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TOWARDS A THEORY OF TRADE FINANCE

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Abstract

Shipping goods internationally is risky and takes time. To allocate risk and to finance the time gap between production and sale, a range of payment contracts is utilized. I study the optimal choice between these payment contracts and their implications for trade. The equilibrium contract is determined by financial market characteristics and contracting environments in both the source and the destination country. Trade increases in enforcement probabilities and decreases in financing costs proportional to the time needed for trade. Empirical results from gravity regressions are in line with the model, highly significant and economically relevant. They suggest that importer finance is as important for trade as exporter finance.

Keywords: trade finance, payment contracts, trade patterns, distance interaction

JEL-Codes: F12, F3, G21, G32

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1 Introduction

Shipping goods internationally is risky and takes time. Therefore, trading partners not only have to agree on the specification and the price of a good, but they also need to decide on the timing of payments. To allocate risk and to finance the time gap between production and sale, a range of different payment contracts is utilized. These can be broadly classified into exporter finance (Open Account), importer finance (Cash in Advance) and bank finance (Letter of Credit).¹

In this paper, I study the optimal choice between these three types of payment contracts and their implications for trade. The equilibrium contract is determined by financial market characteristics and contracting environments in the source and the destination country. The model shows that a transaction should, in general, be financed by the firm in the country with the lower financing costs and the weaker contract enforcement. This minimizes interest rate costs and the probability that the trading partner who did not pre-finance the transaction defaults on her contractual obligations. When two firms in countries with weak contract enforcement trade with each other, bank finance (Letter of Credit) is most useful as it resolves the moral hazard problem of defaulting.²

Through the payment contract choice, financing costs and contracting environments in the source and the destination country interact to shape trade finance costs. These are variable trade costs proportional to the value of goods exported, similar to the iceberg trade cost formulation as introduced by Samuelson (1954). Being an obstacle to trade, trade finance costs affect trade patterns. Exports increase in enforcement probabilities and decrease in financing costs. The latter effect is the larger, the longer it takes from production to sale.

The availability of different payment contracts can be beneficial if financial conditions change. Suppose, for example, a country experiences a financial crisis that leads to a rise

¹According to survey evidence reported in IMF (2009), 42-48 percent of transactions are done through Open Account, which corresponds to pure exporter financing. Cash in Advance, which represents pure importer financing, accounts for 19-22 percent and bank intermediated transactions account for the rest of transactions. The wide use of different working capital practices is also documented by Wagner Ricci and Morrison (1996), who surveyed Fortune 200 companies.

²I also study the case of intermediate type contracts with a partial pre-payment. While they can be a means to reduce financing costs, they cannot resolve the moral hazard problem of the importer.

in interest rates. Then, a payment contract switch can limit adverse effects by moving the financing activity to the country of the trading partner. This is not possible if financial conditions in both countries deteriorate at the same time. Therefore, multilateral crises should have a larger impact on trade flows than national crises.

In the empirical part of the paper, I test key predictions of the model using a panel of bilateral trade flows. I run gravity regressions including interaction terms between distance and financing costs in the source and the destination country to identify the effect of trade finance on trade flows. I find that two countries trade less with each other if their financing costs are higher. As predicted, this effect is the larger, the more time is needed for trade.³

Furthermore, if one country has an absolute advantage in financing costs and the other country has an absolute advantage in contract enforcement, the model suggests that only the minimum financing costs matter. In line with this prediction, I find a strong effect of the minimum financing costs and its interaction with distance on trade flows. At the same time, controlling for the minimum interest rate and its interaction with distance, the exporter and importer financing costs and their interactions with distance all become insignificant. This gives support to the prediction that, when each country has an absolute advantage in one activity, firms should finance trade through the trading partner with lower financing costs.

The paper is related to two strands of theoretical literature. First, there is a large number of papers that study the use of trade credit between firms. Trade credit usually refers to downstream lending between firms in a supply chain, both inside a country and across borders. International trade credit therefore corresponds to one of the three payment contracts considered in this paper, namely Open Account. The literature has concentrated on the relationship of two firms inside a country and has studied under which circumstances trade credit is used as a substitute for bank credit and what the underlying costs and benefits are.⁴ In this paper, the focus is instead on the trade-off between financing costs and contracting environments in different countries to optimally finance trade transactions. The analysis abstracts from any frictions that could imply a wedge between bank and firm

³As no direct time to trade data is available, I use geographical distance as a proxy for the time needed for trade.

⁴See Biais and Gollier (1997), Petersen and Rajan (1997), Wilner (2000), Burkart and Ellingsen (2004), Cunat (2007), Giannetti et al. (2011) and Klapper et al. (2011).

finance inside a country, which is the central issue studied in the trade credit literature.

Second, there are theoretical papers that have considered the relationship between financial market conditions and international trade. Kletzer and Bardhan (1987) show how sovereign default risk and credit market imperfections can result in differences in interest rates and tightness of credit rationing in equilibrium, respectively, and create a comparative advantage. In Matsuyama (2005), the share of revenues an entrepreneur can pledge towards wage payments differs between countries leading to a comparative advantage.⁵ Chaney (2005) develops a theoretical model analyzing financial constraints in a heterogeneous firms trade model based on Melitz (2003). Firms have to finance their fixed entry cost into foreign markets through own liquidity and domestic operating profits. Liquidity is introduced as a second type of heterogeneity. He derives conditions on productivity and liquidity under which a firm exports. Manova (2008b) extends this model to a setting where also export volumes can be affected by financial constraints. In Chaney (2005) and Manova (2008b) only domestic financial market conditions in the form of financial constraints are relevant for the export decisions of firms. In particular, there is no role for financial market conditions and the contracting environment in the destination country and for the costs of trade finance.

While this is the first paper to formally study the choice of payment contracts for trade finance, some other aspects of trade finance have been discussed in policy papers.⁶ Several more recent contributions also study theoretical and empirical aspects of trade finance. Ahn (2010) studies why international transactions might get relatively riskier and why credit supply constraints might affect international trade loans relatively more in a financial crisis. Olsen (2010) elaborates on the idea also discussed in this paper, that enforcement between banks might be easier than between two trading partners, as the former interact more fre-

⁵The broader issue of institutional constraints, trade and outsourcing has been studied extensively. Recent contributions include Nunn (2007), Levchenko (2007) and Antràs et al. (2009). For a survey see Helpman (2006).

⁶Menichini (2009) discusses inter-firm trade finance. She emphasizes the possibility that shocks are propagated through credit chains. Furthermore, she argues that the use of trade finance might be restricted if institutions like contract enforcement and bankruptcy laws are not sufficiently developed. Ellingsen and Vlachos (2009) develop a model of trade credit in a liquidity crisis. They show that in the presence of liquidity hoarding, targeted support of trade finance might be better than increasing the general supply of credit in an economy. Evidence on firm level trade finance of African exporters is documented by Humphrey (2009).

quently. Two papers, Antràs and Foley (2011) and Glady and Potin (2011) directly build on the theory developed here following Schmidt-Eisenlohr (2009). Antràs and Foley (2011) use data from a large US food exporter to test some predictions of the original model and some extensions, whereas Glady and Potin (2011) focus on the role of letters of credit. Finally, Engemann et al. (2011) study the relationship between trade credit and bank credit.

There is a large empirical literature that has provided evidence on the relationship between the financial development of a country and the sectoral concentration of its exports. The general finding is that financial development creates a comparative advantage in industries that are more financially dependent and in which assets are less tangible.⁷ The question whether financial constraints affect the decision to export and export volumes is the focus of a growing number of papers. This literature has so far been inconclusive on the question of causality from financial conditions to exporting decisions as endogeneity remains a key concern.⁸ Amiti and Weinstein (forthcoming) resolve the endogeneity problem using Japanese matched firm-bank data. They identify a bank-firm trade finance channel and find that it accounts for about one third of the decline in exports during the crisis in Japan in the 1990s.⁹

Several authors have studied factors that led to the large drop in international trade in the recent financial crisis. Besides demand side and composition effects and inventory adjustments, some research also provides evidence for the role of financial factors.¹⁰ Berman and Martin (2010) analyze how a financial crisis affects trade and find that African countries with a higher than median trade credit over exports ratio are hit harder. Bricongne et al. (forthcoming) study french firm level data and find effects of credit constraints at the firm level. They argue that, as the share of constrained firms is small, aggregate effects through this channel are limited. Chor and Manova (forthcoming) study US imports and find a negative relationship between interbank rates in a country and its exports in more

⁷See Beck (2002), Beck (2003), and Manova (2008b).

⁸Using firm level data, this question has been addressed for example by Greenaway et al. (2007), Muûls (2008), and Berman and Héricourt (2010). Manova (2008a) and Manova (2008b) studies credit constraints using sectoral level data.

⁹The effects of previous crises on trade have also been studied by Ronci (2004) and Iacovone and Zavacka (2009).

¹⁰For demand side and composition effects see Eaton et al. (2011), Levchenko et al. (2010), Behrens et al. (2010), Bems et al. (2010). Regarding inventory adjustments see Alessandria et al. (2010).

financially dependent sectors during the recent crisis. Using data from a private trade insurance company, van der Veer (2010) estimates that about 5 to 9 percent of the drop in world exports was due to a reduction in trade insurance coverage. In a recent paper, Paravisini et al. (2011) use Peruvian bank credit data at the firm-level and find that credit supply shocks can explain 15 percent of the decline in exports during the financial crisis.

The empirical part of the paper differs from the existing literature in four aspects. First, motivated by the theoretical results, I consider financing costs both in the source and the destination country.¹¹ Second, a financial market efficiency measure, the net interest margin, is used, to study the effects of financing costs on trade flows.¹² Third, a distance interaction is employed to test for an effect of financial conditions proportional to the time needed for trade.¹³ Finally, motivated by the theory, I test for the role of the minimum interest rate between the source and the destination country for trade.

The rest of the paper is organized as follows. Section 2 introduces a model of payment contracts. Section 3 sets the model into a standard intra-industry trade framework, derives implications for trade patterns and discusses payment contract switches. Section 4 presents empirical results. Section 5 concludes.

2 Payment Contracts

To allocate risk and to finance the time gap between the production and the sale of a product, a wide range of payment contracts is utilized. I study the optimal choice of trading partners between these contracts, considering three representative types. These are Open Account (exporter finance), Cash in Advance (importer finance) and Letter of Credit (bank finance).

¹¹An exception is Manova (2008b), who, in a recent revision mentions results from a regression with destination country variables. She finds effects about one third of the size as for the exporter variables.

¹²While the net interest rate margin has not been used in this context, empirical work by Chor and Manova (forthcoming) and Korinek et al. (2010) studies the relationship of trade flows with interbank rates and the US high yield spread during the recent financial crisis, respectively.

¹³As discussed in detail in Section 5, the distance interaction provides a new and direct identification of variable trade costs due to financing requirements. In this, my results contribute to the literature estimating trade costs. See among others Eaton and Kortum (2002), Anderson and van Wincoop (2003), Hummels (2007), Jacks et al. (2008) and Irarrazabal et al. (2010). In contemporaneous empirical work on the financial crisis, Paravisini et al. (2011) include an interaction term between distance and credit supply of a firm but do not find any significant effects.

