Towards a Theory of Trade Finance

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The size of trade finance

- Auboin (2009): Trade credit and insurance market about $10-12 trillion

G20 Summit’s statement, April, 2009:

- “we will ensure availability of at least $250 billion over the next two years to support trade finance through our export credit and investment agencies and through the MDBs (multilateral development banks).”
This paper:

- First theory of payment contract choice in international trade
- Payment contracts: Cash in Advance, Open Account, Letter of Credit
Payment Contracts

<table>
<thead>
<tr>
<th></th>
<th>Dispatch</th>
<th>Arrival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Advance</td>
<td>Importer pays exporter</td>
<td></td>
</tr>
<tr>
<td>Open Account</td>
<td></td>
<td>Importer pays exporter</td>
</tr>
<tr>
<td>Letter of Credit</td>
<td>Importer pays bank</td>
<td>Bank pays exporter</td>
</tr>
</tbody>
</table>
Central Questions

Three questions:

- Why are all contract types in use at the same time?
- What are the trade-offs faced by firms choosing between them?
- What are the implications for aggregate variables: trade costs, prices, quantities and trade elasticity?
Payment Contracts Data

![Pie chart showing payment contracts data]

- 45% Open Account
- 35% Bank Intermediated
- 20% Cash in Advance

Source: IMF - BAFT Survey
## Top Destination Countries for each Payment Type

<table>
<thead>
<tr>
<th>Top CIA</th>
<th>Top OA</th>
<th>Top LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venezuela</td>
<td>59.9</td>
<td>Denmark</td>
</tr>
<tr>
<td>Russia</td>
<td>54.5</td>
<td>Finland</td>
</tr>
<tr>
<td>Ukraine</td>
<td>51.1</td>
<td>Norway</td>
</tr>
</tbody>
</table>

Source: FCIB Survey
World Map
International trade is risky and takes time:

- **Time delay**
  - physical transport time – Hummels (2001)
  - time from factory gate to ship – Djankov, Freund, and Pham (2010)

→ Exporter or importer needs to pre-finance the transaction

- **Moral hazard problem**
  - CIA: Exporter might not deliver after receiving the payment
  - OA: Importer might not pay after receiving the goods

→ Firms can go to court to enforce the contract

→ Payment contracts allocate risk and determine who finances the transaction.
Main results:

- Financial conditions and contracting environments in the source and destination country matter for trade
  - Contracts are a way for firms to minimize financial/legal costs to trade
  - Under any contract, conditions in both countries are relevant

- Effect of financial conditions increasing in distance

- Importance of switching contracts to mitigate adverse effects from financial markets

- Trade finance costs correspond to iceberg type variable trade costs
  - Affects aggregate prices and quantities
Introduction

Literature

Trade credit: Supplier credit inside a country


Trade Finance:

Overview

1. Introduction
2. Micro model
3. Trade model
4. Aggregate regressions
5. Conclusions
Micro Model
Basic Setup I

Exporter:
- Make *take it or leave it offer* to Importer
- Produces
- Exports
- Receives payment

Importer
- Imports
- Sells goods
- Pays exporter
Two imperfections:

- Financial markets are segmented and differ in efficiency
  $\rightarrow$ firms in different countries face different interest rates to finance trade $(r, r^*)$

- Limited enforcement
  $\rightarrow$ exogenous probability of contract enforcement $(\lambda, \lambda^*)$
  $\rightarrow$ cost of enforcement as share of revenues: $\delta R$

Two types of firms:

- Good type: always fulfills contract (share $\eta$)
- Bad type: deviates when short term gain (share $1 - \eta$)
Financing forms - Cash in Advance I

\textbf{date 0} Importer pays $C^{CIA}$ to Exporter

If contract enforced exporter produces at cost $K$ and delivers goods

\textbf{date t} Importer sells goods for revenue $R$
Financing forms - Cash in Advance - Pooling Case I

**Pooling:** Good and Bad type firms ask for the same prepayment.

- **Good type:**
  \[
  \max_C \mathbb{E} \left[ \prod_{E,g}^{CLA,p} \right] = C^{CLA,p} - K,
  \]

- **Bad type:**
  \[
  \max_C \mathbb{E} \left[ \prod_{E,b}^{CLA,p} \right] = C^{CLA,p} - \lambda K,
  \]

  s.t.

  \[
  \mathbb{E} \left[ \prod_{I}^{CLA,p} \right] = \frac{\eta + (1 - \eta)\lambda(1 - \delta)}{(1 + r^*)^t} R - C^{CLA,p} \geq 0,
  \]
  (participation constraint importer)

