) *Nunn*	-0.15**		-0.13**					
	(0.06)		(0.06)					
*log(rule of law) *Rauch*		-0.09*		-0.09**				
		(0.047)		(0.03)				
log(legal)					-0.14***	-0.17***	0.02	0.02
					(0.05)	(0.04)	(0.05)	(0.04)
*log(legal)*Nunn*					-0.14*		-0.12	
					(0.08)		(0.07)	
*log(legal)*Rauch*						-0.10		-0.10**
						(0.07)		(0.04)
log(VA/worker)			-0.10***	-0.10***			-0.10***	-0.10***
			(0.007)	(0.008)			(0.007)	(0.008)
log(GDP)			-0.05***	-0.05***			-0.05***	-0.05***
			(0.003)	(0.003)			(0.003)	(0.003)
log(GDP p.c.)			-0.04***	-0.04***			-0.05***	-0.05***
			(0.008)	(0.009)			(0.006)	(0.007)
log(distance)			0.06***	0.06***			0.06***	0.06***
			(0.006)	(0.007)			(0.007)	(0.007)
N	79,549	79,549	79,549	79,549	79,549	79,549	79,549	79,549
Cluster	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector
Start	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 9: Duration: sectoral Cox regressions.Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.

variables	1	2	3	4
log(rule of law)	-0.16***			
	(0.04)			
log(number procedures)		-0.05***		
		(0.007)		
log(legal)			-0.12***	
			(0.02)	
log(cost)				-0.08***
				(0.009)
log(VA/worker)	-0.16***	-0.16***	-0.16***	-0.16***
	(0.009)	(0.009)	(0.009)	(0.009)
log(distance)	0.12***	0.12***	0.12***	0.11***
	(0.007)	(0.007)	(0.007)	(0.007)
log(GDP)	-0.03***	-0.08***	-0.08***	-0.08***
	(0.003)	(0.003)	(0.003)	(0.009)
log(GDP p.c.)	-0.05***	-0.07***	-0.05***	-0.04***
	(0.009)	(0.005)	(0.007)	(0.006)
N	49,479	49,479	49,479	49,479
Robust	YES	YES	YES	YES
Start	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES

Table 10: Duration robustness I: Cox regressions, only single spells.

Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.

variables	1	2	3	4	5	6	7	8
log(rule of law)	-0.13**	-0.25***	0.06	0.03				
	(0.06)	(0.05)	0.06	0.05				
*log(rule of law)*Nunn*	-0.32***		-0.27***					
	(0.10)		(0.09)					
*log(rule of law)*Rauch*		-0.11		-0.11*				
		(0.08)		(0.06)				
log(legal)					-0.16**	-0.27***	0.05	-0.03
					(0.08)	(0.06)	(0.07)	(0.06)
*log(legal)*Nunn*					-0.33***		-0.28***	
					(0.12)		(0.11)	
*log(legal)*Rauch*						-0.14		-0.14*
						(0.10)		(0.07)
log(VA/worker)			-0.16***	-0.16***			-0.16***	-0.16***
			(0.01)	(0.01)			(0.01)	(0.01)
log(GDP)			-0.08***	-0.08***			-0.08***	-0.08***
			(0.004)	(0.004)			(0.004)	(0.004)
log(GDP p.c.)			-0.04***	-0.04***			-0.05***	-0.05***
			(0.01)	(0.01)			(0.004)	(0.01)
log(distance)			0.12***	0.12***			0.12***	0.12***
			(0.01)	(0.01)			(0.01)	(0.01)
N	49,479	49,479	49,479	49,479	49,479	49,479	49,479	49,479
Cluster	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector	country-sector
Start	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 11: Duration robustness II: sectoral Cox regressions, only single spells.

Notes: Robust standard errors are in parentheses denoting *** 1%, **5%, and *10% significance.