Furthermore, an analysis of an intermediate type contract, combining exporter finance and importer finance, is provided.

The choice between different payment contracts is relevant for two reasons. First, the time gap between the production of goods and the realization of sales revenues is longer for international trade than for domestic sales. As Hummels (2001) reports, physical transport times can be substantial in international trade, in particular, when goods are transported by sea. Additionally, Djankov et al. (2010) document that formal procedures necessary for international trade transactions can be extensive, implying a delay from the factory gate to the means of transportation as well as at the border of the importer. Amiti and Weinstein (forthcoming) calculate that these two causes of delay add up to approximately two months for the median case.¹⁴ This implies that working capital requirements for international trade are larger than for domestic sales.

Second, it is more difficult to enforce contracts across borders. This can be due to differences in legal systems or working languages and a limited willingness of governments to enforce international contracts to the same degree as national ones. Whereas domestic sales naturally take place in a common contracting environment, international trade in general does not. Furthermore, in international trade, a firm might not have a permanent representation in the country of the trading partner, making litigation more difficult and costly. Consequently, international trade is more risky and the allocation of risk more important.¹⁵

2.1 Setup

Suppose there is one exporter and one importer. The exporter can make a take it or leave it offer to the importer. Both firms are risk neutral.¹⁶ There are two points in time. At $t = 0$

¹⁴The median numbers they quote are 21 days from factory to ship in the exporting country and 23 days from the ship to the warehouse in the importing country. Average sea transport time to the US accounts for another 20 days in their calculation.

¹⁵Parties can potentially agree on a court in a third country to provide the contract enforcement. Still, even in that case, the ruling would have to be enforced in the country where the value of the transaction is actually allocated, that is any arrangement requires some degree of local enforcement.

¹⁶As firms are risk neutral, they do not demand trade insurance in the model. This would be different if firms were risk averse or in an extended dynamic setting where firms could become illiquid or insolvent due to losses on trading transactions.

firms agree on a payment contract and the exporter can produce and send goods off to the destination country. If the exporter sends the goods, they arrive after t time units and sales revenues are realized. Denote production costs by K and revenues by R . Assume further that $R > K$.

There are two imperfections in the economy. First, markets to finance international trade transactions are segmented and efficiencies of financial intermediaries differ across countries. As a result the interest rate a firm faces depends on its location. Second, there is limited enforcement of contracts, modeled as an exogenous country-specific probability that a contract will be enforced, in case that a firm does not want to fulfill it voluntarily.¹⁷ Under Cash in Advance, it is the probability that the exporter is forced to deliver the goods after receiving the payment. Under Open Account, it is the probability that an importer has to pay the agreed price for the goods after receiving and selling them.¹⁸ Enforcement is not costless however. Whenever a contract is enforced successfully, a share δ of the revenue is lost due to litigation and other costs associated to the non-cooperative behavior of one of the two trading parties.

Firms can be of good and bad type. Let η denote the share of good type firms in the source country. Good type firms never try to break the contract, whereas bad type firms do so, whenever this is optimal for them.¹⁹

In the following, I formally describe the three financing forms and derive conditions under which each of them is chosen. Let $\lambda \in (0, 1]$ and $r \geq 0$ denote the enforcement probability and the interest rate in the source country, respectively. Variables for the destination country are marked with asterisks.

¹⁷This captures the reduced form of an enforcement game played between the importer and the exporter, which is affected by the legal institutions of the two countries. This could be extended to a model in which firms choose their legal expenditures to achieve or prevent enforcement. In that case the enforcement probability would change with the value at stake and there would be an explicit role for firm heterogeneity.

¹⁸For simplicity these two enforcement probabilities are assumed to be equal. It would be an interesting extension to consider an asymmetry here. This could be rationalized by the difference between the in-kind nature of Open Account and the cash nature of Cash in Advance. For a formalization of this argument see Burkart and Ellingsen (2004).

¹⁹Considering two types of firms allows to endogenize the limited value of contract constraint that I assumed in the original model. See Schmidt-Eisenlohr (2009) for a comparison.

2.2 Cash in Advance, Open Account and Letter of Credit

Cash in Advance Under Cash in Advance the importer first pays the amount C^{CIA} to the exporter. If the exporter is of the good type, she delivers the goods after receipt of the payment. If the exporter is of the bad type, she tries to get away without delivering the products. With probability λ the bad type exporter is forced to deliver the goods anyways, but a share of δ of revenue is lost due to enforcement costs.

A bad type exporter has two choices. First, she can demand the same pre-payment as a good type exporter so that the importer cannot distinguish between the two types. I refer to this case as pooling. Second, she can demand a lower pre-payment, revealing her type. This case is referred to as separating.

For the bad type exporter separating is never optimal as long as good type firms also choose Cash in Advance. It implies a lower payment without any additional gain. A good type exporter cannot signal her type, as any prepayment acceptable for a good type exporter is also acceptable for a bad type exporter.

In the following I first consider the pooling case. Then, I study the case where good type firms do not choose Cash in Advance. I show that under a relatively weak condition this implies that also bad type firms do not choose Cash in Advance.

Under pooling, the expected enforcement costs are $(1 - \eta)\lambda\delta R$ and the expected revenue income of the importer is $(\eta + (1 - \eta)\lambda)R$. The exporter makes a take it or leave it offer and has to respect the importer participation constraint:²⁰

$$\text{Good type: } \max_C E \left[\Pi_{E,g}^{CIA,p} \right] = C^{CIA,p} - K, \quad (1)$$

$$\text{Bad type: } \max_C E \left[\Pi_{E,b}^{CIA,p} \right] = C^{CIA,p} - \lambda K, \quad (2)$$

s.t.

$$E \left[\Pi_I^{CIA,p} \right] = \frac{\eta + (1 - \eta)\lambda(1 - \delta)}{(1 + r^*)^t} R - C^{CIA,p} \geq 0. \quad (3)$$

(participation constraint importer)

²⁰ Assuming for all cases that the exporter and importer discount profits with their local interest rates. To compare profits between CIA and OA they have to be discounted to the same time period.

Under CIA, the trade transaction is financed by the importer. Her participation constraint requires that, taking the default probability into account, her expected profits are non-negative. As the exporter has all negotiation power, the participation constraint of the importer binds under the optimal contract. The optimal payment $C^{CIA,p}$ and optimal expected profits of the exporter are:

$$C^{CIA,p} = \frac{\eta + (1 - \eta)\lambda(1 - \delta)}{(1 + r^*)^t} R, \quad (4)$$

$$\text{Good type: } E \left[\Pi_{E,g}^{CIA,p} \right] = \frac{\eta + (1 - \eta)\lambda(1 - \delta)}{(1 + r^*)^t} R - K. \quad (5)$$

$$\text{Bad type: } E \left[\Pi_{E,b}^{CIA,p} \right] = \frac{\eta + (1 - \eta)\lambda(1 - \delta)}{(1 + r^*)^t} R - \lambda K, \quad (6)$$

Note that the optimal payment $C^{CIA,p}$ is proportional to $\eta + (1 - \eta)\lambda(1 - \delta)$, i.e. the payment is reduced by the expected losses from non-delivery by the exporter and the expected enforcement costs. Despite the fact that there are strictly positive gains from trade, under CIA, production and delivery only take place with probability $\eta + (1 - \eta)\lambda$.

Suppose now that conditions are such that a good type exporter does not choose Cash in Advance. Given the ability to default on the contract, a bad type firm might still consider to offer a Cash in Advance contract, even though this implies revelation of its type. In this case, the importer understands that she deals with a bad type firm and adjusts her expected revenue downwards. Her participation constraint becomes:

$$E \left[\Pi_I^{CIA,s} \right] = \frac{\lambda(1 - \delta)}{(1 + r^*)^t} R - C^{CIA,s} \geq 0 \quad (7)$$

Thus the optimal pre-payment that makes the participation constraint of the importer binding is:

$$C^{CIA,s} = \frac{\lambda(1 - \delta)}{(1 + r^*)^t} R \quad (8)$$

The expected profit for a bad type exporter under CIA in the separating case is thus:

$$E \left[\Pi_{E,b}^{CIA,s} \right] = \frac{\lambda(1 - \delta)}{(1 + r^*)^t} R - \lambda K \quad (9)$$

The bad type exporter does not choose Cash in Advance if the good type exporter does not choose this payment contract and if its expected profits under separation are less or equal to the expected profits of a good type firm under pooling. That is if:

$$E \left[\Pi_{E,g}^{CIA,p} \right] \geq E \left[\Pi_{E,b}^{CIA,s} \right] \quad (10)$$

Plugging in and rearranging, this is the case if:

$$\frac{R}{K} \geq \frac{1 - \lambda}{1 - \lambda(1 - \delta)} \frac{(1 + r^*)^t}{\eta} \quad (11)$$

For Condition (11) to hold, revenues have to be sufficiently larger than production costs. Remember that the advantage of the bad type firm is to save on production costs with some probability. For the rest of the paper, I assume that Condition (11) holds. That is, if a good type firm does not choose Cash in Advance, it is not profitable for a bad type firm to choose Cash in Advance either.²¹

Open Account Under Open Account (OA), the exporter first produces the goods at cost K and delivers them to the importer. Then, the importer sells the goods for R . If of good type, the importer always repays C^{OA} . If of bad type, she tries to deviate, but is forced to repay with probability λ^* , giving rise to enforcement losses of δR . The exporter can choose between two strategies. She can ask for a very high payment, which only bad type firms will accept (separating), or she can ask for a lower payment and both types of firms participate (pooling). The separating case implies the following participation constraint for a bad type importer:

$$E \left[\Pi_{I,b}^{OA,s} \right] = \frac{R - \lambda^* C^{OA}}{(1 + r^*)^t} \geq 0. \quad (12)$$

²¹To see that the condition is relatively weak, consider the following parameter values: $\eta = 0.8, \lambda = 0.8, \delta = 0.05$ and $1 + r^* = 1.1$. Then, the condition requires to revenues to be 1.15 times larger than the production costs. The required factor gets even smaller for a higher share of good type firms η , a better contract enforcement λ or a higher cost of enforcement δ and for lower financing costs $1 + r^*$.