**Optimal pre-payment** ⇒ **participation constraint of importer binds.**
Optimal profits:

\[
E \left[ \Pi_{E,g}^{CIA} \right] = \tilde{\lambda}(1 + r^*)^{-t}R - K
\]

\[
E \left[ \Pi_{E,b}^{CIA} \right] = \tilde{\lambda}(1 + r^*)^{-t}R - \lambda K
\]

with \( \tilde{\lambda} = \eta + (1 - \eta)\lambda(1 - \delta) \)

- Importer pre-finances
  → destination interest rate \( r^* \)

- Exporter has to deliver
  → source enforcement probability \( \lambda \) and source share of good exporters \( \eta \)

- Time needed for trade \( t \)
  → determines importance of financing costs
Financing forms - Cash in Advance - Separating Case

**Separating**: Bad type exporter asks for a lower pre-payment

- Never optimal if good type chooses CIA as well
  \[ \Rightarrow \text{Lower pre-payment without any gain} \]

- What if good type picks other contract (OA or LC)? Separating not optimal as long as:

\[
\frac{R}{K} \geq \frac{1 - \lambda}{1 - \lambda (1 - \delta)} \frac{(1 + r^*)^t}{\eta}
\]
Financing forms - Open Account

- date 0: Exporter produces at cost $K$ and delivers goods
- date $t$: Importer sells goods for revenue $R$
  
  If contract enforced importer pays $C^{OA}$ to Exporter
Pooling case: Exporter offers a contract acceptable to good and bad importers.

\[
\max_C \mathbb{E} \left[ \Pi^{OA,p}_E \right] = \frac{\eta^* + (1 - \eta^*) \lambda^* (1 - \delta)}{(1 + r)^t} C^{OA,p} - K, \tag{1}
\]

s.t.

\[
\mathbb{E} \left[ \Pi^{OA,p}_{I,g} \right] = R - C^{OA,p} \geq 0 \tag{2}
\]

(participation constraint good importer).

Optimal payment \(\Rightarrow\) participation constraint of good importer binds.

\[
C^{OA,p} = R
\]
Optimal profits:

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

with $$\tilde{\lambda}^* = \eta + (1 - \eta) \lambda^*(1 - \delta)$$

- Exporter pre-finance
  - source interest rate $$r$$

- Importer has to pay
  - destination enforcement probability $$\lambda^*$$ and destination share of good importers $$\eta^*$$

- Time needed for trade $$t$$
  - determines importance of financing costs
**Separating case:** Exporter offers a contract that only bad importers accept. This is not optimal as long as:

\[
\frac{R}{K} > \frac{\eta^*(1 + r)^t}{\eta^* - (1 - \eta^*)(1 - \lambda^*)}
\]
Financing forms - Letter of Credit I

**date 0**  Importer pays fee $F^{LC} = f^{LC} C^{LC}$ to her bank for monitoring / guarantee of payment and commits $C^{LC}$

  Exporter produces at cost $K$ and delivers product

**date $t$**  Exporter receives $C^{LC}$ from her bank

  Importer sells product for revenue $R$
Exporter maximizes expected profits:

\[
\max_C E \left[ \Pi_E^{LC} \right] = \frac{C^{LC}}{(1 + r)^t} - K, \\
\text{s.t.} \quad E \left[ \Pi_I^{LC} \right] = \frac{R - C^{LC}}{(1 + r^*)^t} - f^{LC} C^{LC} \geq 0
\]

(participation constraint importer)

Optimal payment ⇒ participation constraint of importer binds.
Optimal profits:

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

- Exporter pre-finances production
  → source interest rate $r$

- Importer has to pre-pay Letter of Credit fee
  → destination interest rate $r^*$ and $f^{LC}$

- Time needed for trade $t$
  → determines importance of financing costs
Proposition 1

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

OA preferred to CIA \iff \frac{\tilde{\lambda}^*}{(1+r)^t} > \frac{\tilde{\lambda}}{(1+r^*)^t},

OA preferred to LC \iff f^{LC} > \frac{1}{(1+r^*)^t} \left[ \frac{1}{\tilde{\lambda}^*} - 1 \right],

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].
Predictions on payment contract choice:

**Corollary 1**

The usage of

i) Cash in Advance increases in $r$, $\lambda$, $\eta$ and $f^{LC}$ and decreases in $\lambda^*$, $\eta^*$ and $r^*$.

ii) Open Account increases in $r^*$, $\lambda^*$, $\eta^*$ and $f^{LC}$ and decreases in $r$, $\lambda$ and $\eta$.

iii) Letter of Credit increases in $\delta$ and decreases in $r$, $\lambda$, $\lambda^*$, $\eta$, $\eta^*$ and $f^{LC}$.

