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).

The usage of these payment contracts varies widely across countries as shown in Table 1, which reports summary statistics from a survey by the The Finance, Credit & International Business Association (FCIB), and Table 2, which displays the top destination countries for each payment contract in the same survey.[1] The most prevalent payment contract according to the survey is Open Account with 55.6 percent, followed by Cash in Advance with 22.9 percent and Letter of Credit with 13.1 percent.[2] Table 2 indicates that relatively riskier destination countries tend to be served by Cash in Advance whereas relatively safer countries are supplied using Open Account.

Table 3 reports regressions of the payment contract data from the FCIB survey on a measure of contract enforcement, a measure of financial development and several controls. The results suggest that Cash in Advance is chosen more often if the destination country has weak enforcement and if its financial markets are relatively well developed. Open Account instead is selected more often if enforcement in the destination is strong and financial markets are less well developed.[3]

Trade finance is a central element in international trade. Auboin (2009) estimates that

[1]The FCIB is an association of finance, credit and business executives. In the survey they ask managers which payment contract is the top payment method used when dealing with a specific country.

[2]This is in line with survey evidence reported in IMF (2009). Their report finds that 42-48 percent of transactions are done through Open Account. Cash in Advance accounts for 19-22 percent and bank intermediated transactions account for the rest of transactions.

[3]As the sample size is relatively small (N=71) and there is a substantial problem of measurement error, these results should only be taken as indicative. These problems show up in the significance levels. While all coefficients have the expected signs, only half of them are statistically significant. For additional evidence on the effect of contract enforcement in the destination country on payment contract choice in an individual firm see Antràs and Foley (2011).

90% of all trade transactions involve some form of trade finance and that the overall market for trade credit and insurance has a size of about $10-12 trillion. Furthermore, several papers show that financial conditions in the source country are a major determinant of aggregate trade flows.[4]

How can these patterns of payment contract choice be rationalized? Which trade-offs does a firm face when taking this decision. Which are the implications for aggregate trade flows? To shed light on these questions, this paper develops a model of payment contract choice between Cash in Advance, Open Account and Letter of Credit.[5] I also study intermediate contracts, which represent a combination Cash in Advance and Open Account.

In the model, an exporter is matched with one importer with whom she plays a one-shot game. The exporter makes a take it or leave it offer to the importer, specifying the type of contract, the price to be paid and the quantity to be delivered. Firms can be of good and bad type. A bad firm tries to deviate from its contractual obligation whenever this is profitable for it. Under Cash in Advance, the exporter might not deliver the goods after receiving the payment and under Open Account, the importer might not pay the agreed price for the goods after receiving and selling them. To address this moral hazard problem, a firm can try to enforce the contract in court, which gives rise, however, to enforcement costs. The probability of enforcing a contract successfully in court depends on the country and is given exogenously.

As trade takes time, either the working capital (Open Account and Letter of Credit), the pre-payment (Cash in Advance) or the Letter of Credit fee has to be financed in advance.

[4]Amiti and Weinstein (2011) and Paravisini et al. (2011) use firm level export data linked with financial data to establish a causal relationship between financial conditions and trade. Some papers document correlations between financial conditions and international trade patterns at the industry level. See in particular Beck (2002), Beck (2003), and Manova (2008). For work on financial constraints and trade see also Greenaway et al. (2007) and Muûls (2008). Finally, effects of financial crisis on trade flows are studied among others by Berman and Martin (2010), Bricongne et al. (2012), Chor and Manova (2012) and van der Veer (2010).

[5]Additional instruments for trade finance such as for example factoring or forfaiting exist. Furthermore, trade credit insurance can play a role, in particular to facilitate transactions on Open Account terms. For tractability, the current setup focuses on the three main payment contracts in use. Factoring and forfaiting can best be seen as variations on the Letter of Credit discussed here as they are other instruments for transferring the risk from the two trading parties to third parties. Trade credit insurance is not required in the model as firms are assumed to be risk neutral. For more details on the different types of payment contracts, see U.S. Department of Commerce (2008).

Financial markets are assumed to be segmented across countries implying different interest rates in the source and the destination country. The choice of payment contract therefore determines the overall financing costs of the transaction.

Payment contracts thus trade-off the risk and the financing requirements of a transaction. Under Cash in Advance, enforcement takes place in the source country whereas financing is done in the destination country. Under Open Account, enforcement has to be assured in the destination country whereas financing takes place in the source country. Under a Letter of Credit, moral hazard is solved in both countries, but financing has to be done in both countries and additional bank fees have to be incurred.

To maximize exporter profits, 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. For similar financing costs, exports to a country with weak enforcement should thus be done through Cash in Advance, while countries with good enforcement should be supplied through Open Account. 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.

Payment contracts have a number of implications for trade costs, aggregate trade flows and the behavior of trade during financial crisis. The model implies that trade finance costs 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 in the source and the destination country. 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 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 like

the recent great recession should have a larger impact on trade flows than national crises.

In the empirical part of the paper, I test the predictions of the model on the effects of financial conditions on aggregate trade flows, in particular the role of importer finance. I run gravity regressions including interaction terms between distance and financing costs in the source and the destination country. 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.[6] According to the regressions importer financing matters as much for international trade as exporter financing. This is quite surprising, given that the literature so far has focused almost exclusively on source country characteristics.

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. 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.[7] 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.

Second, there are theoretical papers that have considered the relationship between financial market conditions and international trade.[8] Chaney (2005) develops a theoretical model analyzing financial constraints on entry in a heterogeneous firms trade model based on Melitz (2003). Manova (2008) extends this model to a setting where also export volumes can be affected by financial constraints. In Chaney (2005) and Manova (2008) 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.

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

[7] See 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).

[8] Kletzer and Bardhan (1987) show how sovereign default risk and credit market imperfections can create a comparative advantage. In Matsuyama (2005), the share of pledgable revenues differs between countries leading to a comparative advantage.

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.[9] Several more recent contributions also study theoretical and empirical aspects of trade finance. Ahn (2010) analyzes the reaction of domestic and international trade finance to 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 frequently. 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 predictions of the model and some extensions, whereas Glady and Potin (2011) focus on the role of letters of credit. Finally, Engemann et al. (2011) and Eck et al. (2011) study the role of international trade credit in addressing problems arising from information asymmetry between exporters and importers.

The empirical part of the paper is closest to the papers that study the relationship between the financial development of a country and the sectoral concentration of its exports.[10] It differs, however, in two central aspects. First, motivated by the theoretical results, I consider financing costs both in the source and the destination country.[11] Second, instead of focusing on sectoral differences, a distance interaction is employed to test for an effect of financial conditions proportional to the time needed for trade.[12]

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.

[9]Menichini (2009) discusses inter-firm trade finance. She suggests 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. Evidence on firm level trade finance of African exporters is documented by Humphrey (2009).

[10]See Beck (2002), Beck (2003), and Manova (2008).

[11]Manova (2008), in a recent revision, also mentions results from a regression with destination country variables. She finds effects about one third of the size as compared to the effects of source country variables.

[12]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.

2 Payment Contracts

This section develops a microeconomic model of the choice between Open Account (exporter finance), Cash in Advance (importer finance) and Letter of Credit (bank finance). This choice is particularly relevant for international trade 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.[13] 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.[14]

2.1 Setup

Each exporter in the source country is matched with one importer in the destination country. A firm can be of good and bad type. Let $\eta \in (0,1)$ denote the share of good firms in the source country. Good firms always fulfill their contractual obligation, whereas bad firms deviate whenever this is optimal for them.[15] The type of a firm is private information.