A binding participation constraint of a bad type importer in the separating case implies:

$$C^{OA,s} = \frac{R}{\lambda^*}. \quad (13)$$

The prepayment C^{OA} is chosen such that it exactly offsets the default probability $1 - \lambda^*$. In expectation the importer thus pays R to the importer. The exporter, however, incurs high enforcement costs δR , as all contracts are with bad type importers. Note that the expected profits of an exporter reflect the fact that the probability for her to be matched with a bad type importer who accepts the separating contract is $1 - \eta^*$. Expected profits thus are:

$$\mathbb{E} \left[\Pi_E^{OA,s} \right] = (1 - \eta^*) \left(\frac{(1 - \delta)R}{(1 + r)^t} - K \right). \quad (14)$$

For pooling to take place, the participation constraint of the good type importers has to be respected:

$$\mathbb{E} \left[\Pi_{I,g}^{OA,p} \right] = \frac{R - C^{OA}}{(1 + r^*)^t} \geq 0. \quad (15)$$

A binding participation constraint of a good type importer in the pooling case implies:

$$C^{OA,p} = R, \quad (16)$$

$$\mathbb{E} \left[\Pi_E^{OA,p} \right] = \frac{\eta^* + (1 - \eta^*)\lambda^*(1 - \delta)}{(1 + r)^t} R - K. \quad (17)$$

Comparing profits implies that an exporter strictly prefers a pooling contract to a separating contract if:

$$\frac{R}{K} > \frac{\eta^*(1 + r)^t}{\eta^* - (1 - \eta^*)(1 - \lambda^*)(1 - \delta)} \quad (18)$$

A separating contract increases expected payments from the importer, but also increases expected enforcement costs. If the enforcement costs are sufficiently high, a pooling contract is therefore optimal. For the rest of the paper, assume that Condition (18) is satisfied and

therefore exporters always offer a contract that implies pooling.²²

Letter of Credit Under a Letter of Credit (LC), banks in the country of the exporter and importer are employed to facilitate the trade transaction. The importer pays a fee f^{LC} to its bank, which issues a letter of credit that guarantees payment to the exporter upon proof of delivery. Banks charge such a fee in order to finance monitoring and other administrative costs related to the issue and execution of a Letter of Credit. Assume that the fee is proportional to the value of transaction R , that is $F^{LC} = f^{LC}C^{LC}$. The bank cooperates with a bank in the country of the exporter. The latter guarantees payment upon proof of delivery. Under the assumption of perfect enforcement at the bank level and perfect third party verifiability, this completely resolves the enforcement problem at the individual contract level.²³ With a Letter of Credit, an exporter therefore does not face any risk of non-payment. Her maximization problem is:

$$\max_C E[\Pi_E^{LC}] = \frac{C^{LC}}{(1+r)^t} - K, \quad (19)$$

$$\text{s.t. } E[\Pi_I^{LC}] = \frac{R - C^{LC}}{(1+r^*)^t} - f^{LC}C^{LC} \geq 0. \quad (\text{participation constraint importer}) \quad (20)$$

The participation constraint of the importer is binding. The optimal payment C^{LC} and discounted expected exporter profits are:

$$C^{LC} = \frac{R}{1 + f^{LC}(1+r^*)^t}, \quad E[\Pi_E^{LC}] = \frac{R}{(1 + f^{LC}(1+r^*)^t)(1+r)^t} - K. \quad (21)$$

Note that, as pre-financing takes place on both sides, the interest rates from both markets affect profits. As enforcement risk is completely resolved, profits are independent of the enforcement parameters λ and λ^* .

²²This assumption is also relatively weak. Suppose for example that $\eta^* = 0.8$, $\lambda^* = 0.8$, $r = 1.1$ and $\delta = 0.05$. Then the condition requires revenues to be at least 1.155 times larger than production costs to rule out the separating contract case. If enforcement abroad λ^* or the enforcement cost δ are higher or if the interest rate at home r is lower, then the required ratio is lower.

²³It is conceivable that perfect enforcement at the banking level is more likely than at the firm level. As banks tend to have more long-term relationships, reputation building and repeated transactions ease enforcement between them. Following this paper, this idea has been looked at in detail by Olsen (2010).

Comparison CIA, OA and LC The six parameters $r, r^*, \lambda, \lambda^*, \eta, \eta^*$ together with the Letter of Credit fee F^{LC} , enforcement cost δ , production cost K and sales revenue R determine a unique ordering of the different payment forms as stated below. Define $\tilde{\lambda} = \eta + (1 - \eta)\lambda(1 - \delta)$ and $\tilde{\lambda}^* = \eta^* + (1 - \eta^*)\lambda^*(1 - \delta)$.

Proposition 1 *The optimal choice of payment contract is uniquely determined by the following conditions:*

$$\begin{aligned} \text{OA preferred to CIA} &\iff \frac{\tilde{\lambda}^*}{(1+r)^t} > \frac{\tilde{\lambda}}{(1+r^*)^t}, \\ \text{OA preferred to LC} &\iff f^{LC} > \frac{1}{(1+r^*)^t} \left[\frac{1}{\tilde{\lambda}^*} - 1 \right], \\ \text{CIA preferred to LC} &\iff f^{LC} > \frac{1}{(1+r)^t} \left[\frac{1}{\tilde{\lambda}} - \left(\frac{1+r}{1+r^*} \right)^t \right]. \end{aligned}$$

Proof. See Appendix A. ■

Several predictions, which can be tested with transaction level data, can be derived:

Corollary 1 *The usage of*

- i) *Cash in Advance increases in r, λ and f^{LC} and decreases in λ^* . If $\frac{f^{LC}}{[1+f^{LC}(1+r^*)^t]^2} < \frac{\tilde{\lambda}(1+r)^t}{(1+r^*)^{2t}}$, the usage of Cash in Advance also decreases in r^* .*
- ii) *Open Account increases in r^*, λ^* and f^{LC} and decreases in r and λ .*
- iii) *Letter of Credit decreases in r, λ, λ^* and f^{LC} .*

Proof. See Appendix A. ■

Cash in Advance is more attractive if financing costs and enforcement at home are high and if financing costs and enforcement abroad are low. Open Account is more profitable if financing costs and enforcement abroad are high and if financing costs and enforcement at home are low. A Letter of Credit is better if financing costs and enforcement at home, enforcement abroad and monitoring costs are low.

The prediction that Open Account increases in enforcement abroad λ^* , while Cash in Advance decreases in enforcement abroad λ^* has been tested recently in Antràs and Foley (2011) using contract level data. Their estimations confirm these two theoretical predictions.

2.3 Intermediate Type Contracts

Until now I have only considered contracts with either pre-payment (CIA) or post-payment (OA) as well as Letters of Credit. It is also possible though to use what I call an intermediate type contract. That is part of the payment is done in advance whereas the remainder is paid after delivery.

Under which circumstances are these contracts preferred to pure importer finance (CIA) or exporter finance (OA)? In principle, they could lead to higher expected profits by either saving on financing costs or by reducing moral hazard problems. In this subsection, I show that in the basic model, quite surprisingly, intermediate contracts only improve expected profits in one specific case: if, in the absence of intermediate type contracts, the exporter chooses OA over CIA and if $r^* < r$. In this case, intermediate type contracts can be used to reduce financing costs. In any other case, an exporter always chooses pure exporter finance (OA) or pure importer finance (CIA).

The limited gain from employing an intermediate type contract is due to the fact that the importer moral hazard problem cannot be solved fully as the importer is the last mover. This changes if a fixed cost of breaking a contract is introduced.²⁴ Then, the importer moral hazard can also be resolved and intermediate type contracts become attractive in more cases.

Under Cash in Advance there is a moral hazard problem on the exporter side, whereas under Open Account the importer can deviate. With intermediate type contracts, there are four possible cases conceivable.²⁵ First the payment can be such that deviating is optimal on both sides of the transactions. Second, the advance payment can be sufficiently low to rule

²⁴Here, I assume this cost to be exogenous. One way to endogenize it is by studying repeated contracts, where the fixed cost represents the loss of future gains from trade. For a detailed analysis see Schmidt-Eisenlohr (2011).

²⁵As in the case of CIA and OA, I only consider the case where a pooling contract is optimal. That is bad type exporters do not have an incentive to deviate by choosing a different payment contract.

out moral hazard of the exporter (This is the case under OA.). Third, the advance payment can be very high to rule out moral hazard by the importer, while inducing moral hazard by the exporter (This is the case under CIA.). Fourth, an intermediate pre-payment level could solve both moral hazard problems at the same time.

Solving Moral Hazard: Four Cases

		Moral Hazard Exporter	
		not resolved	resolved
Moral Hazard Importer	not resolved	I	II (OA)
	resolved	III (CIA)	IV

Note, that the first case can never be optimal. This is the true as depending on financing costs, either the second or the third case implies higher expected profits for the exporter. Furthermore notice that, in the absence of a fixed cost of breaching a contract, the importer moral hazard can never be resolved with any contract but Cash in Advance. As the last mover, the importer always tries to run away without transferring any remaining payment due. Therefore, without such a cost, only exporter moral hazard can be prevented.

Let $\phi \in (0, 1)$ denote the share of the advance payment in the total payment, so the pre-payment at $t = 0$ is $C_0 = \phi C$. In the following, I derive the upper bound for this pre-payment share, which makes the exporter indifferent between deviating and always fulfilling the contract. This corresponds to the second case above. For this, I derive the optimal payment amount and expected profits.

Then, I introduce a fixed cost of breaching a contract. In its presence, a partial pre-payment can simultaneously rule out both types of moral hazard, that is implement the fourth case described above.

Resolving Exporter Moral Hazard (Case II) To prevent the exporter from deviating, the payment after delivery has to be sufficiently large. A bad type exporter produces and sends the products to the importer if the expected post-delivery payment minus the enforcement costs is larger than the deviation payoff. The latter equals the probability of getting away with cheating $(1 - \lambda)$ times the production costs saved from doing so K . The condition therefore is:

$$\frac{\eta^* + (1 - \eta^*)\lambda^*}{(1 + r)^t}(1 - \phi)C - \frac{(1 - \eta^*)\lambda^*}{(1 + r)^t}\delta R - K \geq -\lambda K \quad (22)$$

This implies an upper bound on the prepayment share ϕ :

$$\phi \leq 1 - (1 + r)^t \frac{1 - \lambda}{\eta^* + (1 - \eta^*)\lambda^*} \frac{K}{C} - \frac{(1 - \eta^*)\lambda^*}{\eta^* + (1 - \eta^*)\lambda^*} \frac{R}{C} \equiv \phi^E. \quad (23)$$

Under this condition the moral hazard problem of the exporter is resolved and expected profits are:

$$E[\Pi_E^{IM}] = \phi C + \frac{\eta^* + (1 - \eta^*)\lambda^*}{(1 + r)^t}(1 - \phi)C - \frac{(1 - \eta^*)\lambda^*}{(1 + r)^t}\delta R - K, \quad (24)$$

$$E[\Pi_{I,g}^{IM}] = \frac{R}{(1 + r^*)^t} - \phi C - \frac{1}{(1 + r^*)^t}(1 - \phi)C. \quad (25)$$

$$E[\Pi_{I,b}^{IM}] = \frac{R}{(1 + r^*)^t} - \phi C - \frac{\lambda^*}{(1 + r^*)^t}(1 - \phi)C. \quad (26)$$

$$(27)$$

When does the exporter prefer an intermediate type contract over CIA or OA? Consider the two possible cases.

First, suppose that, in the absence of intermediate type contracts, the exporter chooses OA over CIA. Then, if $r^* < r$, an intermediate payment contract can be used to reduce financing costs. This is optimally done up to the point where the exporter moral hazard constraint is binding, i.e. $\phi = \phi^E = 1 - (1 + r)^t \frac{1 - \lambda}{\eta^* + (1 - \eta^*)\lambda^*} \frac{K}{C} - \frac{(1 - \eta^*)\lambda^*}{\eta^* + (1 - \eta^*)\lambda^*} \frac{R}{C}$. Second, suppose that, in the absence of intermediate type contracts, the exporter chooses CIA over OA. Then, if $r < r^*$, financing costs could be reduced by introducing some late payment by the importer.