⇒ Antras and Foley (2011) confirm result on $\lambda^*$.
⇒ Hoefele, Schmidt-Eisenlohr and Yu (2012) provide evidence on $\lambda$, $r$. 
Trade Model
Trade Model

Embed into Krugman (1980) model:

- CES demand for continuum of differentiated goods

\[
U = \left( \int_{\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}
\]

Standard demand:

\[
q(\omega) = p(\omega)^{-\sigma} P^\sigma Q
\]

- \(\sigma\): Elasticity of substitution
- \(\omega \in \Omega\): Variety of differentiated good
- \(P = \left( \int_{\omega \in \Omega} p(\omega)^{1-\sigma} \right)^{1-\sigma}\): Aggregate price level
Prices, Quantities and Profits

Profits from all contracts can be represented by:

$$\Pi_x = \alpha R - \beta K$$

Solving delivers

$$p_x = \frac{1}{\alpha} p^*_d \quad q_x = \alpha^\sigma \beta^{1-\sigma} q^*_d \quad \Pi_x = \alpha^\sigma (\sigma - \beta (\sigma - 1)) \Pi^*_d$$

⇒ Trade Finance frictions imply iceberg trade costs
Trade Patterns
Proposition 3

For given foreign demand conditions $P^*$ and $Q^*$, expected export revenues

i) decrease in the financing costs in the source and the destination country

ii) the more so, the larger the time needed for trade
Testing the Aggregate Predictions
Introduction

Data

Sources:

- Aggregate trade flows 1980-2004 from CEPII trade and production database
- Geographical distance and bilateral controls (CEPII)
- Net interest margin and private credit over GDP from Beck et al. (2009)
- Contract enforcement from World Bank WGI

Final sample:

- 144 countries
- 1987-2004
- 18260 exporter-importer pairs
- 142761 observations
Empirical questions:

- Do financial conditions affect trade? (direct effect)
  → the more so, the larger distance? (interaction effect)

Advantages of interaction effect:

- Can control for importer × year and exporter × year fixed effects
  → identification across country pairs

- Less concern with problem of reverse causality → Effect of trade finance
  that is proportional to distance (on financial efficiency at the country level)
Main specification:

\[ \ln Y_{ijt} = \zeta_0 + \zeta_1 \ln (\text{dist}_{ij}) \cdot \ln (1 + r_i) + \zeta_2 \ln (\text{dist}_{ij}) \cdot \ln (1 + r_j) \]

\[ + \sum_{k=5}^{K} \zeta_k X + \zeta_{K+1} \ln (\text{dist}_{ij}) + \chi_{it} + \chi_{jt} + \epsilon_{ijt}. \]

Main prediction:

\[ \zeta_1, \zeta_2 < 0 \]

(Interaction terms between distance and financing costs, source and destination country)

→ Is the (negative) effect of interest rate costs proportional to distance?
Table 5. Financing Costs, Distance and Export Volumes

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>In bilateral exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification</td>
<td>(1)</td>
</tr>
<tr>
<td>Ln exp int $\times$ Ln dist</td>
<td>-5.241***</td>
</tr>
<tr>
<td></td>
<td>(0.37)</td>
</tr>
<tr>
<td>Ln imp int $\times$ Ln dist</td>
<td>-6.275***</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
</tr>
<tr>
<td>Exp law $\times$ Ln dist</td>
<td>0.215***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
</tr>
<tr>
<td>Imp law $\times$ Ln dist</td>
<td>0.091***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
</tr>
<tr>
<td>Ln GDPE $\times$ Ln dist</td>
<td>-0.057**</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
</tr>
<tr>
<td>Ln GDPI $\times$ Ln dist</td>
<td>0.173***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
</tr>
<tr>
<td>Ln dist</td>
<td>-0.844***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.807</td>
</tr>
<tr>
<td>N</td>
<td>142761</td>
</tr>
<tr>
<td># exporter-importer clusters</td>
<td>18260</td>
</tr>
<tr>
<td># exporters</td>
<td>144</td>
</tr>
<tr>
<td>Country pair controls</td>
<td>y</td>
</tr>
<tr>
<td>Imp $\times$ year, exp $\times$ year FE</td>
<td>y</td>
</tr>
<tr>
<td>Country pair FE</td>
<td>n</td>
</tr>
</tbody>
</table>
Quantitative findings

Distance Effect:

- Compare Spain-Korea (10013km) with Spain-Egypt (3355km)
- 1 percent decrease in financing costs
  $\Rightarrow$ 2.35 percent larger increase in exports and 3.23 percent larger increase in imports
- If Spain improved to net interest margin of Netherlands (1.0441 to 1.0125)
  $\Rightarrow$ 7.11 percent larger increase in exports and 9.78 percent larger increase in imports
More Theoretical Results