[13] Amiti and Weinstein (2011) calculate that these two causes of delay add up to approximately two months for the median case.

[14] Parties 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.

[15] Considering two types of firms allows to endogenize the limited value of contract constraint that I assumed in Schmidt-Eisenlohr (2009). See Appendix E for an illustration of this case which makes the

Firms are risk neutral.[16] The exporter and importer play a one-shot game.[17]

First, the exporter makes a take it or leave it offer to the importer.[18] Then, the exporter can produce and send off goods to the destination country. Sent goods arrive at the importer after t time units and sales revenues are realized. Denote production costs by K and revenues by R.

There are two imperfections in the economy. First, markets to finance international trade transactions are segmented and financial intermediaries across countries differ in their efficiency. As a result the interest rate a firm faces depends on its location. Second, there is limited enforcement of contracts. This is captured by an exogenous country-specific probability that a contract is enforced in the case where a firm does not choose to fulfill it voluntarily.[19] 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.[20] 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 with the non-cooperative

model more tractable, but requires the additional limited value constraint. The first paper I am aware of to introduce two types of firms into a setting with an importer-exporter pair is Araujo and Ornelas (2007). The most similar approach regarding this point is taken by Glady and Potin (2011) who also introduce two types of firms and a pooling case. Eck et al. (2011) also study two types of firms and separating and pooling cases. Different to this paper, they study how trade credit can be used as a signaling device to resolve problems of asymmetric information.

[16] As firms are risk neutral, they do not demand trade insurance in the model. If firms were risk averse, but had access to a perfect insurance market charging fair premia, the results of the model should not change.

[17] One shot transactions are common in international trade. Eaton et al. (2011) find for US-Colombia matched importer-exporter pairs that the probability of survival of newly formed trade pairs is less than 50%. Even pairs that have survived for five years or longer have average separation rates above 40%. In Schmidt-Eisenlohr (2011), I study the case of repeated transactions for a simplified version of the model. Then, in some cases, trigger strategies can be implemented to improve upon the one-shot equilibrium.

[18] Appendix C discusses the case where the importer has all bargaining power. While expressions change, all effects of country characteristics on the payment contract choice go in the same direction as in the case analyzed here.

[19] This 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.

[20] For 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).

behavior of one of the two trading parties.[21] Finally, 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.

2.2 Cash in Advance, Open Account and Letter of Credit

Cash in Advance - Overview Cash in Advance corresponds to a full pre-payment by the importer. That is, before delivery, the importer pays an amount C^{CIA} to the exporter. Then, the exporter decides whether to deliver the goods. If the exporter is of the good type, she always delivers the goods. If the exporter is of the bad type, she tries to default on the contract. With probability λ she is forced to deliver the goods anyways. The importer, however, loses a share δ of revenues due to enforcement costs. With probability $1 - \lambda$ the exporter successfully defaults on the contract. Note that in the absence of a contract fine, a bad exporter always has an incentive to default on the contract.

A bad exporter has two choices. First, she can demand the same pre-payment as a good 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 exporter separating is never optimal as long as good firms also choose Cash in Advance. It implies a lower payment without any additional gain. A good exporter cannot signal her type, because any prepayment acceptable for a good exporter is also acceptable for a bad exporter. Therefore, if both types choose Cash in Advance, the pooling case arises. Finally, I consider the case where good firms do not choose Cash in Advance. I show that under a relatively weak parameter restriction this implies that also bad firms do not choose Cash in Advance. If this restriction is fulfilled, it is therefore sufficient to focus on the pooling case when studying Cash in Advance.

[21] In the baseline model outlined in the following, this cost fully falls on the firm that enforces the contract. In Appendix B, I discuss the case where a contract fine can be included in the contract that falls on the defaulting party. Then, additional incentive conditions have to be taken into account. These imply that under some conditions both firms choose to fulfill the contract voluntarily.

Cash in Advance - pooling case The exporter maximizes her expected profits subject to the importer participation constraint:[22]

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

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

$$\text{s.t.}$$

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

(participation constraint importer)

$$\mathrm{E}\left[\Pi_{E,g}^{CIA,p}\right] = C^{CIA,p} - K \geq 0. \tag{4}$$

(participation constraint good exporter)

The participation constraint of the importer requires that her expected profits are non-negative. As the exporter has all negotiation power, the participation constraint of the importer binds under the optimal contract. A necessary condition for the pooling contract is that the participation constraint of good exporters holds. The optimal payment $C^{CIA,p}$ and optimal expected profits of a good and bad exporter, respectively, are:

$$C^{CIA,p} = \frac{\eta + (1-\eta)\lambda(1-\delta)}{(1+r^*)^t} R, \tag{5}$$

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

$$\text{Bad type: } \mathrm{E}\left[\Pi_{E,b}^{CIA,p}\right] = \frac{\eta + (1-\eta)\lambda(1-\delta)}{(1+r^*)^t} R - \lambda K. \tag{7}$$

Despite the fact that there are strictly positive gains from trade under CIA as long as $\frac{1-(1-\eta)\lambda\delta}{(1+r^*)^t} R \geq K$, production and delivery only take place with probability $\eta + (1-\eta)\lambda$.

Cash in Advance - separating case Suppose now that conditions are such that a good exporter does not choose Cash in Advance. Given the ability to default on the contract, a bad firm might still consider to offer a Cash in Advance contract even though this implies

[22] It is assumed that 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.

revelation of her type. In this case, the importer understands that she deals with a bad firm and adjusts her expected revenue downwards. Her participation constraint becomes:

$$\mathrm{E}\left[\Pi_I^{CIA,s}\right] = \frac{\lambda(1-\delta)}{(1+r^*)^t}R - C^{CIA,s} \geq 0. \tag{8}$$

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

$$C^{CIA,s} = \frac{\lambda(1-\delta)}{(1+r^*)^t}R. \tag{9}$$

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

$$\mathrm{E}\left[\Pi_{E,b}^{CIA,s}\right] = \frac{\lambda(1-\delta)}{(1+r^*)^t}R - \lambda K. \tag{10}$$

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

$$\mathrm{E}\left[\Pi_{E,g}^{CIA,p}\right] \geq \mathrm{E}\left[\Pi_{E,b}^{CIA,s}\right]. \tag{11}$$

Plugging in and rearranging, this is the case if:

$$\frac{R}{K} \geq \frac{1-\lambda}{1-\lambda(1-\delta)}\frac{(1+r^*)^t}{\eta}. \tag{12}$$

For Condition (12) to hold, revenues have to be sufficiently larger than production costs. Remember that the advantage of the bad firm is to save on production costs with some probability. For the rest of the paper, I assume that Condition (12) holds. That is, if a good firm does not choose Cash in Advance, it is not profitable for a bad firm to choose Cash in Advance either.[23]

[23]To see that the condition is relatively weak, consider the following parameter values: $\eta = 0.8, \lambda = 0.8, \delta = 0.05$, $1 + r^* = 1.1$ and $t = 0.25$ (3 months). Then, the condition holds if revenues are at least 1.07 times larger than the production costs. This ratio is even smaller if the share of good firms η is higher, if contract enforcement λ is stronger, if the cost of enforcement δ is higher, if financing costs $1 + r^*$ are lower

Open Account - Overview Open Account represents full payment after delivery. That is, first, the exporter produces the goods and delivers them to the importer. Then, after t time units, the goods arrive at the importer who sells them. The importer now decides whether to pay the claim of the exporter. If of good type, the importer always pays C^{OA}. If of bad type, she tries to deviate, but is forced to pay with probability λ^*, giving rise to enforcement losses of δR. Now the exporter can choose between a pooling and a separating strategy.