As noted above, in this case the importer moral hazard cannot be prevented. Thus, given that financing is cheaper for the exporter and that importer moral hazard is active, it is optimal to set the pre-payment to zero. This corresponds to OA, which is a contradiction. Therefore, in this case, an intermediate type contract can never be preferred.

To summarize, an intermediate type contract can reduce interest rate costs if $r^* < r$ and OA is preferred in the absence of an intermediate type contract. No intermediate contract is chosen if CIA is preferred in its absence. In the one shot game, a partial pre-payment alone is not sufficient to resolve the moral hazard problem of the importer. This is different if there is a fixed cost of breaching a contract as studied in the next subsection.

Intermediate type contracts and fixed costs of breaking a contract (Implementing Case IV) Suppose that breaking a contract does inflict some fixed cost on the party breaking the contract. This could represent either legal costs associated with fending off any claims by the trading partner, a loss of reputation or a loss of future gains from trade. Let p denote the value-independent penalty from breaching a contract. Under which condition can an intermediate type contract resolve the moral hazard both on the exporter and the importer side? (Case IV)

Suppose both trading partners always fulfill their contract. This is optimal for the exporter iff the second period payment exceeds the gains from deviation net of the contract breaking cost p :

$$\begin{aligned} \frac{1}{(1+r)^t}(1-\phi)C &\geq (1-\lambda)K - p \\ \Leftrightarrow C &\geq \frac{(1-\lambda)K - p}{1-\phi}(1+r)^t \end{aligned} \tag{28}$$

The importer does not deviate iff she prefers paying the remaining amount $(1-\phi)C$ over deviating:

$$\begin{aligned} p &\geq (1-\phi)(1-\lambda^*)C \\ \Leftrightarrow C &\leq \frac{p}{(1-\phi)(1-\lambda^*)} \end{aligned} \tag{29}$$

Combining the two conditions:

Proposition 2 *An intermediate type contract can fully resolve the moral hazard of the exporter and the importer iff:*

$$p \geq \frac{(1+r)^t(1-\lambda)(1-\lambda^*)}{1+(1+r)(1-\lambda^*)}K$$

Proof. Follows directly from combining Equations (28) and (29). ■

The ability of an intermediate type contract to resolve both moral hazard problems increases in contract enforcement in the source and the destination country and in the cost of breaking a contract p , and decreases in the source country interest rate $1+r$.

If there are sufficiently high fixed costs of breaking a contract, for example representing high future gains from trade, intermediate type contracts can resolve both moral hazard problems simultaneously. In that case, they can dominate CIA, OA and LC if interest rates in the source and the destination country do not differ by too much.

3 Trade Model

What are the implications from payment contracts for quantities, revenues and profits at the firm level and in the aggregate? To address this question, I incorporate the model from the previous section into a standard international trade framework as in Helpman and Krugman (1985). The analysis delivers new predictions for the patterns of international trade flows, illustrates the similarity between financing costs and iceberg trade costs and reveals how the ability to switch between different payment contracts implies differential effects of unilateral and multilateral financial crises on trade flows.

3.1 Setup

Preferences There are L representative consumers in the economy, each supplying inelastically one unit of labor. The individual utility function is:

$$U = Q^\mu q_0^{1-\mu} \quad \text{with } Q = \left(\int_{\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}. \quad (30)$$

Q is a CES (constant elasticity of substitution) basket of a continuum of differentiated goods and q_0 is a homogenous good. Utility is Cobb-Douglas in the homogeneous good and the differentiated goods. The demand for the differentiated good is:

$$q(\omega) = p(\omega)^{-\sigma} P^\sigma Q, \quad (31)$$

where ω denotes a variety of the differentiated good, $P = \left(\int_{\omega \in \Omega} p(\omega)^{1-\sigma} \right)^{1-\sigma}$ is the price index of the optimal CES basket, and $\sigma > 1$ is the elasticity of substitution between varieties.

Technology Labor is the only input factor. Firms in the homogenous goods sector face perfect competition and operate a constant returns to scale technology that requires one unit of labor per unit of output. The homogenous good is freely traded. Only equilibria in which every country produces the homogenous good are considered. This equalizes wages, which are normalized to one, making the homogenous good the numeraire. In the differentiated goods sector firms operate under monopolistic competition. Each variety is produced by only one firm. There is a fixed cost of entry f . The production of one unit of the differentiated product requires a units of labor.

3.2 Optimal Behavior of Firms

Given CES demand and monopolistic competition, firms in the differentiated sector charge a constant markup over marginal costs to maximize profits. Domestic prices, quantities and

profits are:

$$p_d = \frac{\sigma}{\sigma - 1} a, \quad q_d = (p_d)^{-\sigma} P^\sigma Q, \quad \Pi_d = q_d \left[\frac{a}{\sigma - 1} \right]. \quad (32)$$

Let Π_x denote the profits from exporting. From before, expected exporter profits are:

$$\begin{aligned} E[\Pi_{x,g}^{CIA}] &= \tilde{\lambda}(1 + r^*)^{-t} R - K, \\ E[\Pi_{x,b}^{CIA}] &= \tilde{\lambda}(1 + r^*)^{-t} R - \lambda K, \\ E[\Pi_x^{OA}] &= \tilde{\lambda}^*(1 + r)^{-t} - K, \\ E[\Pi_x^{LC}] &= (1 + r)^{-t} (1 + f^{LC}(1 + r^*)^t)^{-1} R - K. \end{aligned}$$

Note that these can be represented by the general expression:

$$E[\Pi_x] = \alpha^c R - \beta^{c,i} K, \quad (33)$$

with $c \in \{CIA, OA, LC\}$ and $i \in \{good, bad\}$.

Under Cash in Advance, a bad type exporter has lower expected production costs. Thus, she might want to promise a higher quantity at a lower unit price than a good type exporter. This is not optimal though, as this would reveal her type.²⁶ Thus, the problem of the good type exporter does not only determine the contract type, but also the price and quantity of goods exported by a firm. Optimization implies the following export prices, quantities and

²⁶The condition for the optimality of a pooling contract under Cash in Advance changes from before. This is the case as now, the optimal price and therefore R and K would differ across types if a separating contract was chosen. Expected profits for a good type exporter under pooling are $\tilde{\lambda}^\sigma (1 + r^*)^{-\sigma t} \Pi_d^*$ and expected profits of a bad type exporter under separation are $\lambda(1 - \delta)^\sigma (1 + r^*)^{-\sigma t} \Pi_d^*$. This implies the following new condition for a pooling contract to be the equilibrium outcome: $\delta > \frac{\lambda^{\frac{1}{\sigma}} - (1 - \eta)\lambda - \eta}{\lambda^{\frac{1}{\sigma}} - (1 - \eta)\lambda}$. This condition is relatively weak. If, for example, $\eta = 0.8$, $\lambda = 0.8$, and $\sigma = 5$ it is fulfilled for any $\delta \geq 0$.

profits:²⁷

$$p_x = \frac{1}{\alpha^c} p_d^*, \quad E[q_x] = A^{c,i} q_d^* \quad (34)$$

$$E[R_x] = \frac{1}{\alpha^c} A^{c,i} R_d^*, \quad E[\Pi_x] = (\alpha^c)^\sigma (\sigma - \beta^{c,i}(\sigma - 1)) \Pi_d^* \quad (35)$$

with $A^{c,i} = (\alpha^c)^\sigma \beta^{c,i}$.²⁸

Note that the parameters α^c and $\beta^{c,i}$, which represent the costs of trade finance, enter the problem proportional to the value of exports. Thus, in the model, variable trade costs that arise from the financing requirement and the enforcement problem are similar to the iceberg trade cost formulation.²⁹

3.3 Implications for Trade Patterns

Taking into account payment contracts delivers new results for international trade patterns. In particular, as trade finance can be obtained from financial markets in the source and the destination country, financial conditions and contracting environments in both countries affect trade flows. The model implies the following testable predictions on trade patterns:

Proposition 3 *For given foreign demand conditions P^* and Q^* , expected export revenues of a good type exporter (a bad type exporter, keeping the payment contract fixed)*

i) decrease weakly (strictly) if financing costs in the source or (and) the destination coun-

²⁷Expected profits of good types can be normalized to $E[\tilde{\Pi}_x] = E[\frac{\Pi_x}{\alpha^c}] = R - \frac{1}{\alpha^c} K$. Maximizing the original objective function $E[\Pi]$ implies the same optimal decisions as maximizing the new function $E[\tilde{\Pi}]$. Therefore, the price setting problem is equivalent to the standard case with new per unit production costs of $\frac{1}{\alpha^c} a$. For details see Appendix B.

²⁸ $E[q_x]$ is the expected quantity, taking into account that under CIA only a fraction $\eta + (1 - \eta)\lambda$ of export contracts is enforced.

²⁹Per unit trade costs can lead to very different predictions than iceberg type trade costs as first discussed by Alchian and Allen (1964) and shown empirically by Hummels and Skiba (2004). While trade finance costs represent an important case of pure iceberg type trade costs, arguably many other costs such as physical transport costs can be much better represented by per unit costs. For more recent contributions to this line of research see Irarrazabal et al. (2010) and Wood (2011).

$$\text{try increase: } \frac{\partial E[R_x]}{\partial(1+r)} \leq 0, \frac{\partial E[R_x]}{\partial(1+r^*)} \leq 0, \frac{\partial E[R_x]}{\partial(1+r)} + \frac{\partial E[R_x]}{\partial(1+r^*)} < 0$$

- ii) *increase weakly if the probability of contract enforcement in the source or the destination country increases:* $\frac{\partial E[R_x]}{\partial \lambda} \geq 0, \frac{\partial E[R_x]}{\partial \lambda^*} \geq 0$

Proof. See Appendix A. ■

Under any payment contract, the source or the destination country financing costs affect variable costs and thus the volume of trade. Therefore, if financing costs in one country increase, expected export revenues of a firm either decrease or are unaffected. If financing costs in both countries increase, expected export revenues of a firm decrease. Furthermore, expected export revenues of a firm increase in enforcement probabilities in the source and the destination country.