- Trade in financial crisis
  → Unilateral vs. multilateral financial crisis

- Intermediate type contracts
  → Only profitable in special case to reduce financing costs, more attractive with repeated interactions

- FOB prices
  → vary systematically with payment contract type, potentially important for empirical work
Conclusions

- First model of payment contract choice
  $\Rightarrow$ Firms trade-off country level differences in enforcement and financing costs
- Source and destinations country characteristics matter
- Under any contract, conditions in both countries are relevant
- Switching contracts can affect trade in financial crisis
Future work / potential extensions

- Trade credit insurance
- Implications for economic development
- Trade finance and financial crisis
- The dynamics of trade relationships
- Product and firm heterogeneity?
- Historical trade patterns and the trade-offs between financing costs and contract enforcement (Greif (1993))
Thanks!


**Separating case:** Exporter offers a contract that only bad importers accept

\[
E \left[ \Pi_{I,b}^{OA,s} \right] = R - \lambda^* C^{OA} \geq 0
\]

(participation constraint bad importer)

Binding participation constraint implies:

\[
C^{OA,s} = \frac{R}{\lambda^*}
\]
Expected exporter profits in the separating case are:

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

Pooling is preferred if:

\[
\frac{R}{K} > \frac{\eta^* (1 + r)^t}{\eta^* - (1 - \eta^*)(1 - \lambda^*)}
\]
Testing the Choice Model
Testing the Choice Model

Hoefele, Schmidt-Eisenlohr and Yu (2012): Testing the mechanism with World Bank Enterprise Survey data.

- Cross-section data from firm level survey for 54 developing countries between 2006 and 2009
- Firms report share of post-, pre- and on-delivery payments in total sales
- Shares of payment contracts in total sales
  ⇒ Compare firms with different export intensities
Additional data sources:

- WB Doing Business Survey
  - Enforcement measure: calendar days to resolve a commercial dispute
- Financial data from Beck et al. (2009)
  - Financing costs: net interest margin
Main addition to the model:

- Trade finance contracts for domestic and international firms
  - International trade: Differences in country level enforcement and financing costs
  - Domestic trade: Same country level enforcement and financing costs

$\Rightarrow$ Only international contracts affected by country level variables
Compare two exporters with different export intensities (share of exports in total sales)
⇒ Contracts of exporter with higher export intensity more affected by country level enforcement and financing costs

That exporter with higher export intensity uses relatively more Open Account if

i) financing costs in the source country are lower
   \((Open \ Account \ more \ attractive)\)

ii) contract enforcement in the source country is worse
   \((Cash \ in \ Advance \ less \ attractive)\)
Source Country Specification

Our main estimation equation:

\[ OA_{it} = \psi_0 + \psi_1 XS_{it} + \psi_2 XS_{it} \times ENF_{ct} + \psi_3 XS_{it} \times INT_{ct} \]
\[ + \psi X_{it} + \nu_j + \nu_c + \nu_t + \epsilon_{it}. \]

**Main prediction:** \( \psi_2 < 0 \) and \( \psi_3 < 0 \)

- \( OA_{it} \): Share of Open Account
- \( XS_{it} \): Share of exports in total sales
- \( ENF_{ct} \): Measure of contract enforcement
- \( INT_{ct} \): Net interest margin
- \( X_{it} \): Firm level controls
- Industry, country and year FE
- i: firm; t: year; c: country; j: industry
### Table: Payment Contract Choice

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>In bilateral exports</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Exportershare</td>
<td>0.139**</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.162)</td>
</tr>
<tr>
<td>Enforcement x Exportshare</td>
<td>-53.141***</td>
<td>52.910</td>
</tr>
<tr>
<td></td>
<td>(17.055)</td>
<td>(44.970)</td>
</tr>
<tr>
<td>Interest Margin x Exportshare</td>
<td>-1.593**</td>
<td>-4.633***</td>
</tr>
<tr>
<td></td>
<td>(0.619)</td>
<td>(1.759)</td>
</tr>
<tr>
<td>Enforcement x Exportshare x Complexity</td>
<td>-193.232**</td>
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<tr>
<td></td>
<td>(76.205)</td>
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<tr>
<td>Interest Margin x Exportshare x Complexity</td>
<td>5.388*</td>
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<tr>
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<td>(2.970)</td>
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<tr>
<td>Exportshare x Complexity</td>
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<td>Enforcement x Complexity</td>
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<td>Interest Margin x Complexity</td>
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<td>R-squared</td>
<td>0.302</td>
<td>0.307</td>
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<tr>
<td>N</td>
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<td>3447</td>
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