Open Account - pooling case For pooling to take place, the participation constraint of a good importer has to be respected:

$$\max_C \mathrm{E}\left[\Pi_E^{OA,p}\right] = \frac{\eta^* + (1-\eta^*)\lambda^*(1-\delta)}{1+r} C^{OA,p} - K, \tag{13}$$

s.t.

$$\mathrm{E}\left[\Pi_{I,g}^{OA,p}\right] = R - C^{OA,p} \geq 0 \tag{14}$$

(participation constraint good importer).

It is optimal for the exporter to choose $C^{OA,p}$ such that the participation constraint of the good importer binds. This implies:

$$C^{OA,p} = R, \tag{15}$$

$$\mathrm{E}\left[\Pi_E^{OA,p}\right] = \frac{\eta^* + (1-\eta^*)\lambda^*(1-\delta)}{(1+r)^t} R - K. \tag{16}$$

Open Account - separating case The separating case implies the following participation constraint for a bad importer:

$$\mathrm{E}\left[\Pi_{I,b}^{OA,s}\right] = \frac{R - \lambda^* C^{OA}}{(1+r^*)^t} \geq 0. \tag{17}$$

or if the time needed for trade t is shorter.

It is now optimal for the exporter to make the participation constraint of a bad importer bind. This implies:

$$C^{OA,s} = \frac{R}{\lambda^*}. \tag{18}$$

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

$$\mathrm{E}\left[\Pi_E^{OA,s}\right] = (1-\eta^*)\left(\frac{(1-\lambda^*\delta)R}{(1+r)^t} - K\right). \tag{19}$$

From a comparison of profits, it is evident, that an exporter prefers a pooling contract to a separating contract if:

$$\frac{R}{K} > \frac{\eta^*(1+r)^t}{\eta^* - (1-\eta^*)(1-\lambda^*)}. \tag{20}$$

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 (20) is satisfied and thus exporters always offer a contract that implies pooling.[24]

Letter of Credit A Letter of Credit (LC) captures the case where banks in the source and the destination country are employed to facilitate the trade transaction. The importer pays a fee F^{LC} to her bank, which issues a letter of credit that guarantees payment to the exporter upon proof of delivery. This fee finances monitoring and other administrative costs related

[24]This assumption is also relatively weak. Suppose for example that $\eta^* = 0.8$, $\lambda^* = 0.8$, $1 + r = 1.1$, $\delta = 0.05$ and $t = 0.25$ (3 months). Then the condition requires revenues to be at least 1.08 times larger than production costs to rule out the separating contract case. If enforcement in the destination country λ^* or the enforcement cost δ are higher or if the interest rate in the source country $1 + r$ or the time needed for trade t are lower, then the required ratio is even lower.

to the issue and execution of a Letter of Credit. Assume that the fee is proportional to the value of the transaction C^{LC}, that is $F^{LC} = f^{LC}C^{LC}$. The bank cooperates with a bank in the country of the exporter. 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.[25] With a Letter of Credit, an exporter therefore does not face any risk of non-payment. Her maximization problem is:

$$\max_{C} \mathrm{E}\left[\Pi_E^{LC}\right] = \frac{C^{LC}}{(1+r)^t} - K, \tag{21}$$

$$\text{s.t. } \mathrm{E}\left[\Pi_I^{LC}\right] = \frac{R - C^{LC}}{(1+r^*)^t} - f^{LC}C^{LC} \geq 0 \qquad \text{(participation constraint importer).} \tag{22}$$

To maximize her expected profits, the exporter chooses C^{LC} such that the participation constraint of the importer binds. The optimal payment C^{LC} and discounted expected exporter profits are:

$$C^{LC} = \frac{R}{1 + f^{LC}(1+r^*)^t}, \qquad \mathrm{E}\left[\Pi_E^{LC}\right] = \frac{R}{(1 + f^{LC}(1+r^*)^t)(1+r)^t} - K. \tag{23}$$

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

Comparison CIA, OA and LC The six parameters $r, r^*, \lambda, \lambda^*, \eta, \eta^*$ together with the Letter of Credit fee f^{LC} and enforcement cost δ 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:*

[25] It is conceivable that enforcement is easier between banks than between firms. 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).

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

Proof. See Appendix F. ■

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

Corollary 1 *The usage of*

i) Cash in Advance weakly increases in r, λ, η and f^{LC} and weakly decreases in λ^*, η^* and r^*.

ii) Open Account weakly increases in r^*, λ^*, η^* and f^{LC} and weakly decreases in r, λ and η.

iii) Letter of Credit weakly increases in δ and weakly decreases in r, λ, λ^*, η, η^* and f^{LC}.

Proof. See Appendix F. ■

Cash in Advance is more attractive if financing costs and enforcement in the source country are high and if financing costs and enforcement in the destination country are low. Open Account is more profitable if financing costs and enforcement in the destination country are high and if financing costs and enforcement in the source country are low. A Letter of Credit is preferable if financing costs and enforcement in the source country, enforcement in the destination country and Letter of Credit fees are low. Changes in the shares of good firms η and η^* have the same effects on the payment contract choice as changes in the levels of contract enforcement in the respective countries. A higher enforcement cost δ makes a Letter of Credit more attractive compared to Open Account or Cash in Advance.

The prediction that Open Account increases in enforcement in the destination country λ^*, while Cash in Advance decreases in enforcement in the destination country λ^* has been

tested recently in Antràs and Foley (2011) using contract level data. Their estimations confirm these two theoretical predictions. The predictions on enforcement and financing costs in the destination country λ^* and r^* are also in line with the evidence from the FCIB survey discussed in the introduction.

2.3 Intermediate Contracts

Until now I have only considered contracts with either pre-payement (CIA) or post-payment (OA) as well as Letters of Credit. It is also possible to use what I call an intermediate contract. That is part of the payment is done in advance whereas the remainder is payed after delivery.[26]

Under which circumstances are these contracts preferred to pure importer finance (CIA) or pure 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, quite surprisingly, intermediate contracts only improve expected profits in one specific case: if, in the absence of intermediate contracts, the exporter chooses OA over CIA and if the interest rate in the destination country is lower than in the source country. In this case, intermediate contracts can be used to reduce financing costs. In any other case, an exporter always chooses either pure exporter finance (OA) or pure importer finance (CIA).

Let $\phi \in (0, 1)$ denote the share of the advance payment in 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.

Resolving Exporter Moral Hazard To prevent the exporter from deviating, the payment after delivery has to be sufficiently large. A bad 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

[26]While there is no direct data on the use of intermediate contracts, anecdotal evidence, reported to the author by firms involved in trade finance, suggests that these are also employed in practice.

cheating $(1-\lambda)$ times the production costs saved from doing so K. The condition therefore is:

$$\frac{\eta^* + (1-\eta^*)\lambda^*}{(1+r)^t}(1-\phi)C - \frac{(1-\eta^*)\lambda^*}{(1+r)^t}\delta R - K \geq -\lambda K. \tag{24}$$

This implies an upper bound on the prepayment share ϕ:

$$\phi \leq 1 - (1+r)^t \frac{1-\lambda}{\eta^* + (1-\eta^*)\lambda^*}\frac{K}{C} - \frac{(1-\eta^*)\lambda^*}{\eta^* + (1-\eta^*)\lambda^*}\frac{R}{C} \equiv \phi^E. \tag{25}$$

When does the exporter prefer an intermediate contract over CIA or OA? Consider the two possible cases. First, suppose that, in the absence of intermediate 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 moral hazard constraint of the exporter binds, i.e. where $\phi = \phi^E = 1-(1+r)^t \frac{1-\lambda}{\eta^*+(1-\eta^*)\lambda^*}\frac{K}{C} - \frac{(1-\eta^*)\lambda^*}{\eta^*+(1-\eta^*)\lambda^*}\frac{R}{C}$. Second, suppose that, in the absence of intermediate contracts, the exporter chooses CIA over OA. Then, if $r < r^*$, financing costs could be reduced by introducing some late payment by the importer. Note that importer moral hazard cannot be prevented, as in the absence of a contract fine, the importer as the last mover always has an incentive to deviate. 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 contract can never be preferred.