As shown in Section 2, due to pooling, the equilibrium payment contract choice depends on the expected profits of good type exporters. Furthermore, for good type firms, the payment contract that maximizes expected profits also implies the highest expected revenues. Thus, in Proposition 3, statements on good type exporters hold even when allowing for an endogenous switch of payment contract. Bad type exporters have to imitate the payment contract and quantities of good type exporters. Therefore, the statements in Proposition 3 only hold for bad type exporters if the payment contract is held fixed.³⁰

As discussed before, the working capital requirement of a firm increases in the time needed for trade. Expected export revenues therefore react more strongly to changes in financial conditions if trade takes more time. This is captured in the following proposition:

Proposition 4 *For given foreign demand conditions P^* and Q^* , the log of expected export revenues of a good type exporter (a bad type exporter, keeping the payment contract fixed)*

- i) *decreases weakly (strictly) if the log financing costs in the source or (and) the destination country increase:* $\frac{\partial \ln E[R_x]}{\partial \ln(1+r)} \leq 0, \frac{\partial \ln E[R_x]}{\partial \ln(1+r^*)} \leq 0, \frac{\partial \ln E[R_x]}{\partial \ln(1+r)} + \frac{\partial \ln E[R_x]}{\partial \ln(1+r^*)} < 0$

³⁰Note that payment contracts changes mostly take place if there are large swings in financing costs or contract enforcement. For smaller changes, exporters keep the same payment contract and only adjust prices and quantities. Furthermore, as, in the model, bad type exporters only represent a small fraction of all firms, their effect on aggregate revenues is limited.

ii) the more so, the larger the log distance between them: $\frac{\partial^2 \ln E[R_x]}{\partial \ln(1+r) \partial \ln t} \leq 0$, $\frac{\partial^2 \ln E[R_x]}{\partial \ln(1+r^*) \partial \ln t} \leq 0$, $\frac{\partial^2 \ln E[R_x]}{\partial \ln(1+r) \partial \ln t} + \frac{\partial^2 \ln E[R_x]}{\partial \ln(1+r^*) \partial \ln t} < 0$.

Proof. See Appendix A. ■

Proposition 4 predicts that the effect of interest rates on trade flows is increasing in $\ln t$, the log of time it takes to transport goods abroad and sell them in the destination country. This provides the theoretical basis for the distance interactions employed in the next section.

Choosing between payment contracts allows firms to trade off differences in the financing costs as well as in contract enforcement between countries. This allows for a direct way to test for the relevance of the payment contract choice model. In general, as stated in Proposition 1, the choice between exporter finance (OA) and importer finance (CIA) depends both on contract enforcement and interest rates at home and abroad. Comparing enforcement and interest rates of two countries and focusing on the choice between CIA and OA, four cases are possible: In cases I and IV, there is a clear prediction on the payment contract, which

CIA vs. OA: Four Cases

	$r > r^*$	$r \leq r^*$
$\tilde{\lambda} > \tilde{\lambda}^*$	I: always CIA	II: both possible
$\tilde{\lambda} \leq \tilde{\lambda}^*$	III: both possible	IV: always OA

is independent of the relative effect of enforcement and financing costs. In both cases, one country has an absolute advantage in financing costs and the other country has an absolute advantage in limiting moral hazard. The model predicts that in case I CIA is chosen and thus only the destination country interest rate should matter for trade. In case IV, OA is preferable and thus only the source country interest rate should affect trade volumes.

Proposition 5 *Suppose firms choose between CIA and OA and suppose $\tilde{\lambda} > \tilde{\lambda}^*$ and $r > r^*$ or $\tilde{\lambda} \leq \tilde{\lambda}^*$ and $r \leq r^*$. Then, the log of expected export revenues*

i) decreases in the log of the minimum interest rate: $\frac{\partial E[\ln R_x]}{\partial \min\{\ln(1+r_i), \ln(1+r_j)\}} < 0$

iii) the more so, the larger $\ln t$ $\frac{\partial^2 E[\ln R_x]}{\partial \min\{\ln(1+r_i), \ln(1+r_j)\} \partial \ln t} < 0$

Proof. See Appendix A. ■

If one country has an absolute advantage in financing ($r^i < r^j$) and the other country has an absolute advantage in fulfilling contracts ($\tilde{\lambda}^j > \tilde{\lambda}^i$), then the payment contract is clearly determined. That is the choice is independent of the relative importance of enforcement as compared to financing costs. In this case, only the minimum financing cost of the two countries matter. This effect increases in the log of the time needed for trade $\ln t$. These predictions, which follow directly from the payment contract choice model, are tested in the second part of my empirical analysis.

3.4 Contract Switching and Financial Crisis

When financing costs change, firms can react by switching payment contracts to optimally substitute between financial conditions at home and abroad.³¹ Suppose for example that initially CIA is used. Then, if the interest rate abroad r^* rises, at some point, it is optimal for the exporter to switch to OA, the cost of which is independent of the foreign interest rate.

The ability to limit the adverse effects from changes in financial markets through payment contracts switches implies asymmetric reactions of trade flows to financial turmoil. If there is country-specific financial turmoil, firms can constrain costs by switching payment contracts as described. If instead there is global financial turmoil that affects the financial markets of both the source and the destination country, this possibility no longer exists and trade flows react more strongly to a crisis. This suggests that in the recent global financial crisis trade finance might have had a stronger effect on aggregate trade flows than in former more locally concentrated crises.

³¹For a more detailed analysis see Schmidt-Eisenlohr (2009).

4 Empirical Tests

The model predicts that financing costs affect trade flows. An increase in interest rates in the source and the destination country makes trade finance more costly, implying higher export prices and lower export quantities and revenues. Proposition 4 states that the size of this effect should be proportional to the time needed for trade. Proposition 5 predicts that if one country has an absolute advantage in financing and the other country has an absolute advantage in enforcement, only the minimum financing cost of the two countries should matter for trade. I use a panel of bilateral trade data to test these predictions.

The analysis proceeds in five steps. First, I present the baseline regression which tests Proposition 4 and which provides evidence for a negative relationship between financing costs and trade flows. I find that the size of the effect of financing costs on trade flows is increasing in the geographical distance between trading partners. Second, based on the results of the baseline regression, I study comparative statics and show that the relationship is economically relevant. Next, I check the robustness of these results. The introduction of interaction terms between geographical distance and measures of contract enforcement (rule of law) and economic development (log of GDP per capita) to the regression does not change the main findings. Results also hold when I introduce exporter \times year and importer \times year fixed effects and estimate a fixed effects model. Replacing the net interest margin by private capital over GDP as the variable capturing financial conditions delivers very similar results. Then, I address the question of causality.

Finally, I test the predictions of Proposition 5. I find strong evidence that when one country has an absolute advantage in financing and the other country has an absolute advantage in enforcement, the minimum financing cost and its interaction have large negative effects on trade. Furthermore, my results confirm the prediction that in this case, only the minimum financing cost, independently of whether it is of the source or of the destination country, affects trade. All other financing costs variables become insignificant as predicted by the theory.

4.1 Data

I use data on bilateral trade flows for the years 1980 to 2004 from the CEPII trade and production database. Data on geographical distance and other bilateral indicators is from the CEPII gravity dataset collected by Head et al. (2010). The financial market efficiency (net interest margin) and financial market development measures (private credit over GDP) are taken from Beck et al. (2009). The net interest margin is the ratio between the accounting value of the net interest revenues of banks and their total earning assets. It measures the average ex-post markup of the lending activities of banks in a country and therefore represents a measure of financial sector efficiency. This measure differs from ex-ante spreads as it also captures losses on non-performing loans. The alternative measure, private credit over GDP, is a much broader indicator of general financial development. While the latter seems more appropriate for studying financial constraints, the former seems better suited for addressing the question of trade finance and its effects on variable costs studied here. Data on GDP per capita and population are taken from the Penn World Tables (Heston et al. (2009)). The measure for contract enforcement is extracted from the World Bank Worldwide Governance Indicators. The final sample contains 150 exporting countries over the period 1980-2004. When including the net interest rate margin the number of countries reduces to 144 and the period to 1987-2004. With contract enforcement the years covered are 1998, 2000, and 2002-2004. Descriptive statistics of the main variables for the three data sets used in the main analysis (using the net interest rate margin) are shown in Tables 1a-c.

4.2 Estimation and Results

The baseline regression tests the relationship between bilateral trade flows and financing costs (log of $(1 + \text{net interest rate margin})$) in the source and the destination country. It tests both for the direct effect of financing costs and for the effect of their interaction terms with geographical distance.

$$\begin{aligned} \ln Y_{ijt} = & \zeta_0 + \zeta_1 \ln(1 + r_i) + \zeta_2 \ln(1 + r_j) + \zeta_3 \ln(dist_{ij}) \cdot \ln(1 + r_i) \\ & + \zeta_4 \ln(dist_{ij}) \cdot \ln(1 + r_j) + \zeta_5 \ln(dist_{ij}) + \theta'X + \chi_i + \chi_j + \chi_t + \epsilon_{ijt}. \end{aligned} \quad (36)$$

An observation $\ln Y_{ijt}$ is the log trade flow from country i to country j in year t . The regression controls for importer, exporter and year fixed effects and for a set of control variables X . r_i and r_j are the net interest margins in the source and the destination country, respectively, and $dist_{ij}$ is the geographical distance between the two main cities of country i and j . The control variables are the log of exporter and importer GDP per capita, exporter and importer population, GATT membership status and several bilateral indicators.³²

Distance effect The regression reported in Column 1 of Table 2 provides evidence that financial conditions are correlated with trade flows. Countries with higher net interest rate margins trade less with each other. The size of this effect is increasing in the geographical distance between trading partners. This can be seen by noting that, in line with Proposition 4, both coefficients on the distance interaction ζ_3 and ζ_4 are highly significant and negative. The preferred specification is presented in column 3, where exporter \times year and importer \times year fixed effects are included. In this specification ζ_3 and ζ_4 are larger and also highly significant.

Economic relevance The marginal effects of financing costs evaluated at the mean log bilateral distance (8.6) for the regressions in columns 1 and 2 are reported in Table 3. They imply that a one percent higher financing cost in a country is associated with 2.0 percent lower exports and 2.3 percent lower imports by that country. To evaluate the economic relevance of the distance interaction, consider the following comparative statics. Compare trade between Spain and Egypt (25 percentile by distance, 3355 km) with trade between Spain and South Korea (75 percentile by distance, 10013km). Suppose the net interest margin in Spain was one percent higher. Then we should expect Spain to have a 5.2 percent larger drop of its exports and a 6.3 percent larger drop of its imports when trading with South Korea instead of Egypt due to the larger geographical distance. Table 4 reports comparative statics for all specifications from Table 2.

³²These are: common currency, regional trade agreement, agreements conferring preferential treatments (EU to ACP and ACP to EU), contiguity, common official language, common language (at least 9% spoken), colonial history, common colonizer, current colonial relationship, colonial relationship post 1945 and whether countries are or were the same country.

Robustness One concern is potential omitted variable bias. If there are variables that are correlated with the net interest rate margin and bilateral trade flows that are not included in the regression, the estimate of the distance interaction can be biased. To address this issue, Columns 2, 4 and 6 introduce two additional interaction terms. A measure of contract enforcement (rule of law) and its interaction with distance are added to the regression to control for institutional factors. An interaction between the log of GDP per capita and distance is added to control for effects from the general economic development of countries. Comparing column 2 to column 1, the introduction of these additional regressors reduces the point estimates for ζ_3 and ζ_4 to about a half of their previous values. They remain highly significant and economically relevant.

Columns 5 and 6 estimate a fixed effects model, where effects are identified from within country pair variation over time.³³ ζ_3 and ζ_4 become smaller but remain highly significant with the exception of ζ_4 in column 6.³⁴

Another concern might be the measure for financial conditions employed in the regressions so far. The choice of the net interest margin is motivated by the theoretical part of the paper, which focuses on financing costs of international trade. An alternative is to use private credit over GDP as a general measure for financial development, first introduced to the literature by Beck (2002). This is the standard measure used as a proxy for financial conditions, in particular, in papers that study the role of financial constraints. As a robustness check, I rerun the regressions shown in Table 2 Columns 1 to 4, using private credit over GDP instead of the net interest margin. The results are reported in Table 5. They support the findings from the previous regressions. Note that financial development increases in the ratio of private credit over GDP. That is, the higher the ratio, the better are financial conditions. Therefore, all coefficients on the financial measure have exactly the opposite sign from the regressions in Table 2.

