Trade Finance in a Liquidity Crisis

Tore Ellingsen

Jonas Vlachos

The World Bank
Poverty Reduction and Economic Management Network
International Trade Department
November 2009

Abstract

The paper discusses the reasons for supporting international trade finance during a liquidity crisis. Targeted interventions are justified when prices are rigid and sellers insist on immediate payment due to fears of strategic default. In this case, buyers who reject the seller's offer fail to internalize the seller's benefit from additional

liquidity. A general infusion of credit will not facilitate the beneficial transaction, but an infusion targeted at the buyer's bank's trade finance supply will do so. Since there is a need for interventions in one country to benefit actors in another, international coordination is called for.

This paper—a product supported by the International Trade Department, Poverty Reduction and Economic Management Network—is part of a larger effort in the department to better understand the role of trade finance in the current global economic crisis in the context of the G20 initiative. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at Tore.Ellingsen@hhs.se and jonas.vlachos@ne.su.se.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

TRADE FINANCE IN A LIQUIDITY CRISIS

*Tore Ellingsen and Jonas Vlachos**

1. INTRODUCTION

The current economic crisis is characterized by a severe contraction of credit. Although reliable statistics are scarce, several observers note that this contraction also appears to have hit the trade finance sector hard (Auboin, 2009). As trade finance plays a critical role in supporting international trade (80-90 percent of world trade relies on trade finance), the shortage of trade finance potentially has severe consequences for the world economy. Indeed, the onset of the financial crisis during the fall of 2008 was accompanied by a dramatic drop in international trade.¹

By themselves, the declines in trade and trade finance do not necessarily provide reasons for targeted government interventions. First of all, demand is falling and exports along with it. Further, risk levels have gone up which motivates an increase in the cost of all types of credit. Any resources spent on trade finance provision could be used to relieve other constraints in the economy so it is not obvious that targeting trade finance is warranted. In this note, we discuss the consequences from the drying up of trade finance and address the question if targeted trade credit policies are motivated.

*The paper was written in the spring of 2009. We thank the reviewers Jean-Pierre Chauffour, Tom Farole, and Leora Klapper for very helpful comments.

¹According to the latest release of IMF's World Economic Outlook Database (April 2009), world trade is projected to drop by about 11 percent in 2009 compared to 2008. The impact of the crisis came fast, OECD's *Monthly Statistics of International Trade* shows that exports from 18 large OECD countries fell by 22 percent in November 2008, relative to November 2007. As late as September 2008, exports were still growing.

Our main argument in favor of trade finance targeting in times of a financial crisis is that firms are then likely to have an incentive to hoard cash. When hoarding occurs, funding for inter-firm transactions has greater social value than other funding, because trade finance cannot be hoarded by borrowers. Thus, the reasons for promoting trade finance are stronger than for promoting credit in general.

While these arguments pertain both to domestic and international trade finance, we argue that they are stronger in the international context. Because international loan enforcement is weaker than domestic enforcement, sellers are less willing to keep international loans on their books, and it is the seller's insistence on immediate payment that creates the demand for liquidity in the first place.

The crisis also means that uncertainty has increased, probably magnifying problems of asymmetric information in the credit market. We discuss the effects that asymmetric information about financial constraints can have on inter-firm trade. While we find that such financial uncertainty is harmful, our conclusion is that general financial easing may be as effective as specific easing of trade finance for dealing with this problem.

The paper is organized as follows. The next two sections provide some brief definitions and some background. Section 2 focuses on the details of trade finance, whereas Section 3 gives a brief overview of the role of financial frictions in international trade. Section 4 outlines our main argument for trade finance support. A formal model buttressing our argument is presented in Section 5. Sections 6 and 7 discuss, in a similarly formal way, some of the issues that our basic model neglects. The Sections 5-7 may thus be skipped by readers without an interest in checking the fine details of our arguments.