To summarize, an intermediate contract can reduce interest rate costs if $r^* < r$ and OA is preferred in the absence of an intermediate contract. No intermediate contract is chosen if CIA is preferred in its absence.

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 based on Krugman (1980).

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:

$$U = \left(\int_{\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}. \tag{26}$$

Q is a CES (constant elasticity of substitution) basket of a continuum of differentiated goods. The demand for the differentiated good is:

$$q(\omega) = p(\omega)^{-\sigma} P^{\sigma} Q, \tag{27}$$

where ω denotes a variety of the differentiated good, $P = \left(\int_{\omega \in \Omega} p(\omega)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ 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 operate under monopolistic competition. Each variety is produced by only one firm. There is a fixed cost of production f. The production of one unit of the differentiated good requires a units of labor.

3.2 Optimal Behavior of Firms

Given CES demand and monopolistic competition, firms charge a constant markup over marginal costs to maximize profits. Domestic prices, quantities and profits are:

$$p_d = \frac{\sigma}{\sigma - 1} a, \qquad q_d = (p_d)^{-\sigma} P^{\sigma} Q, \qquad \Pi_d = q_d \left[\frac{a}{\sigma - 1} \right]. \tag{28}$$

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

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

Note that these can be represented by the general expression:

$$\mathrm{E}\left[\Pi_{x,i}\right] = \alpha^c R - \beta_i^c K, \tag{29}$$

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

Under Cash in Advance, a bad exporter has lower expected production costs. Thus, she might want to promise a higher quantity at a lower unit price than a good exporter. This is not optimal though as this would reveal her type.[27] Thus, the problem of the good exporter does not only determine the contract type, but also the price and quantity of the goods exported by a firm. Optimization implies the following export prices, quantities and profits for all contract types c and firm types i:[28]

$$p_x^c = \tfrac{1}{\alpha^c} p_d^*, \qquad \mathrm{E}\left[q_{x,i}^c\right] = A_i^c q_d^*, \tag{30}$$

$$\mathrm{E}\left[R_{x,i}^c\right] = \tfrac{1}{\alpha^c} A_i^c R_d^*, \quad \mathrm{E}\left[\Pi_{x,i}^c\right] = (\alpha^c)^\sigma(\sigma - \beta_i^c(\sigma-1))\Pi_d^*, \tag{31}$$

with $A_i^c = (\alpha^c)^\sigma \beta_i^c$.[29]

[27] The 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 exporter under pooling are $\tilde{\lambda}^\sigma(1+r^*)^{-\sigma t}\Pi_d^*$ and expected profits of a bad 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 $\delta \geq 0$.

[28] Expected profits of good exporters can be normalized to $\mathrm{E}\left[\tilde{\Pi}_x\right] = \mathrm{E}\left[\frac{\Pi_x}{\alpha^c}\right] = R - \frac{1}{\alpha^c}K$. Maximizing the original objective function $\mathrm{E}[\Pi]$ implies the same optimal decisions as maximizing the new function $\mathrm{E}\left[\tilde{\Pi}\right]$. 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 A.

[29] $\mathrm{E}[q_x]$ is the expected quantity, taking into account that under CIA only a fraction $\eta + (1-\eta)\lambda$ of export

Note that the parameters α^c and β_i^c, 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.

3.3 Implications for Trade Patterns

Taking into account payment contracts delivers new insights on 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 2 *For given demand conditions P^* and Q^* in the destination country, expected export revenues of a good exporter (a bad exporter, keeping the payment contract fixed)*

i) decrease weakly (strictly) if financing costs in the source or (and) the destination country 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 F. ■

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 weakly increase in enforcement probabilities in the source and the destination country.

For good firms, the payment contract that maximizes expected profits also implies the highest expected revenues. Thus, in Proposition 2, statements on good exporters hold even

contracts is enforced.

when allowing for an endogenous switch of payment contract. Bad exporters imitate the payment contract and quantities of good exporters. Therefore, the statements in Proposition 2 only hold for bad 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 3 *For given destination country demand conditions P^* and Q^*, the log of expected export revenues of a good exporter (a bad exporter, keeping the payment contract fixed)*

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

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 F. ■

Proposition 3 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 Section 4.

3.4 Contract Switching and Financial Crisis

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

[30] Note that switches between payment contracts 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 exporters only represent a small fraction of all firms, their effect on aggregate revenues is limited.

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

The ability to limit the adverse effects of changes in financial markets through payment contract 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.

4 Empirical Tests

The model developed in this paper has predictions both on the payment contract choice at the firm level as well as on aggregate trade flows. While it seems desirable to test both sets of predictions, testing the payment contract choice is difficult due to data limitations. In this section, I focus on the two novel predictions regarding aggregate trade flows.[32] First, I test whether not only source but also destination market financial conditions affect trade flows. Second, I test whether the effect of financing costs on trade is proportional to the time needed for trade (Proposition 3).

The analysis proceeds in four steps. First, I present the baseline regression that provides evidence for a negative relationship between financing costs and trade flows, both for exporter and importer finance. I find that, as predicted, the size of the effect of financing costs on trade flows is increasing in the geographical distance between trading partners. Second, I study comparative statics and show that the estimated relationships are 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 continue to hold when I introduce exporter $\times$ year and importer $\times$ year

[32]This constitutes an indirect test of the payment contract choice model. While the prediction on the destination country effects is novel to the theory developed here, it could in principle also be generated by an alternative model that features a role for importer finance. In Appendix D, I derive a test that is more closely related to the payment contract choice as modeled in this paper.

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. Finally, I address the question of causality.

4.1 Data

I use data on bilateral trade flows from the CEPII trade and production database. 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. The measure for contract enforcement is extracted from the World Bank Worldwide Governance Indicators. Data on geographical distance and other bilateral indicators is from the CEPII gravity dataset collected by Head et al. (2010). Data on GDP per capita and population are taken from the Penn World Tables (Heston et al. (2009)). 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 4a-c.

4.2 Estimation and Results

The baseline regression tests the relationship between bilateral trade flows and financing costs (log of (1+ 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 interactions with

geographical distance.

$$\ln Y_{ijt} = \zeta_0 + \zeta_1 \ln(1 + r_i) + \zeta_2 \ln(1 + r_j) + \zeta_3 \ln(dist_{ij}) \cdot \ln(1 + r_i) \tag{32}$$
$$+\zeta_4 \ln(dist_{ij}) \cdot ln(1 + r_j) + \zeta_5 \ln(dist_{ij}) + \theta' X + \chi_i + \chi_j + \chi_t + \epsilon_{ijt}.$$

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 the log of exporter and importer GDP per capita, exporter and importer population, GATT membership status and several bilateral indicators.[33] 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.

Distance effect The regression reported in Column 1 of Table 5 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 3, 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 6. They imply that a one percent increase in financing costs 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

[33]These 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.

interest margin in Spain increased by one percent. 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 than when trading with Egypt due to the larger geographical distance. Table 7 reports comparative statics for all specifications displayed in Table 5.