Can we interpret the relationship identified by the interaction terms between distance

³³This resolves the time-invariant part of the omitted variable bias discussed in Anderson and van Wincoop (2003). An alternative would be to follow Baier and Bergstrand (2009) and explicitly introduce exogenous multilateral-resistance terms.

³⁴This might be due to collinearity, that is the high correlation between the net interest margin and per capita GDP (-.47) and contract enforcement (-.54), respectively.

and the measures of financial conditions as causal? The main concern in this context is reverse causality. If a country does a lot of international trade, this increases its demand for financial services. A larger demand in turn can lead to efficiency gains in the provision of finance, reducing the net interest rate margin.³⁵ As discussed earlier, the distance interaction identifies effects proportional to the geographical distance between trading partners. Therefore, the relevant reverse causality to be considered is the following. Suppose there is an increase in the demand from a destination country. This increases the demand for trade finance in the source country proportional to the geographical distance from this trading partner. Reverse causality is a problem if working capital financing for international trade is sufficiently large to have a first-order effect on the overall demand for finance in a country. While lending related to international trade finance is certainly an important activity in many countries, it can be argued that in most cases it represents a relatively small share of overall finance. A first-order effect from trade finance on the borrowing rate of firms therefore seems unlikely. This suggests that there is a causal effect of financing costs on trade, proportional to distance.

Testing the mechanism Proposition 5 suggests a direct way of testing for the mechanism proposed in the model. For this, focus on the tradeoff between Cash in Advance and Open Account. If either (I) $\tilde{\lambda} > \tilde{\lambda}^*$ and $r > r^*$ or (IV) $\tilde{\lambda} \leq \tilde{\lambda}^*$ and $r \leq r^*$, the model predicts an unambiguous choice of payment contract. Cash in Advance for case I and Open Account for case IV. In both cases, only the lower interest rate of the two countries is predicted to affect the volume of trade.

To test this empirically, I therefore restrict the sample to include all observations where either I or IV is the case, measuring r by the net interest rate margin and $\tilde{\lambda}$ by rule of law. This reduces the sample size from 78742 to 21119. As can be seen by comparing Table 1a with Table 1c, the summary statistics of this subset are very similar to those of the full sample. The baseline specification (Table 6, Column 3) for the test on the minimum

³⁵Do and Levchenko (2007) and Braun and Raddatz (2008) find evidence for reverse causality from trade flows and trade openness, respectively, to financial development.

financing cost is:

$$\begin{aligned}
\ln Y_{ijt} = & \zeta_0 + \zeta_1 \ln(1 + r_i) + \zeta_2 \ln(1 + r_j) \\
& + \zeta_3 \ln(dist_{ij}) \cdot \ln(1 + r_i) + \zeta_4 \ln(dist_{ij}) \cdot \ln(1 + r_j) \\
& + \zeta_5 \ln(\min\{1 + r_i, 1 + r_j\}) + \zeta_6 \ln(dist_{ij}) \cdot \ln(\min\{1 + r_i, 1 + r_j\}) \\
& + \zeta_7 \ln(dist_{ij}) + \theta'X + \chi_i + \chi_j + \chi_t + \epsilon_{ijt}.
\end{aligned} \tag{37}$$

The main prediction from Proposition 5 is first, that the minimum interest rate has a negative effect on the volume of trade ($\zeta_5 + \zeta_6 \frac{1}{N} \sum_1^N (\ln dist_{ij}) < 0$) and second, that this effect is increasing in the log of time needed for trade $\ln t$ ($\zeta_6 < 0$). Furthermore, controlling for the minimum interest rate and its interaction with distance, the source and the destination country interest rates and their interactions with distance should not affect trade. That is $\zeta_1, \zeta_2, \zeta_3, \zeta_4 = 0$.

An observation $\ln Y_{ijt}$ is the log trade flow from country i to country j in year t . The regression controls for importer, exporter and year fixed effects and for a set of control variables X . The control variables are the same as employed for the baseline regression, discussed following Equation (37). Additionally, to ensure that the minimum net interest rate margin is not picking up an effect of GDP per capita or contract enforcement, Columns 2, 3, 5 and 6 control for the contract enforcement and the GDP per capita in the country with the minimum interest rate.³⁶ Columns 3 and 6 furthermore control for the interactions between distance and a set of controls. These are the enforcement (rule of law) and the GDP per capita in the country with the minimum interest rate, GDP per capita in the source and destination country and enforcement (rule of law) in the source and the destination country.³⁷

First, I rerun the regressions from Table 2 Columns 2 and 4 with the new sample, which is reported in Table 6, Columns 1 and 4. I find somewhat larger coefficients on the interaction between distance and financing costs in the source and destination country, but overall the

³⁶Enforcement and GDP per capita are strongly negatively correlated with the net interest rate margin (-.54 and -.47 respectively).

³⁷In an alternative robust check I control for the maximum enforcement of each country pair and the maximum GDP per capita of each country pair and their interactions with distance. Results do not change under this alternative specification. They are available upon request.

results are very similar to those in Table 2. Columns 2 and 4 test for the direct effect of the minimum interest rate. ζ_5 is negative in both cases and significant at the 10 percent level. Columns 3 and 6 test for the interaction between distance and the minimum interest rate. The coefficients for ζ_6 are large, negative and highly significant. The average effect is negative and significant. Furthermore, as predicted by the theory, coefficients $\zeta_1, \zeta_2, \zeta_3$ and ζ_4 all become insignificant. That is, after controlling for the minimum financing costs, the source and destination country financing costs do not matter. This is evidence for the hypothesis that if one country has an absolute advantage in financing whereas the other country has an absolute advantage in enforcement, trade transactions are financed by the side with access to cheaper funds. Note that, given that each country is required to have an absolute advantage, this exercise focuses on country pairs that are not too dissimilar.³⁸ An alternative explanation for this empirical finding, that does not rely on the trade-off derived in the payment contract choice model, is thus difficult to come up with.

5 Conclusions

Firms in international trade utilize different payment contracts to optimally trade off differences in financing costs and contractual environments between source and destination countries. Financial conditions have large effects on bilateral trade flows, with costs in the destination country being as important as those in the source country. This is in stark contrast to most of the literature on finance and trade which almost exclusively focused on the role of conditions in the source country. Furthermore, when contract enforcement and financing costs predict the same payment contract, only the minimum interest rate affects trade. That is, for these cases, the empirical analysis in this paper provides strong evidence that two trading partners finance trade through the financial market offering lower costs, independently of whether this is the source or the destination market.

While standard trade theory abstracts from the explicit modeling of importers, the theory and empirical results in this paper show that it can be important to consider the actual trade

³⁸As mentioned above, enforcement and the net interest rate margin are strongly negatively correlated. Therefore, on average countries with the better enforcement also have the lower financing costs.

relationships between firms in two countries; in particular, to consider an exporter and an importer as well as potentially other actors such as banks. In this, my paper is related to a growing literature departing from the view of exporters selling directly to customers in the foreign market.³⁹

The model could be extended allowing for heterogeneity both in the firm and in the product dimension. Product differences could imply different degrees of enforceability in court or different time horizons of trade relationships. Firm differences in size could affect the relative negotiation power between the exporter and the importer, the ability to enforce contracts in court, to punish deviations from a trigger strategy and to switch contracts in the presence of fixed costs. In an extension, currencies could be introduced to study the interaction of the payment contract decision with exchange rate risk.

While the aggregate regressions in this paper constitute a first step, more empirical work is desirable. A dataset containing information on payment contracts, for example, could be used to test the predictions from Section 2. Antràs and Foley (2011) take a first step in this direction using data from a large US food exporter. Employing a dataset with variation in both source and destination countries would be the natural next step.

Finally, following Greif (1993), historical trade patterns could be studied in light of the trade-off between financial market characteristics and contracting environments between source and destination country derived in the model. Improvements in institutions over time should be related to the types of payment contracts utilized.

A Proofs

Proof of Proposition 1 Given the assumptions on parameters, only pooling contracts are offered in equilibrium. Thus, CIA is only used if this payment contract maximizes expected profits of good type exporters. For OA and LC expected exporter profits are equal for both types. Therefore, the expected profits of good type exporters completely determine the

³⁹See for example Araujo and Ornelas (2007), Bernard et al. (2010), Antràs and Costinot (2011) and Ahn et al. (2011).

payment contract choice. Expressions in Proposition 1 thus follow directly from combining equations (5), (17) and (21).

Proof of Corollary 1 The three conditions are:

$$\begin{aligned}
I : \text{OA preferred to CIA} &\iff \frac{\tilde{\lambda}^*}{(1+r)^t} - \frac{\tilde{\lambda}}{(1+r^*)^t} > 0, \\
II : \text{OA preferred to LC} &\iff \frac{1}{(1+r)^t} \left[\tilde{\lambda}^* - \frac{1}{1+f^{LC}(1+r^*)^t} \right] > 0, \\
III : \text{CIA preferred to LC} &\iff \frac{\tilde{\lambda}}{(1+r^*)^t} - \frac{1}{(1+r)^t(1+f^{LC}(1+r^*)^t)} > 0
\end{aligned}$$

Define $\kappa = \frac{\tilde{\lambda}(1+r)^t[1+f^{LC}(1+r^*)^t]^2}{(1+r^*)^{2t}}$. The following table shows whether the sign of each of the three conditions I-III is more likely to be positive or negative if a parameter $\in \{r, r^*, \lambda, \lambda^*\}$ changes. + indicates that the condition is more likely to hold if the parameter increases. – indicates that the condition is less likely to hold if the parameter increases. 0 indicates that a change in the parameter has no effect on whether the condition holds.

Effects of Changes in Financing and Contracting Conditions on Contract Choice

This table reports how the contract choice is affected by changes in the four variables characterizing financing conditions and enforcement probabilities and costs. Each row refers to one of the four variables. Each column refers to one of the three conditions from Proposition 1 comparing two contracts types. The signs indicate whether an increase in the variable makes it more or less likely that the first payment contract is chosen over the second. In column 1 for example, the first minus sign indicates that a higher r makes OA less and CIA more attractive.

Condition Variable	I (OA vs. CIA)	II (OA vs. LC)	III (CIA vs. LC)
r	–	0	+
r^*	+	+	– (if $f^{LC} < \kappa$)
λ	–	0	+
λ^*	+	+	0

This implies: i) CIA increases in r and λ and decreases in λ^* . It also decreases in r^* if $f^{LC} < \kappa$.

ii) OA increases in r^* and λ^* and decreases in r and λ .

iii) LC decreases in r , λ and λ^* .

It is also easily verified that the usage of

i) CIA increases in f^{LC} .

ii) OA increases in f^{LC} .

iii) LC decreases in f^{LC} .