2. DEFINITIONS AND BASIC THEORY

A broad definition of trade finance is any financial arrangements connected to inter-firm commercial transactions. By this definition, extension of ordinary trade credit

is an example of trade finance. A narrow definition of trade finance is the funding of individual international commercial transactions by financial intermediaries.

Even the broadly defined trade finance phenomenon is puzzling at first glance. Why do firms that are not specializing in financial intermediation extend credit to other firms? A common explanation for this is that firms in a business relationship acquire information about each other that it would be expensive (or even impossible) for banks to obtain. While plausible, the basic monitoring story does not explain why trade finance is almost exclusively provided in-kind; if the monitoring advantage is so great, why don't firms also lend cash to each other?

One explanation for this pattern is that firms with access to funding for the purchase of illiquid assets are less tempted to engage in activities that are undesirable from the investors' point of view, as discussed by Burkart and Ellingsen (2004). Since in-kind credit is expensive to divert to other usages, potential moral hazard problems on the borrower's side are reduced when trade credit is extended. This has the important implication that trade credit and other types of credit are complements rather than substitutes, a prediction that is supported by evidence in Giannetti et al (2009).

Such complementarities suggest that alternative sources of funding cannot fill the gap when trade credit dries up. Instead, reduced trade credit will worsen the access to other types of credit as well. While this would seem to be a general argument in favor of targeting trade finance over other types of interventions, such a conclusion cannot necessarily be drawn. The reason is that the value of this additional bank credit in principle could be extracted by the seller who provides the trade credit. Thus, it is not clear that the trade credit multiplier effect justifies specific trade credit subsidies. Rather, it is an argument for relaxing the sellers' access to finance by improving the workings of the financial sector in general.

The narrow definition of trade finance restricts attention to international transactions that are directly funded by intermediaries. Of course, not all international

transactions are intermediated; sometimes the seller keeps the receivable on the own books as is common for domestic trade credit. However, the more significant role of intermediaries in international trade is interesting, because it informs us that there could be greater obstacles to the extension of international trade credit. Our interpretation is that sellers are more worried about strategic default in the case of foreign buyers. Thus, sellers tend to insist on upfront payment from foreigners.² Since the foreign buyer frequently needs the credit, the natural arrangement is to borrow from a bank in the own country. That bank in turn, for the reasons discussed above, is more willing to provide specific loans for input purchases than to provide general cash loans. Hence, one natural arrangement is for the buyer's bank to verify the shipment, and pay upon delivery to the seller's bank, while providing a loan to the buyer.

According to our analysis, the need for immediate payments due to fears of strategic default is the deep reason why trade finance is so vulnerable to liquidity crises. The importance of strategic default fears is demonstrated by the numerous studies documenting that international contract enforcement is a serious concern for firms involved in international trade (Rauch, 2001).³ Similarly, cross-border trust has also been shown to be an important determinant of international trade and investment (Guiso et al, 2008).

²Numerous studies document that international contract enforcement is a serious concern for firms involved in international trade (Rauch, 2001) Indeed, much of the recent theoretical work on international trade is built on the assumption of imperfect contract enforcement (Antràs and Rossi-Hansberg, 2009). Cross-border trust has also been shown to be an important determinant of international economic activity (Guiso et al, 2008).

³Indeed, much of the recent theoretical work on international trade is built on the assumption of imperfect contract enforcement (Antràs and Rossi-Hansberg, 2009). See also Anderson and Marcouillier (2002) who find that poor contract enforcement is a major impediment to international trade.

3. FINANCE, TRADE, AND FDI

Financial markets and intermediaries play an important role in the modern economy by reducing frictions between borrowers and lenders. To a large extent such frictions are caused by informational asymmetries between the transacting parties. There is by now a substantial body of theoretical and empirical work showing that financial frictions have a substantial impact on international trade. For example, Chaney (2005) shows that if there are fixed costs for entering the export market, liquidity constraints can prevent some firms from exporting even when it would otherwise be profitable to do so.⁴ Svaleryd and Vlachos (2002, 2005) provide evidence for such a link by finding that countries with well developed financial markets tend to trade more and to export relatively more in sectors highly dependent on external financing. Relatedly, Manova (2008) finds that equity market liberalizations tend to boost exports and particularly so in industries where firms are likely to face liquidity constraints.