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. First, a measure of contract enforcement (rule of law) and its interaction with distance are included to control for institutional factors. Second, an interaction between the log of GDP per capita and distance is added to capture effects related to the general economic development of countries. A comparison of Column 2 with Column 1 reveals that the introduction of these additional regressors reduces the point estimates of 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.[34] ζ_3 and ζ_4 become smaller but remain highly significant with the exception of ζ_4 in column 6.[35]

As a further robustness check, I rerun the regressions shown in Table 5 Columns 1 to 4, using private credit over GDP instead of the net interest margin. The former is the standard measure for financial development, in particular, in papers that study the role of financial constraints. The results are reported in Table 8. 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 5.

[34]This 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.

[35]This 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.

Can we interpret the relationship between financial conditions and trade flows as identified by the interaction terms between distance 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.[36] 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 of trade finance on the borrowing rate of firms therefore seems unlikely. This suggests that financing costs have an economically relevant effect on trade flows, proportional to distance.

5 Conclusions

This paper has developed a model that shows how firms can utilize different payment contracts to optimally trade off differences in financing costs and contractual environments between source and destination countries. Its empirical analysis finds that 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 focuses on the role of conditions in the source country.

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

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

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 destination market.[37]

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 and the profitability to switch between 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 test relevant predictions of the model, 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. To test all predictions of the model, a dataset with variation in both source and destination countries would be required.

A Derivations of Trade Prices, Quantities, Revenues and Profits

There are two cases to be considered. First, a firm can choose its optimal price and quantity independently of the other type. Alternatively, it can imitate the other type. In the following I derive both cases. To save on notation, I leave out the superscript c for the type of contract and the subscript i for the type of firm. All expressions hold for all contracts $c \in \{CIA, OA, LC\}$ and all types $i \in \{good, bad\}$.

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

Optimal prices and quantities - independent decision A firm maximizes: $\max_p \mathrm{E}[\Pi_x] = (\alpha p^{1-\sigma} - \beta a p^{-\sigma})(P^*)^\sigma Q^*$.

This implies: $p_x = \frac{\beta}{\alpha}\frac{\sigma}{\sigma-1}a = \frac{\beta}{\alpha}p_d^*$.

The expected traded quantity is: $\mathrm{E}[q_x] = \beta p_x^{-\sigma}(P^*)^\sigma Q^* = (\alpha)^\sigma \beta q_d^*$.

Expected export revenues are: $\mathrm{E}(R_x) = p_x \mathrm{E}[q_x] = (\alpha)^{\sigma-1}\beta R_d^*$.

Expected profits are: $\mathrm{E}[\Pi_x] = \alpha pq - \beta aq = \alpha^\sigma \beta^{1-\sigma}\Pi_d^*$.

For good firms this implies:

$$p_{x,g} = \frac{1}{\alpha}p_d^*, \quad \mathrm{E}[q_{x,g}] = \alpha^\sigma q_d^*, \quad \mathrm{E}(R_{x,g}) = \alpha^{\sigma-1}R_d^*, \quad \mathrm{E}[\Pi_{x,g}] = \alpha^\sigma \Pi_d^*$$

A bad firm not imitating a good firm would choose:

$$p_{x,b}^{nim} = \frac{\beta}{\alpha}p_d^*, \quad \text{implying} \quad \mathrm{E}[\Pi_{x,b}^{nim}] = \alpha^\sigma \beta^{1-\sigma}\Pi_d^*$$

Optimal prices and quantities - bad type imitating good type If a bad firm imitates a good firm, it chooses the same price and quantity as a good firm. Under Cash in advance, however, it only delivers the goods with probability λ. Its expected profits are therefore:

$$\mathrm{E}[\Pi_{x,b}^{im}] = \alpha p^{1-\sigma} - \beta a p^{-\sigma}(P^*)^\sigma Q^* = (\alpha)^\sigma(\sigma - \beta(\sigma-1))\Pi_d^*$$

B Introducing a Contract Fine

For tractability, the main analysis abstracts from any contract fine or other form of punishment imposed on a defaulting party. This section introduces a contract fine and shows how this affects the model. It derives the conditions under which this implies a voluntary fulfillment of the contractual obligations by bad exporters and bad importers, respectively.

In the following assume that there is a contract fine that can be imposed on the defaulting party if enforcement is successful. Let this fine be exogenously given and proportional to the sales revenues R such that the total fine is ΔR.[38] The main difference implied by this

[38]The cost of breaking the contract could also be driven by a loss in future gains from trade. In Schmidt-

additional element is that now bad firms might fulfill their obligations voluntarily. Therefore, we now have to check for an additional incentive constraint that determines whether a firm tries to default or not.

Cash in Advance The problem of a good exporter does not change. She always delivers the product. A bad exporter now has to decide whether to voluntarily deliver the goods or whether to try to deviate risking the contract fine. Expected profits of a bad exporter with voluntary delivery are:

$$\mathrm{E}\left[\Pi_{E,b}^{CIA,p,vd}\right] = C - K. \tag{33}$$

Expected profits of a bad exporter with non-voluntary delivery are:

$$\begin{aligned}\mathrm{E}\left[\Pi_{E,b}^{CIA,p,nvd}\right] &= \lambda(C - K - \Delta R) + (1-\lambda)C \\ &= C - \lambda K - \lambda \Delta R.\end{aligned} \tag{34}$$

Comparing these two expressions implies that non-voluntary delivery is preferred over voluntary deliver iff:

$$\frac{K}{R} > \frac{\lambda}{1-\lambda}\Delta. \tag{35}$$

If condition (35) is violated, then the expected contract fine is sufficiently high as compared to the gains from deviating to make any firm always fulfill the contract. If the condition holds, we are back to the case analyzed in the main part of the paper.

Open Account Under Open Account we now have to check for the incentive constraint of a bad importer. Again, the problem of a good firm is not changed as she always pays after receipt of the goods anyways. A bad firm has to decide whether to voluntarily pay for the goods or whether to try to deviate risking the contract fine. Expected profits of a bad

Eisenlohr (2011), I study this explicitly by looking at repeated contracts.

importer with voluntary payment are:

$$\mathrm{E}\left[\Pi_{I,b}^{OA,vp}\right] = R - C. \tag{36}$$

Expected profits of a bad importer with non-voluntary payment are:

$$\mathrm{E}\left[\Pi_{I,b}^{OA,nvp}\right] = R - \lambda^*(C + \Delta R). \tag{37}$$

Non-voluntary payment is therefore preferred by a bad importer iff:

$$\frac{C}{R} > \frac{\lambda^*}{1-\lambda^*}\Delta. \tag{38}$$

If this condition is not fulfilled, all firms always follow through with their contractual obligations and the problem is solved. For a further comparison with the main text, assume in the following that this condition is fulfilled. Note that there always exists some Δ for which this is the case. The exporter, again, has to choose between the separating and the pooling case.