Proof of Proposition 3 From before, expected revenues and profits for a good type firm are (as $\beta = 1$):

$$E[R_x] = (\alpha^c)^{\sigma-1} R_d^*, \quad E[\Pi_x] = (\alpha^c)^\sigma \Pi_d^* \quad (38)$$

Note that: $E[\Pi_x^{1,g}] \geq E[\Pi_x^{2,g}] \Leftrightarrow E[R_x^{1,g}] \geq E[R_x^{2,g}]$. That is, for a good type exporter, the payment contract which maximizes expected profits also implies the highest expected revenues. If a good type exporter is indifferent between two payment contracts, they deliver the same expected profits and imply the same expected revenues. There are two cases which can trigger a payment contract change:

1) Financing costs increase or the enforcement probability decreases in one country, implying lower profits. Then, the contract is only changed if this limits the reduction in profits and revenues. This cannot lead to a net increase in profits and revenues, because this would be a contradiction to profit maximization in the first place.

2) Financing costs decrease or the enforcement probability increases in one country, implying higher profits. Then, the contract is only changed if this implies even higher profits and revenues. This cannot lead to a net reduction in profits and revenues, because this would be a contradiction to profit maximization in the first place.

Therefore, a change in payment contract does not change the sign of the derivative of the expected revenues with respect to the parameters of interest $(r, r^*, \lambda, \lambda^*)$.

Next, I prove the statements with respect to the specific parameters. In general, expected

revenues are:

$$\mathbb{E} [R_{x,i}^c] = p_x \mathbb{E} [q_x] = \frac{1}{\alpha^c} A^{c,i} R_d^* = (\alpha^c)^{\sigma-1} \beta^{c,i} R_d^*$$

With:

$$\alpha^{CIA} = \tilde{\lambda}(1+r^*)^{-t}, \alpha^{OA} = \tilde{\lambda}^*(1+r)^{-t}, \alpha^{LC} = (1+r)^{-t}(1+f^{LC}(1+r^*)^t)^{-1}$$

And:

$$\beta^{CIA,g} = \beta^{OA} = \beta^{LC} = 1, \beta^{CIA,b} = \lambda$$

As $\sigma > 1$: $\frac{\partial \mathbb{E}[R_x]}{\partial \alpha^c} > 0$. Also note that: $\frac{\partial \mathbb{E}[R_x]}{\partial \beta^{c,i}} > 0$.

Proof part 1 (for all firms):

(i)

$$\frac{\partial \mathbb{E} [R_{x,i}^c]}{\partial (1+r)} \leq 0 \text{ as } \frac{\partial \alpha^c}{\partial (1+r)} \leq 0 \text{ and } \frac{\partial \beta^{c,i}}{\partial (1+r)} = 0 \quad \forall c \in \{CIA, OA, LC\} \text{ and } \forall i \in \{good, bad\}$$

.

$$\frac{\partial \mathbb{E} [R_{x,i}^c]}{\partial (1+r^*)} \leq 0 \text{ as } \frac{\partial \alpha^c}{\partial (1+r^*)} \leq 0 \text{ and } \frac{\partial \beta^{c,i}}{\partial (1+r^*)} = 0 \quad \forall c \in \{CIA, OA, LC\} \text{ and } \forall i \in \{good, bad\}.$$

$$\begin{aligned} \frac{\partial \mathbb{E} [R_{x,i}^c]}{\partial (1+r)} + \frac{\partial \mathbb{E} [R_x]}{\partial (1+r^*)} &< 0 \text{ as either } \frac{\partial \alpha^c}{\partial (1+r)} < 0 \text{ or } \frac{\partial \alpha^c}{\partial (1+r^*)} < 0 \quad \forall c \in \{CIA, OA, LC\} \\ &\text{and } \frac{\partial \beta^{c,i}}{\partial (1+r)} = 0 \quad \forall c \in \{CIA, OA, LC\} \text{ and } \forall i \in \{good, bad\}. \end{aligned}$$

(ii)

$$\frac{\partial \mathbb{E} [R_{x,i}^c]}{\partial \lambda^*} \geq 0 \text{ as } \frac{\partial \alpha^c}{\partial \lambda^*} \geq 0 \text{ and } \frac{\partial \beta^{c,i}}{\partial \lambda^*} = 0 \quad \forall c \in \{CIA, OA, LC\} \text{ and } \forall i \in \{good, bad\}.$$

$$\frac{\partial E[R_{x,i}^c]}{\partial \lambda} \geq 0 \text{ as } \frac{\partial \alpha^c}{\partial \lambda} \geq 0 \text{ and } \frac{\partial \beta^{c,i}}{\partial \lambda} \geq 0 \quad \forall c \in \{CIA, OA, LC\} \text{ and } \forall i \in \{good, bad\}.$$

Proof of Proposition 4 As in Proposition 3, the result holds for good type exporters when allowing for an endogenous change of payment contract. The proof for this is analogous to the proof above.

Next, I prove the statements with respect to the specific parameters:

$$E[R_{x,i}^c] = (\alpha^c)^{\sigma-1} \beta^{c,i} R_d^*$$

$$\ln(E[R_{x,i}^c]) = (\sigma - 1) \ln \alpha^c + \ln \beta^{c,i} + \ln R_d^*$$

Now:

$$\begin{aligned} \ln \alpha^{CIA} &= \ln \tilde{\lambda} - t \ln(1 + r^*), \ln \alpha^{OA} = \ln \tilde{\lambda}^* - t \ln(1 + r), \\ \ln \alpha^{LC} &= -t \ln(1 + r) - \ln(1 + f^{LC}(1 + r^*)^t) \end{aligned}$$

And:

$$\ln \beta^{CIA,g} = \ln \beta^{OA} = \ln \beta^{LC} = 0 \text{ and } \ln \beta^{CIA,b} = \ln \lambda$$

Thus:

$$\frac{\partial \ln(E[R_{x,i}^c])}{\partial x} = (\sigma - 1) \frac{\partial \ln \alpha^c}{\partial x}$$

for $x \in \{r, r^*\}$. And

$$\frac{\partial^2 \ln(E[R_{x,i}^c])}{\partial x \partial \ln t} = (\sigma - 1) \frac{\partial^2 \ln \alpha^c}{\partial x \partial \ln t}$$

for $x \in \{r, r^*\}$. From here the proof is easily confirmed by looking at the derivatives of $\ln \alpha^c$ with respect to $\ln(1 + r)$ and $\ln(1 + r^*)$, and the two cross derivatives with $\ln t$.

Proof of Proposition 5 Revenues are given by:

$$\ln E [R_{x,i}^c] = (\sigma - 1) \ln \alpha^c + \ln \beta^{c,i} + \ln R_d^*$$

There are two cases:

- (i) if $\tilde{\lambda} > \tilde{\lambda}^*$ and $r > r^*$, then CIA is optimal. Then, $\ln \alpha = \ln \alpha^{CIA} = \ln \tilde{\lambda} - t \ln(1 + r^*)$ and $\frac{\partial \ln \beta}{\partial \ln(1+r)} = \frac{\partial \ln \beta}{\partial \ln(1+r^*)} = 0$. As $\frac{\partial \ln \alpha}{\partial \ln(1+r^*)} < 0$ and $\frac{\partial \ln \alpha}{\partial \ln(1+r)} = 0$, the log of expected revenues decreases in $\ln(1 + r^*)$ and is independent of $\ln(1 + r)$.
- (ii) if $\tilde{\lambda} \leq \tilde{\lambda}^*$ and $r \leq r^*$, then OA is optimal. Then, $\ln \alpha = \ln \alpha^{OA} = \ln \tilde{\lambda}^* - t \ln(1 + r)$ and $\frac{\partial \ln \beta}{\partial \ln(1+r)} = \frac{\partial \ln \beta}{\partial \ln(1+r^*)} = 0$. As $\frac{\partial \ln \alpha}{\partial \ln(1+r)} < 0$ and $\frac{\partial \ln \alpha}{\partial \ln(1+r^*)} = 0$, the log of expected revenues decreases in $\ln(1 + r)$ and is independent of $\ln(1 + r^*)$.

B Derivations of Trade Prices, Quantities, Revenues and Profits

Good type firms maximize:

$$\max_p E[\Pi_x^c] = (\alpha^c p^{1-\sigma} - ap^{-\sigma})(P^*)^\sigma Q^*$$

This implies:

$$p_x^c = \frac{1}{\alpha^c} \frac{\sigma}{\sigma - 1} a = \frac{1}{\alpha^c} p_d^*$$

The expected traded quantity is:⁴⁰

$$\begin{aligned} E[q_x^{c,i}] &= \beta^{c,i} p_x^{-\sigma} (P^*)^\sigma Q^* \\ &= (\alpha^c)^\sigma \beta^{c,i} q_d^* \end{aligned}$$

Expected export revenues are:

$$E(R_x^{c,i}) = p_x E[q_x] = (\alpha^c)^{\sigma-1} \beta^{c,i} R_d^*$$

Expected profits are:

$$\begin{aligned} E[\Pi_x^{c,i}] &= \alpha^c R - \beta^{c,i} K \\ &= \alpha^c p \bar{q} - \beta^{c,i} a \bar{q}, \end{aligned}$$

where $\bar{q} = \frac{E[q_x]}{\beta^{c,i}}$ is the contracted quantity.

$$\begin{aligned} E[\Pi_x^{c,i}] &= (\alpha^c p - \beta^{c,i} a) \frac{E[q_x]}{\beta} \\ &= (\alpha^c)^\sigma (\sigma - \beta^{c,i} (\sigma - 1)) \Pi_d^* \end{aligned}$$

⁴⁰ β enters this expression in the first line as under CIA a bad ty[e exporter only delivers with probability λ .

C Tables

Table 1a. Summary Statistics, Full Sample

This table gives Summary Statistics for the full sample employed in regressions for Table 2. Variables are: log of bilateral trade value, log of (1+exporter net interest rate margin), log of (1+importer net interest rate margin), log of exporter GDP, log of importer GDP, log of bilateral distance. The table reports the mean, standard deviation, the min and the max of each variable.

Summary Statistics N=142761				
Variable	Mean	Std. Dev.	Min	Max
Ln trade	8.227	3.71	-6.925	18.875
Ln exp int	.05	.034	.007	.351
Ln imp int	.05	.034	.007	.351
Ln GDPE	8.902	1.031	6.42	10.921
Ln GDPI	8.848	1.067	6.42	10.921
Ln dist	8.595	.857	4.088	9.901

Table 1b. Summary Statistics, Law Control Sample

This table gives Summary Statistics for the law control sample employed in the regressions for Table 2. Variables are: log of bilateral trade value, log of (1+exporter net interest rate margin), log of (1+importer net interest rate margin), log of exporter GDP, log of importer GDP, log of bilateral distance. The table reports the mean, standard deviation, the min and the max of each variable.