Not only trade, but also the behavior of multinational firms (MNCs) and their suppliers are affected by financial constraints. Consistent with an explanation based on fixed costs for liquidity constrained local firms to enter production, Chor et al (2008) find that MNCs are more likely to undertake vertical investments in countries with well developed financial markets. In other words, local firms are more likely to become part of an international supply chain when they are less liquidity constrained. Theoretically, it is plausible that interacting with a MNC can reduce such liquidity constraints: First of all, less credit constrained MNCs extend credit to constrained local suppliers. Second, contracting with a MNC can increase the credit worthiness of a local supplier thereby alleviating constraints. However, evidence in Javorcik and

⁴Chaney's model can account for the puzzlingly weak link between exchange rate fluctuations and exports. When the exchange rate appreciates, existing exporters reduce exports. This effect is to some extent offset as the increased value of domestic assets abroad reduces the liquidity constraints for potential exporters.

Spatareanu (2009) suggest that less constrained local firms are the ones that select into becoming suppliers to MNCs, rather than suppliers benefiting from the financial links to the MNC.

Such evidence indicate that the decline in exports since the onset of the current crisis is not solely due to a drop in demand, but that financial constraints are an important part of the story. To quantify the relative impact of a decline in trade finance is substantially more difficult, not the least because of the lack of data. On the one hand, the above evidence tell us that trade finance cannot remove all financial frictions in international trade. If that were the case, local financial development would not have such a strong impact on exports. The evidence that the investment strategies of MNCs and their local suppliers depend on local financial conditions further indicate that international trade finance has its limits; after all, a MNC is better positioned to extend credit across international borders than firms interacting at arm's length. On the other hand, the sheer amount of trade that relies on trade finance indicates that increased financial distress in one country is likely to spill over to other countries through this channel. Further, it is known from previous crises episodes that domestic trade finance falls relative to sales in times of financial crises (Love et al, 2007).

Some aspects of the current crisis suggest that international trade finance will be particularly badly hit. As opposed to domestic trade credit, international trade finance frequently relies on financial intermediaries; banks issue letters of credit and guarantees that are reinsured by other financial firms. Unlike most previous crisis episodes, today's crisis is truly global and affecting all types of financial intermediaries. Thus, uncertainty about the creditworthiness of the issuing and receiving banks has added to the general increase in business risk brought about by the recession. Indicative of such effects is that the costs of trade finance have increased sharply (Dorsey, 2009).

4. WHY SUPPORT TRADE FINANCE?

The above discussion highlights the important linkages between finance and trade in general, but does not say much that specifically concerns trade finance. While it is likely that trade finance has been particularly badly hit by the current crisis, problems in the general financial system are the root cause for this. At first sight, it is therefore far from obvious that targeting trade finance is the best response. In the next sections, we will provide arguments for giving priority to trade finance programs rather than more general programs aimed at easing credit conditions. In this section, we provide the building blocks for our arguments.

For a variety of reasons, most markets for corporate financing do not have market-clearing prices. Many borrowers would like to have additional funds at prevailing interest rates, but if their pledgeable returns are smaller than their full returns, lenders will rationally lend less than the borrowers desire. When credit constraints bind, it is sometimes (but far from always) justified to intervene in financial markets. For a general introduction to these issues, we refer to Tirole (2005); see also Holmström and Tirole (2009). At the core of our argument in favor of an international trade finance program is the insight that it is more difficult to make credible pledges across borders than within borders (e.g. Rodrik, 2000).