Open Account, separating case In the separating case, profit maximization requires the participation constraint of a bad importer to bind:

$$\mathrm{E}\left[\Pi_{I,b}^{OA,s,nvp}\right] = R - \lambda^*(C + \Delta R) = 0. \tag{39}$$

Solving for C delivers:

$$C_{I,b}^{OA,s,nvp} = \left(\frac{1}{\lambda^*} - \Delta\right) R. \tag{40}$$

There are two cases. If $C_{I,b}^{OA,s,nvp} \leq R$, it is optimal for the exporter to choose pooling and ask for $C = R$. If $C_{I,b}^{OA,s,nvp} > R$, the separating case might be profitable. I compare this case in the following with the pooling case to determine the condition under which this is true. Under the separating case with non-voluntary payment, noting that a share of $1 - \eta$

firms are of bad type and accept the contract, the expected profits of an exporter are:

$$\mathrm{E}\left[\Pi_E^{OA,s,nvp}\right] = (1-\eta^*)\left[\frac{\lambda^*(C-\delta R)}{(1+r)^t} - K\right]. \tag{41}$$

Plugging in C delivers:

$$\mathrm{E}\left[\Pi_E^{OA,s,nvp}\right] = (1-\eta^*)\left[\frac{1-\lambda^*(\Delta+\delta)}{(1+r)^t}R - K\right]. \tag{42}$$

Open Account, Pooling Under pooling $C^{OA,p} = R$. This implies:

$$\mathrm{E}\left[\Pi_E^{OA,p,nvp}\right] = \frac{\eta^* + (1-\eta^*)\lambda^*(1-\delta)}{(1+r)^t}R - K. \tag{43}$$

Choice between separating and pooling by the exporter Combining expressions (42) and (43) an exporter prefers pooling iff:

$$\frac{R}{K} > \frac{\eta^*(1+r)^t}{\eta^* - (1-\eta^*)[(1-\lambda^*(1+\Delta)]}. \tag{44}$$

Note that this condition simplifies to Equation (20) in the main text for $\Delta = 0$.

Letter of Credit Under a Letter of Credit, deviating is never optimal as an exporter only gets paid after delivery and an importer only receives the goods after payment. Contract fines therefore do not change the problem of the firms.

Summary When a contract fine is added to the model, additional incentive constraints have to be taken into account. That is, if the contract fine is sufficiently large both firms always fulfill their contract voluntarily. If the contract fine is too small, the moral hazard problem remains and the mechanism discussed in the main part of the paper prevails.

C Importer Bargaining Power

In this section, Cash in Advance, Open Account and Letter of Credit are analyzed under the alternative assumption that all bargaining power lies with the importer.

Cash in Advance - Overview The importer has two choices. She can pay an amount in advance that is only accepted by bad exporters (separating case) or she can pay a sufficiently high amount in advance to also make good exporters accept the offer (pooling). In the following I solve the problem for both cases and compare the outcomes. Then, similarly to the analysis in the main text, I derive a condition under which only pooling occurs.

Cash in Advance - Separating Case The participation constraint of a bad exporter is:

$$\mathrm{E}\left[\Pi_{E,b}^{CIA,s}\right] = C^{CIA,s} - \lambda K \geq 0. \tag{45}$$

A binding constraint therefore implies: $C^{CIA,s} = \lambda K$. This leads to the following expected profits of an importer under Cash in Advance, noting that only a fraction $1-\eta$ of exporters accept this contract:

$$\mathrm{E}\left[\Pi_{I}^{CIA,s}\right] = (1-\eta)\left(\frac{\lambda(1-\delta)}{(1+r^*)^t}R - \lambda K\right). \tag{46}$$

Cash in Advance - Pooling Case The participation constraint of a good exporter is:

$$\mathrm{E}\left[\Pi_{E,g}^{CIA,p}\right] = C^{CIA,p} - K \geq 0. \tag{47}$$

A binding constraint therefore implies: $C^{CIA,p} = K$. Leading to the following expected profits for an importer:

$$\mathrm{E}\left[\Pi_{I}^{CIA,p}\right] = \frac{\eta + (1-\eta)\lambda(1-\delta)}{(1+r^*)^t}R - K. \tag{48}$$

Comparing profits from the pooling and the separating case it is easy to see that pooling is preferred by the importer if:

$$\frac{R}{K} > (1-(1-\eta)\lambda)\frac{1+r^*}{\eta}. \tag{49}$$

Open Account Under Open Account the separating case is never chosen by the importer. A bad importer would have to pay more to signal her type, which can never be optimal. A good importer cannot signal her type by paying less as this can always be mimicked by the bad type. The participation constraint of a good exporter under pooling is:

$$\mathrm{E}\left[\Pi_{E,g}^{OA,p}\right] = \frac{\eta^* + (1-\eta^*)\lambda^*(1-\delta)}{(1+r)^t} C^{OA,p} - K \geq 0. \tag{50}$$

A binding constraint therefore implies that $C^{OA,p} = \frac{(1+r)^t}{\eta^*+(1-\eta^*)\lambda^*(1-\delta)}K$. This leads to the following expected profits of a good importer:

$$\mathrm{E}\left[\Pi_{I,g}^{OA,p}\right] = R - \frac{(1+r)^t}{\tilde{\lambda}^*}K. \tag{51}$$

The expected profits of a bad importer are:

$$\mathrm{E}\left[\Pi_{I,b}^{OA,p}\right] = R - \lambda^*\frac{(1+r)^t}{\tilde{\lambda}^*}K. \tag{52}$$

Letter of Credit Under a Letter of Credit the exporter participation constraint is:

$$\mathrm{E}\left[\Pi_{E}^{LC}\right] = \frac{C^{LC}}{(1+r)^t} - K \geq 0. \tag{53}$$

A binding constraint implies that $C^{LC} = K(1+r)^t$. This leads to the following expected profits by the importer:

$$\mathrm{E}\left[\Pi_{I}^{LC}\right] = \frac{1}{(1+r^*)^t}R - \left(\frac{1}{(1+r^*)^t} + f^{LC}\right)(1+r)^t K. \tag{54}$$

Payment Contract Comparisons Comparing the equations on expected importer profits (48), (52) and (54) with the equations on the expected exporter profits in the main text (6), (16) and (23) reveals the same patterns as derived formally for Proposition 1 and for Corollary 1. In particular, the effects of financing costs and enforcement in the source and the destination country have the same directions on the payment contract choice, independently whether the exporter or the importer has all bargaining power.

D Testing the Mechanism

The empirical section of the paper tested for the effects of source and destination country financing conditions on aggregate trade flows. In this section, I derive a test that is more closely related to the payment contract choice as modeled in this paper. 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 in the source and the destination country. 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

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

prediction on the payment contract, which 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 4 *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: $\frac{\partial E[\ln R_x]}{\partial \min\{\ln(1+r_i),\ln(1+r_j)\}} < 0$.

ii) 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 F. ■

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 $\ln t$.

Testing the mechanism To test Proposition 4 empirically, I 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 4a with Table 4c, the summary statistics of this subset are very similar to those of the full sample. Note, in particular, as reported in Table 9, that the number of exporters does not change. That is, any country has some country with which as a pair if fulfills the condition. In 2004, at the low income end an example of such a country pair is Burundi and Nigeria, in the middle income group it is Hungary and Vietnam and in the high income group it is Norway and Germany. The baseline specification (Table 9, Column 3) for the test on the minimum financing cost is:

$$\begin{aligned} \ln Y_{ijt} = \zeta_0 + \zeta_1 \ln(1+r_i) + \zeta_2 \ln(1+r_j) \\ +\zeta_3 \ln(dist_{ij}) \cdot \ln(1+r_i) + \zeta_4 \ln(dist_{ij}) \cdot ln(1+r_j) \\ +\zeta_5 \ln\left(\min\{1+r_i, 1+r_j\}\right) + \zeta_6 \ln(dist_{ij}) \cdot \ln\left(\min\{1+r_i, 1+r_j\}\right) \\ +\zeta_7 \ln(dist_{ij}) + \theta' X + \chi_i + \chi_j + \chi_t + \epsilon_{ijt}. \end{aligned} \tag{55}$$

The main prediction from Proposition 4 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 $\zeta_1, \zeta_2, \zeta_3, \zeta_4 = 0$.

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.[39] 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.[40]

First, I rerun the regressions from Table 5 Columns 2 and 4 with the new sample, which is reported in Table 9, 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 results are very similar to those in Table 5. 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

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

[40] In 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.

absolute advantage, this exercise focuses on country pairs that are not too dissimilar.[41] 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.