Summary Statistics N=78742				
Variable	Mean	Std. Dev.	Min	Max
Ln trade	7.974	3.733	-6.925	18.875
Ln exp int	.05	.033	.009	.351
Ln imp int	.05	.033	.009	.351
Exp law	.185	.973	-1.786	1.946
Imp law	.147	.98	-1.786	1.946
Ln GDPE	8.913	1.059	6.42	10.921
Ln GDPI	8.851	1.096	6.42	10.921
Ln dist	8.6	.846	4.088	9.901

Table 1c. Summary Statistics, Absolute Advantage Sample

This table gives Summary Statistics for the absolute advantage sample employed in regressions for Table 6. This is a sub-sample of all country pairs in which one country has an absolute advantage in financing costs ($\ln(1+\text{net interest margin})$) and the other country has an absolute advantage in contract enforcement (rule of law). Variables are: log of bilateral trade value, log of $(1+\text{exporter net interest rate margin})$, log of $(1+\text{importer net interest rate margin})$, log of exporter GDP, log of importer GDP, log of bilateral distance. The table reports the mean, standard deviation, the min and the max of each variable.

Summary Statistics N=21119				
Variable	Mean	Std. Dev.	Min	Max
Ln trade	7.961	3.941	-6.925	18.755
Ln exp int	.048	.028	.009	.278
Ln imp int	.048	.027	.009	.278
Exp law	.089	.898	-1.786	1.946
Imp law	.068	.904	-1.786	1.946
Ln GDPE	8.801	1.029	6.42	10.921
Ln GDPI	8.758	1.063	6.42	10.921
Ln dist	8.542	.896	4.107	9.894

Table 2. Financing Costs, Distance and Export Volumes

This table analyzes the effects of financing costs in the exporting and importing country and their interactions with distance on export volumes. The dependent variable is the log of exports from country i to country j in year t , 1987-2004. Financing costs are measured by the net interest margin. Time to trade is proxied by the geographical distance between the main cities of two countries. Contract enforcement is proxied by Rule of Law. Regressions in columns 1 and 2 control for the log of GDP per capita, population and GATT status for exporter and importer, respectively. All regressions include a constant and control for a set of bilateral controls as discussed in the text. Column 2 also controls for contract enforcement in both countries. Errors are clustered by exporter-importer pairs. Standard errors are in parenthesis. Significance levels: * : 10% ** : 5% *** : 1%.

Dependent variable	ln bilateral exports					
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Ln exp int	39.105*** (2.94)	12.088*** (3.99)				
Ln imp int	47.159*** (3.06)	21.649*** (3.86)				
Ln exp int x ln dist	-4.783*** (0.35)	-1.670*** (0.46)	-5.241*** (0.37)	-2.147*** (0.49)	-0.469** (0.21)	-0.082 (0.37)
Ln imp int x ln dist	-5.752*** (0.36)	-2.654*** (0.45)	-6.275*** (0.38)	-2.955*** (0.48)	-1.432*** (0.21)	-2.341*** (0.37)
Exp law x ln dist		0.220*** (0.03)		0.215*** (0.03)		-0.049 (0.03)
Imp law x ln dist		0.104*** (0.03)		0.091*** (0.03)		0.014 (0.03)
Ln GDPE x ln dist		-0.058** (0.03)		-0.057** (0.03)		0.007 (0.06)
Ln GDPI x ln dist		0.164*** (0.03)		0.173*** (0.03)		0.119** (0.06)
Ln dist	-0.883*** (0.03)	-2.200*** (0.29)	-0.844*** (0.03)	-2.251*** (0.30)		
R-squared	0.798	0.794	0.807	0.801	0.182	0.145
N	142761	78742	142761	78742	142761	78742
# exporter-importer clusters	18260	17924	18260	17924	18260	17924
# exporters	144	144	144	144	144	144
Country controls	y	y	-	-	-	-
Country pair controls	y	y	y	y	y	y
Importer, exporter, year FE	y	y	-	-	-	-
Imp × year, exp × year FE	n	n	y	y	y	y
Country pair FE	n	n	n	n	y	y

Table 3. Marginal effects of change in financing costs

This table reports the marginal effects for the regression results in Table 2. The values represent the percentage changes of exports and imports, respectively, resulting from a one percent increase in financing costs (1+net interest margin) evaluated at the sample mean bilateral distance (8.6). Columns (1) and (2) correspond to columns (1) and (2) in Table 4. Standard errors are in parenthesis. Significance levels: * : 10% ** : 5% *** : 1%.

Effects from 1 % increase in financing costs		
Specification	(1)	(2)
Exports	-2.002*** (0.31)	-2.270*** (0.39)
Imports	-2.280*** (0.30)	-1.174*** (0.38)
Mean ln dist	8.595	8.599
N	142761	78742

Table 4. Comparative statics for change in financing costs

This table reports comparative statics for the regression results in Table 2. I compare trade between a country pair at the 25 distance percentile (e.g. Spain - Egypt, 3355km) with trade between a country pair at the 75 distance percentile (e.g. Spain - South Korea, 10013km). Values report the reaction of trade to a one percent increase in financing costs (1+net interest margin). Standard errors are in parenthesis. Significance levels: * : 10% ** : 5% *** : 1%.

Effects from 1 % increase in financing costs						
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Exports						
25 distance percentile	0.278 (0.33)	-1.468*** (0.44)	- -	- -	- -	- -
75 distance percentile	-4.951*** (0.40)	-3.293*** (0.48)	- -	- -	- -	- -
Difference	-5.230*** (0.38)	-1.826*** (0.51)	-5.730*** (0.40)	-2.347*** (0.54)	-0.512** (0.23)	-0.089 (0.40)
Imports						
25 distance percentile	0.463 (0.33)	0.102 (0.42)	- -	- -	- -	- -
75 distance percentile	-5.827*** (0.39)	-2.800*** (0.48)	- -	- -	- -	- -
Difference	-6.289*** (0.39)	-2.902*** (0.49)	-6.861*** (0.42)	-3.231*** (0.53)	-1.566*** (0.23)	-2.560*** (0.41)
N	142761	78742	142761	78742	142761	78742

Table 5. Financial Development, Distance and Export Volumes

This table analyzes the relationship between financial development in the source and the destination country and export volumes. The regressions test for a direct effect of financial development and for an effect of its interaction with distance. The dependent variable is the log of exports from country i to country j in year t , 1980-2004. Financial development is proxied by private credit over GDP. Time to trade is proxied by the geographical distance between the main cities of two countries. Contract enforcement is proxied by rule of law. Regressions in columns 1 and 2 control for the log of GDP per capita, population and GATT status for exporter and importer, respectively. All regressions include a constant and control for a set of bilateral controls as discussed in the text. Column 2 also controls for contract enforcement in both countries. Errors are clustered by exporter-importer pairs. Standard errors are in parenthesis. *, ** and *** denote significance at the 10%, 5% and 1% level.

Dependent variable	ln bilateral exports			
Specification	(1)	(2)	(3)	(4)
Exp fin devt	-4.465*** (0.29)	-3.211*** (0.37)		
Imp fin devt	-5.327*** (0.30)	-2.260*** (0.41)		
Exp fin devt x ln dist	0.523*** (0.03)	0.360*** (0.04)	0.552*** (0.03)	0.371*** (0.04)
Imp fin devt x ln dist	0.606*** (0.03)	0.256*** (0.05)	0.618*** (0.04)	0.263*** (0.05)
Exp law x ln dist		0.143*** (0.03)		0.156*** (0.03)
Imp law x ln dist		0.022 (0.03)		0.009 (0.03)
Ln GDPE x ln dist		-0.095*** (0.03)		-0.104*** (0.03)
Ln GDPI x ln dist		0.161*** (0.03)		0.172*** (0.03)
ln dist	-1.981*** (0.03)	-2.365*** (0.27)	-2.024*** (0.03)	-2.390*** (0.28)
R-squared	0.772	0.786	0.788	0.792
N	228045	82812	228045	82812
# exporter-importer clusters	19253	18262	19253	18262
# exporters	150	150	150	150
Country controls	y	y	-	-
Country pair controls	y	y	y	y
Importer, exporter, year FE	y	y	-	-
Imp \times year, exp \times year FE	n	n	y	y

Table 6. Minimum Financing Costs, Distance and Exports

This table analyzes the effect of the minimum of financing costs of the exporting and importing country and its interactions with distance on export volumes. The dependent variable is the log of exports from country i to country j in year t , 1987-2004. The sample is restricted to cases where $r > r^*$ & $\lambda > \lambda^*$ or $r \leq r^*$ & $\lambda \leq \lambda^*$. Financing costs are measured by the net interest margin. Time to trade is proxied by the geographical distance between the main cities of two countries. Contract enforcement is proxied by Rule of Law. Regressions in columns 1 to 3 control for the log of GDP per capita, population and GATT status for exporter and importer, respectively. All regressions include a constant and a set of bilateral controls as discussed in the text. Columns 2 and 3 also control for contract enforcement in both countries. Errors are clustered by exporter-importer pairs. Standard errors are in parenthesis. Significance levels: * : 10% ** : 5% *** : 1%.

Dependent variable	ln bilateral exports					
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Ln exp int	26.717*** (7.77)	-1.415 (1.29)	7.910 (9.88)			
Ln imp int	19.455** (7.99)	-3.545*** (1.30)	0.612 (10.45)			
Ln exp int x ln dist	-3.406*** (0.90)		-1.046 (1.15)	-3.609*** (0.98)		-1.094 (1.27)
Ln imp int x ln dist	-2.856*** (0.94)		-0.481 (1.22)	-2.995*** (1.01)		-0.465 (1.33)
Ln min int		-3.917* (2.15)	52.051*** (18.58)		-5.016* (2.86)	53.405*** (19.93)
Ln min int x ln dist			-6.702*** (2.17)			-7.037*** (2.31)
Law of min int		-0.255*** (0.08)	1.789** (0.81)		-0.264*** (0.10)	2.045** (0.84)
Law of min int x ln dist			-0.227** (0.09)			-0.258*** (0.10)
Ln GDP of min int		0.061 (0.06)	-1.188** (0.53)		0.056 (0.06)	-1.159** (0.56)
Ln GDP of min int x ln dist			0.143** (0.06)			0.140** (0.06)
Ln dist	-2.471*** (0.41)	-1.354*** (0.04)	-2.513*** (0.41)	-2.485*** (0.42)	-1.350*** (0.04)	-2.557*** (0.42)

continued on next page

Table 6 continued. Minimum Financing Costs, Distance and Exports

Dependent variable	ln bilateral exports				
Specification	(1)	(2)	(3)	(4)	(5)
Exp law x ln dist	0.116** (0.05)		0.229*** (0.06)	0.107** (0.05)	0.236*** (0.06)
Imp law x ln dist	0.051 (0.05)		0.165** (0.07)	0.051 (0.05)	0.182** (0.08)
Ln GDPE x ln dist	-0.101** (0.04)		-0.170*** (0.05)	-0.103** (0.04)	-0.170*** (0.05)
Ln GDPI x ln dist	0.259*** (0.04)		0.188*** (0.05)	0.266*** (0.04)	0.197*** (0.05)
R-squared					
N	0.810 21119	0.804 21119	0.810 21119	0.824 21119	0.825 21119
# exporter-importer clusters	8015	8015	8015	8015	8015
# exporters	144	144	144	144	144
Country controls	y	y	-	-	-
Country pair controls	y	y	y	y	y
Importer, exporter, year FE	y	y	y	-	-
Imp × year, exp × year FE	n	n	n	y	y

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