When a financial crisis turns into a recession, as now, interventions in financial markets have two beneficial effects. The first *direct effect* is the value of additional funds to the financially constrained firms themselves. The second *indirect effect* is the value to the constrained firms' trading partners of the additional activity in the constrained firm. For example, when the constrained firm increases its production it needs more inputs, and input suppliers' profit goes up. Our view is that policies to deal with the current crisis ought to focus on the indirect effect rather than the direct effect. There are two reasons. First, the indirect effects are large during a crisis due to excess capacity. Second, an increase of general credit provision may not lead to an immediate expansion of production at all, because borrowers are so afraid of being

even more heavily constrained in the future that they simply hoard the additional funds.

In case our reasoning about hoarding appears overly hypothetical, let us quote some recent crisis management advice of Boston Consulting Group (2008): The first four pieces of advice (after the advice of forming a crisis management team) are: (1) Hoard your cash. (2) Reduce trade credit. (3) Start working capital initiatives. (4) Restructure your debt. BCG's report essentially advocates a reduction of spending together with taking available loans while they can still be had. If firms follow this advice, and we believe that many do, the outcome is that firms collectively suffer from the contraction in demand. Moreover, the link between expansion of general credit and output expansion is broken. This is the simple microeconomic story behind the macroeconomic observation that, during crises, growth in the monetary base is partly offset by a reduction in velocity.

That cash hoarding is indeed part of the current problems is suggested by the massive buildup of excess reserves by US banks. Edlin and Jaffee (2009) report that such reserves are up from 2 billion dollars in August 2008 to 798 billion dollars in January 2009 and propose a tax on excess reserves to get banks to lend. We are not aware of such figures for banks in other countries or for non-financial firms, but the size of the numbers for US banks indicates that the problem is severe.

A final building block of our argument is that prices are downwardly rigid in the short term. For some reason, sellers cannot or will not immediately reduce their prices despite a high premium on liquidity. The price rigidity could, for example, be due to reputational concerns or because of long-term contracting clauses, either between the seller and the buyer (e.g., a long term agreement about price) or between the seller and other buyers (e.g., a most favored customer clause).

We do not assume that prices are stuck at a level that the buyer is unwilling to pay, but only that they are so high that the buyer is unwilling pay cash immediately, in view of the high opportunity cost of liquidity. Because of limited pledgeability,

the seller on the other hand is unwilling to extend the necessary credit. Also, the opportunity cost of liquidity implies that a general loan to either party will be hoarded rather than spent on the transaction, because the buyer does not internalize the seller's benefit when deciding whether to trade. However, and this is the main point, targeted trade finance loans cannot be used for another purpose, and will thus be used to fund the transaction.

Let us now consider how the argument works in a richer context where banks are involved in the funding of international transactions. Clearly, the pledgeability problem is again the central reason for why international trade finance involves intermediaries. Sellers frequently do not extend trade credit to foreign buyers directly, but instead leave the lending to a domestic bank, who in turn contracts with the buyer's bank. Usually, these transactions leave the actual credit on the balance sheet of either of the banks, rather than on the seller's balance sheet. That is, the banks transfer liquidity to the seller. It is straightforward to see why the liquidity shock will disrupt such bank lending in the same way as it disrupts spot transactions: If banks can earn returns r on liquidity, the buyer and the seller will no longer be able to compensate the banks for the kind of liquidity service that they have previously been offering.

The problem is most severe when there is less trust across borders than within them. Then, there is less trust between the two banks than between the buyer and the buyer's bank. In this case, the inability to pledge future returns is transferred from the buyer to the buyer's bank. In normal times, trade credit will typically be left on the books of the buyer's bank – with the seller's bank being paid off at the transaction date. Since nobody wants to make transaction date payments when liquidity is scarce, we are essentially back to the original problem facing the two firms. (With complete cross-border trust between banks, the seller can hold a claim on the domestic bank, the domestic bank can hold a claim of the foreign bank, and the foreign bank can hold a claim on the buyer, and all the claims can last until the buyer obtains cash.)