E The case of $\eta = 0$ and $\eta^* = 0$

This section illustrates the simpler model as introduced in Schmidt-Eisenlohr (2009) where there are no good firms, that is $\eta = 0$ and $\eta^* = 0$ and where the cost of enforcing contracts is zero $\delta = 0$. This model has been adapted among others by Antràs and Foley (2011) and Glady and Potin (2011).

In order to make the payment choice contract model work, an additional assumption which I call the limited value of contract constraint has to be made. This assumption requires that the payment value agreed upon does not exceed the sales value of the goods in the destination market. Now, the exporter maximizes her expected profits taking into account the participation constraint of the importer and the limited value of contract constraint.

Cash in Advance The maximization problem now is:

$$\max_C \mathrm{E}\left[\Pi_E^{CIA}\right] = C^{CIA} - \lambda K, \tag{56}$$

$$\text{s.t. } C^{CIA} \leq R, \qquad \text{(limited value of contract)} \tag{57}$$

$$\text{and } \mathrm{E}\left[\Pi_I^{CIA}\right] = \lambda R - (1+r^*)^t C^{CIA} \geq 0. \qquad \text{(participation constraint importer)} \tag{58}$$

Under Cash in Advance, the participation constraint of the importer always binds. This implies the following optimal payment and expected profits:

$$C^{CIA} = \frac{\lambda}{(1+r^*)^t} R_{xm}, \qquad \mathrm{E}\left[\Pi_E^{CIA}\right] = \frac{\lambda}{(1+r^*)^t} R - \lambda K. \tag{59}$$

[41] As 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.

Open Account The exporter now maximizes the following problem:

$$\max_{C} \mathrm{E}\left[\Pi_E^{OA}\right] = \frac{1}{(1+r)^t}(\lambda^* C^{OA} - K(1+r)^t), \tag{60}$$

$$\text{s.t. } C^{OA} \leq R, \qquad \text{(limited value of contract)} \tag{61}$$

$$\text{and } \mathrm{E}\left[\Pi_I^{OA}\right] = \frac{1}{(1+r^*)^t}(R - \lambda^* C^{OA}) \geq 0, \qquad \text{(participation constraint importer)}, \tag{62}$$

Under Open Account, the limited value of contract condition always binds. The optimal payment amount and expected profits are thus:

$$C^{OA} = R, \qquad \mathrm{E}\left[\Pi_E^{OA}\right] = \frac{\lambda^*}{(1+r)^t}R - K. \tag{63}$$

Letter of Credit As a Letter of Credit fully resolves the enforcement problem, its analysis is independent of the share of good firms η. For more details on the simple model please see Schmidt-Eisenlohr (2009).

F 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 exporters. For OA and LC expected exporter profits are equal for both types. Therefore, the expected profits of good exporters completely determine the payment contract choice. Expressions in Proposition 1 thus follow directly from combining equations (6), (16) and (23).

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 $\in \{r, r^*, \lambda, \lambda^*, \eta, \eta^*, f^{LC}, \delta\}$ 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	I (OA vs. CIA)	II (OA vs. LC)	III (CIA vs. LC)
Variable			
r	$-$	0	$+$
r^*	$+$	$+$	$-$ (if $f^{LC} < \kappa$)
λ	$-$	0	$+$
λ^*	$+$	$+$	0
η	$-$	0	$+$
η^*	$+$	$+$	0
f^{LC}	0	$+$	$+$
δ	*amb.*	$-$	$-$

Combining the results from the above table implies: i) CIA weakly increases in r, λ, η and f^{LC} and weakly decreases in λ^* and η^*. It also weakly decreases in r^* if $f^{LC} < \kappa$; ii) OA weakly increases in r^*, λ^*, η^* and f^{LC} and weakly decreases in r, λ and η; iii) LC weakly increases in δ and weakly decreases in r, λ, λ^*, η, η^* and f^{LC}.

Proof of Proposition 2 From before, expected revenues and profits for a good firm are (as $\beta = 1$): $\mathrm{E}[R_x] = (\alpha^c)^{\sigma-1} R_d^*$ and $\mathrm{E}[\Pi_x] = (\alpha^c)^{\sigma} \Pi_d^*$.
Note that: $\mathrm{E}[\Pi_x^{1,g}] \geq \mathrm{E}[\Pi_x^{2,g}] \Leftrightarrow \mathrm{E}[R_x^{1,g}] \geq \mathrm{E}[R_x^{2,g}]$. That is, for a good exporter, the payment contract which maximizes expected profits also implies the highest expected revenues. If a good 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:

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

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

Proof part 1 (for all firms):

(i)

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

.

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

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

(ii)

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

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

Proof of Proposition 3 As in Proposition 2, the result holds for good exporters when allowing for an endogenous change of payment contract. The proof for this is analogous to the proof above. Next, to prove the statements with respect to the specific parameters,

note that: $\ln\left(\mathrm{E}\left[R^c_{x,i}\right]\right) = (\sigma-1)\ln\alpha^c + \ln\beta^{c,i} + \ln R^*_d$. Now, $\ln\alpha^{CIA} = \ln\tilde{\lambda} - t\ln(1+r^*)$, $\ln\alpha^{OA} = \ln\tilde{\lambda}^* - t\ln(1+r)$ and $\ln\alpha^{LC} = -t\ln(1+r) - ln(1+f^{LC}(1+r^*)^t)$. Taking the derivatives with respect to $\ln(1+r)$ and $\ln(1+r^*)$, and the two cross derivatives with $\ln t$ it is easy to check the results stated in the Proposition.

Proof of Proposition 4 Revenues are given by: $\ln\mathrm{E}\left[R^c_{x,i}\right] = (\sigma-1)\ln\alpha^c + \ln\beta^{c,i} + \ln R^*_d$

i) There are two cases:

1) 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 $\frac{\partial\alpha}{\partial(1+r^*)} < 0$ and $\frac{\partial\alpha}{\partial(1+r)} = 0$, the log of expected revenues decreases in $\ln(1+r^*)$ and is independent of $\ln(1+r)$.

2) 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 $\ln(1+r^*)$.

ii) Follows from i) and taking the cross derivatives with respect to the log of the respective interest rates and the log of distance.

G Tables

Table 1. Summary Statistics, FCIB International Credit & Collections Survey

Share of firms that state that Cash in Advance, Open Account or Letter of Credit is the top payment method for transacting with the country. Only countries in regard of which more than 10 firms responded are included. The final sample covers 70 countries between 2008-2010.

	Summary Statistics N=143			
Variable	Mean	Std. Dev.	Min	Max
CIA	22.9	13.4	0	72.7
OA	55.6	21.4	13.0	94.4
LC	13.1	9.9	0	50.0

Table 2. Top Destination Countries for each Payment Type, FCIB Survey

Top 5 destination countries for each payment contract. Share of firms that state that Cash in Advance, Open Account or Letter of Credit is the top payment method for transacting with the country. Only countries in regard of which more than 10 firms responded are included. The final sample covers 70 countries between 2008-2010.