To the extent that sellers and buyers are located in the same country, there is reason to expect domestic support for trade credit funding. However, when they are located in separate countries, the most appropriate intervention is to provide selective funds to the buyer's bank, whereas the benefits to a large extent flow to the seller's country. This, then, is an argument for international policy coordination.

An empirical implication of our argument is that imports in countries where there is less trust in the buyer's bank will be hit relatively hard by the financial crisis. According to IMF (2009), imports to LDCs are expected to decline more than exports from these countries, while the reverse is expected among advanced economies. Assuming that there is less trust in the LDCs banks (partly due to less credible government guarantees), this is in line with our model's predictions. Needless to say, this is not a formal test of the model and the pattern could be due to other factors, but at least the pattern is broadly consistent with our story.

The next section articulates our argument formally. Thereafter we discuss two other models that capture dimensions that the first model neglects.

5. PRICE RIGIDITY AND TRADE FINANCE

Here is a simple model that clarifies the logic of our main argument. A seller has a resource that a buyer may purchase and refine. Refining takes two periods. For simplicity, we assume that the process is costless. It increases the value of the resource from c to v . Traditionally, the seller and the buyer have been trading at a price $\bar{p} = (c + v)/2$ that splits the gains from trade equally. For reasons alluded to above (and further expanded upon in the next section), we suppose that this price is rigid in the short run.

However, due to an imminent liquidity shock, both the seller and the buyer faces a one-period return to holding cash of r . That is, from the date 0 perspective, the two parties know that they can trade to generate a surplus at date 2 of $v - c$, but also that any cash held at the beginning of period 0 earns an expected return r if

held until date 1. Note that r may reflect either the expected return on investments made at date 1 or the drop in input prices between date 0 and date 1, but not the nominal one-period return on holding cash - which is typically close to zero.

Consequently, the buyer is only willing to pay a price of p if $v \geq p(1 + r)$, or equivalently if $p \leq v/(1 + r)$. The seller, on the other hand is willing to accept any price p satisfying $p \geq c/(1 + r)$. If the price for one reason or another is rigid at $\bar{p}$, then trade is disrupted if $\bar{p} > v/(1 + r)$, or equivalently if $r > (v - c)/(v + c)$. In other words, if the liquidity shock is sufficiently large relative to the return to trading, then it disrupts trade at the price $\bar{p}$.

So far, we have only considered spot payments at date 0. What if the buyer could credibly promise to pay at date 2? In this case, the problem evaporates, since both parties are willing to trade at $\bar{p}$ as long as they do not have to forgo the date 1 return on liquidity.⁵ In other words, the buyer's inability to credibly pledge future payments to the seller is at the heart of the problem. For simplicity, let us assume that the buyer is unable to make any credible long-term promises about future payments to the seller.

Observe that this problem cannot be resolved by just extending more credit to the buyer, since these funds are more profitably invested to earn the liquidity return r than by paying $\bar{p}$ at date 0. However, here comes our main point: *Extending specific trade finance to the buyer does work*, as long as the rate of interest is smaller than $(v - \bar{p})/\bar{p}$. Since such funds have no alternative use, they will be used to facilitate transactions. Of course, liquidity is increased by the same amount as a general credit facility, but the liquidity benefits now accrue to the seller rather than to the buyer. Thus, funding of trade credit generates benefits over and above those generated by general credit facilities.

⁵Large buyers in industrialized countries sometimes unilaterally initiate delayed payments to domestic suppliers. In terms of our model, this is a rational response to liquidity shocks as long as the pledge to pay later is credible.

As indicated above the presence of banks does not make a substantial difference to the argument. In normal times, outstanding credit will typically be left on the books of the buyer's bank – with the seller's bank being paid off at date 0. Since the date 0 payments are infeasible when liquidity is scarce, we are essentially back to the original problem facing the two firms, at least as long as there is insufficient trust between the two banks.