Top CIA		Top OA		Top LC	
Venezuela	59.9	Denmark	92.9	China	36.3
Russia	54.5	Finland	92.3	South Korea	35.3
Ukraine	51.1	Norway	90.9	Jordan	33.3
Nicaragua	45.5	Ireland	87.5	Indonesia	33.0
Bulgaria	42.2	Switzerland	85.7	Thailand	28.5

Table 3. Regressions of Payment Contracts on Country-Level Variables

All regressions in the table use the Seemingly Unrelated Regression method (SUR). CIA represents Cash in Advance and OA represents Open Account. Financial development is proxied by private credit over GDP and contract enforcement is proxied by Rule of Law. Standard errors are in parenthesis. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

	(1)		(2)	
	CIA	OA	CIA	OA
Imp fin devt.	**2.5445**	**-3.5028**	**28.520**	**-68.131****
	(3.9040)	**(6.3964)**	**(29.280)**	**(27.337)**
Imp law	**-10.748*****	**8.8998****	**-21.261**	**34.673***
	(2.4595)	**(4.0297)**	**(20.068)**	**(18.736)**
Imp GDP per capita	0.1516	0.3828	1.5088	-0.3342
	(0.1574)	(0.2579)	(1.1000)	(1.0270)
N	71	71	71	71
R-squared	0.4129	0.3118	0.8420	0.9398
Year FE	y	y	y	y
Country FE	n	n	y	y

Table 4a. Summary Statistics, Full Sample

This table gives Summary Statistics for the full sample employed in regressions for Table 5. 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 4b. Summary Statistics, Law Control Sample

This table gives Summary Statistics for the law control sample employed in the regressions for Table 5. 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 4c. Summary Statistics, Absolute Advantage Sample

This table gives Summary Statistics for the absolute advantage sample employed in regressions for Table 9. This is a sub-sample of all country pairs in which one country has an absolute advantage in financing costs (ln(1+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+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=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 5. 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***	12.088***				
	(2.94)	(3.99)				
Ln imp int	47.159***	21.649***				
	(3.06)	(3.86)				
Ln exp int x ln dist	**-4.783*** **	**-1.670*** **	**-5.241*** **	**-2.147*** **	**-0.469** **	**-0.082**
	(0.35)	**(0.46)**	**(0.37)**	**(0.49)**	**(0.21)**	**(0.37)**
Ln imp int x ln dist	**-5.752*** **	**-2.654*** **	**-6.275*** **	**-2.955*** **	**-1.432*** **	**-2.341*** **
	(0.36)	**(0.45)**	**(0.38)**	**(0.48)**	**(0.21)**	**(0.37)**
Exp law x ln dist		0.220***		0.215***		-0.049
		(0.03)		(0.03)		(0.03)
Imp law x ln dist		0.104***		0.091***		0.014
		(0.03)		(0.03)		(0.03)
Ln GDPE x ln dist		-0.058**		-0.057**		0.007
		(0.03)		(0.03)		(0.06)
Ln GDPI x ln dist		0.164***		0.173***		0.119**
		(0.03)		(0.03)		(0.06)
Ln dist	-0.883***	-2.200***	-0.844***	-2.251***		
	(0.03)	(0.29)	(0.03)	(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 $\times$ year, exp $\times$ year FE	n	n	y	y	y	y
Country pair FE	n	n	n	n	y	y

Table 6. Marginal effects of change in financing costs

This table reports the marginal effects for the regression results in Table 5. 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 5. Standard errors are in parenthesis. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Effects from 1 % increase in financing costs

Specification	(1)	(2)
Exports	-2.002***	-2.270***
	(0.31)	(0.39)
Imports	-2.280***	-1.174***
	(0.30)	(0.38)
Mean ln dist	8.595	8.599
N	142761	78742

Table 7. Comparative statics for change in financing costs

This table reports comparative statics for the regression results in Table 5. 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	0.278	-1.468***	-	-	-	-
percentile	(0.33)	(0.44)	-	-	-	-
75 distance	-4.951***	-3.293***	-	-	-	-
percentile	(0.40)	(0.48)	-	-	-	-
Difference	-5.230***	-1.826***	-5.730***	-2.347***	-0.512**	-0.089
	(0.38)	(0.51)	(0.40)	(0.54)	(0.23)	(0.40)
			Imports			
25 distance	0.463	0.102	-	-	-	-
percentile	(0.33)	(0.42)	-	-	-	-
75 distance	-5.827***	-2.800***	-	-	-	-
percentile	(0.39)	(0.48)	-	-	-	-
Difference	-6.289***	-2.902***	-6.861***	-3.231***	-1.566***	-2.560***
	(0.39)	(0.49)	(0.42)	(0.53)	(0.23)	(0.41)
N	142761	78742	142761	78742	142761	78742

Table 8. 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***	-3.211***		
	(0.29)	(0.37)		
Imp fin devt	-5.327***	-2.260***		
	(0.30)	(0.41)		
Exp fin devt x ln dist	**0.523*** **	**0.360*** **	**0.552*** **	**0.371*** **
	(0.03)	**(0.04)**	**(0.03)**	**(0.04)**
Imp fin devt x ln dist	**0.606*** **	**0.256*** **	**0.618*** **	**0.263*** **
	(0.03)	**(0.05)**	**(0.04)**	**(0.05)**
Exp law x ln dist		0.143***		0.156***
		(0.03)		(0.03)
Imp law x ln dist		0.022		0.009
		(0.03)		(0.03)
Ln GDPE x ln dist		-0.095***		-0.104***
		(0.03)		(0.03)
Ln GDPI x ln dist		0.161***		0.172***
		(0.03)		(0.03)
ln dist	-1.981***	-2.365***	-2.024***	-2.390***
	(0.03)	(0.27)	(0.03)	(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 9. 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***	-1.415	7.910			
	(7.77)	(1.29)	(9.88)			
Ln imp int	19.455**	-3.545***	0.612			
	(7.99)	(1.30)	(10.45)			
Ln exp int x ln dist	-3.406***		-1.046	-3.609***		-1.094
	(0.90)		(1.15)	(0.98)		(1.27)
Ln imp int x ln dist	-2.856***		-0.481	-2.995***		-0.465
	(0.94)		(1.22)	(1.01)		(1.33)
Ln min int		**-3.917***	**52.051*** **		**-5.016***	**53.405*** **
		(2.15)	**(18.58)**		**(2.86)**	**(19.93)**
Ln min int x ln dist			**-6.702*** **			**-7.037*** **
			(2.17)			**(2.31)**
Law of min int		-0.255***	1.789**		-0.264***	2.045**
		(0.08)	(0.81)		(0.10)	(0.84)
Law of min int x ln dist			-0.227**			-0.258***
			(0.09)			(0.10)
Ln GDP of min int		0.061	-1.188**		0.056	-1.159**
		(0.06)	(0.53)		(0.06)	(0.56)
Ln GDP of min int x ln dist			0.143**			0.140**
			(0.06)			(0.06)
Ln dist	-2.471***	-1.354***	-2.513***	-2.485***	-1.350***	-2.557***
	(0.41)	(0.04)	(0.41)	(0.42)	(0.04)	(0.42)

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Table 9 continued. Minimum Financing Costs, Distance and Exports

Dependent variable	ln bilateral exports					
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Exp law x ln dist	0.116**		0.229***	0.107**		0.236***
	(0.05)		(0.06)	(0.05)		(0.06)
Imp law x ln dist	0.051		0.165**	0.051		0.182**
	(0.05)		(0.07)	(0.05)		(0.08)
Ln GDPE x ln dist	-0.101**		-0.170***	-0.103**		-0.170***
	(0.04)		(0.05)	(0.04)		(0.05)
Ln GDPI x ln dist	0.259***		0.188***	0.266***		0.197***
	(0.04)		(0.05)	(0.04)		(0.05)
R-squared	0.810	0.804	0.810	0.824	0.819	0.825
N	21119	21119	21119	21119	21119	21119
# exporter-importer clusters	8015	8015	8015	8015	8015	8015
# 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	y	-	-	-
Imp × year, exp × year FE	n	n	n	y	y	y

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