Clearly, a general increase of credit to the buyer's bank will not solve the problem, because the buyer's bank will prefer to earn the liquidity return r over any interest rate that can be economically offered in return for a date 0 payment. However, if instead the buyer's bank is offered *a selective facility for trade credit extension*, then it will utilize it as long as it earns a positive return, even if that return is below r . Thus, the argument in favor of trade credit is the same whether banks are involved or not.

6. DURABLE GOODS AND ENDOGENOUS DEFLATION

Our argument above rested on two key assumptions: rigid prices and financial frictions. One feature of the crisis is the fear of falling prices, especially in durable goods markets. What is the relationship between financial frictions and price deflation? Is there a straightforward channel from financial frictions to temporary downward price rigidity?

To study this question, let us consider the following scenario, adapted from Stokey (1979).⁶ A seller produces a durable good. For simplicity, suppose that production costs are zero and that the good is infinitely lived. Let time be discrete, and let buyers value the good at v per period. Due to impatience as well as financial constraints, buyers discount future utility at a rate r per period. Let $\delta = 1/(1 + r)$ denote the

⁶Stokey's main point is actually that intertemporal price discrimination does *not* occur when buyers have identical discount factors. Our point is that with different discount factors it occurs under reasonable additional assumptions.

corresponding discount factor.

If all buyers are identical, the optimal pricing strategy for the seller is to extract all the buyers' surplus by setting the price

$$p^* = \frac{v}{1 - \delta}.$$

Suppose now that the shock to the financial sector hits buyers differently. One group of buyers gets hit hard, and now faces an interest rate r_H . The other group gets hit less, and faces the interest rate $r_L < r_H$. Let δ_L and δ_H denote the corresponding discount factors. Ideally, the seller would now want to set different prices for the two types of buyer. However, such “third-degree” price discrimination may be impossible either due to arbitrage or because the seller cannot observe buyers' financial constraints. In order to extract as much surplus as possible, the seller may therefore engage in intertemporal price discrimination instead.

Rather than deriving the optimal intertemporal price discrimination scheme, let us illustrate the argument by considering the strategy to sell immediately to type L and wait one period to sell to type H . Obviously, if type L has bought already, the optimal price next period is

$$p_H^* = \frac{v}{1 - \delta_H}.$$

In order to induce type L to buy immediately instead of waiting, the initial price must give at least as high utility. That is,

$$\frac{v}{1 - \delta_L} - p_L \geq \delta \left(\frac{v}{1 - \delta_L} - p_H^* \right).$$

Let p_L^* denote the largest p_L that is consistent with the above condition:

$$p_L^* = \frac{v}{1 - \delta_H} (1 + \delta_L - \delta_H).$$

Let h be the fraction of type H buyer types and let δ denote the seller's discount factor. The profit associated with intertemporal price discrimination can then be written

$$\pi(p_L^*, p_H^*) = (1 - h)p_L^* + \delta h p_H^*.$$

Without intertemporal price discrimination, the seller can in principle choose between two options: (i) Only sell to type L at a price $v/(1 - \delta_L)$. (ii) Sell to both types at price $v/(1 - \delta_H)$. Note that the first option relies on the problematic assumption that the seller can credibly commit not to reduce the price in the next period. Comparing intertemporal price discrimination to the uniform price strategy (option (ii)), it is straightforward to check that price discrimination is preferable if

$$h < \frac{\delta_L - \delta_H}{1 - \delta + \delta_L - \delta_H}.$$

At first sight, it appears that intertemporal price discrimination is more likely to be profitable when δ is large. However, if $\delta \geq \delta_L$, it would pay for the seller to lend to the most constrained buyers. On the other hand, if $\delta \leq \delta_H$, such a financial transaction is unprofitable. Thus, the likelihood of intertemporal price discrimination is highest when the seller is neither so unconstrained as to offer trade credit to fund immediate purchase by all buyers nor so constrained as to prefer all revenues immediately to larger revenues gradually.

Under intertemporal price discrimination, the winners from the financial shock are the buyers that are hit less hard; they now pay less than their reservation value. The relatively better financial position is turned into a net gain. The other buyer group is indifferent, whereas the seller loses.

It is worth noting that the durable goods model is able to produce a prolonged period of price deflation even if there is no exogenously imposed price rigidity. Moreover, if funds are being made available at interest rate r_L specifically for the purchases of durable goods, price deflation would end and purchases would be made immediately.

7. PERISHABLE GOODS

Even without deflation, financial constraints can entail inefficient trade if there is asymmetric information about trading partners' financial conditions. However, in this case it is less obvious that a general subsidy of trade credit is the optimal solution.

To clarify our arguments, let us consider a modification of the above model. Suppose now that a buyer's opportunity cost of funds is r_b . The maximum amount that a type i buyer is willing to pay is thus

$$\bar{p}_b = \frac{v}{1 + r_b}.$$

Suppose that the seller cannot observe a buyer's borrowing cost, thinking it to be uniformly distributed on some interval $[r_l, r_h]$. That is, the distribution function is $g(r) = 1/(r_h - r_l)$ for all r in this interval and 0 otherwise. Accordingly, a buyer's willingness to pay for the seller's product, call it ρ , is uniformly distributed on the interval $[\frac{v}{1+r_h}, \frac{v}{1+r_l}]$. That is,

$$f(\rho) = \frac{1}{\frac{v}{1+r_l} - \frac{v}{1+r_h}}$$

in this interval and 0 otherwise. The corresponding cumulative distribution function is

$$F(\rho) = \frac{\rho - \frac{v}{1+r_h}}{\frac{v}{1+r_l} - \frac{v}{1+r_h}}.$$

Since a buyer purchases at price p if and only if $\rho > p$, the demand facing the seller is simply the probability that $\rho > p$, which is $1 - F(p)$.

If the uncertainty is sufficiently small, it is optimal for the seller to set the largest price that induces trade with probability 1, namely the price

$$p_1^* = \frac{v}{1 + r_h}.$$

However, as the uncertainty increases, it is eventually optimal to set a price which a buyer will reject if the opportunity cost of funds is sufficiently large. To be precise, the seller chooses the price to maximize expected profit

$$\pi = (p - c)(1 - F(p)),$$

and the unique interior solution to this problem is

$$p_2^* = \frac{c + \frac{v}{1+r_l}}{2}.$$

In this case, a buyer refuses to trade with positive probability. The absence of trade is inefficient whenever $\frac{v}{1+r_b} > c$. As an illustration of the argument, consider the example $c = 1, v = 1.2, r_l = 0.01$. To begin with, suppose for simplicity that there is no uncertainty, so $r_h = r_l$. We imagine that the period length is a month, so the corresponding yearly interest rate is about 12.7%. Even in periods with single digit market interest rates, this is a reasonable number for a firm that cannot borrow unlimited amounts in the banks or in commercial bond markets. With small uncertainty, the price is $p_1^* = 1.2/1.01$, yielding a mark-up slightly below 20%. Letting the opportunity cost of funds and uncertainty grow by increasing r_h , the price, p_1^* , starts to drop, until it reaches the level when it is no longer optimal to sell with probability 1, which happens at the point where $p_2^* = \frac{v}{1+r_h}$, which in the example is when $r_h \approx 0.097 \equiv \hat{r}$. As financial constraints tighten further, the price stays at $p_2^* = 1.0941$. Thus, the mark-up stays at about half the original level, and any increase in uncertainty simply reduces the probability of trade, as a buyer with $r_b > r_h$ is not willing to pay the price.

Suppose now that each buyer is granted trade finance by some government body at a rate r_p , smaller than or equal to $\hat{r}$. Then, it is optimal for the seller to set the price $\frac{v}{1+r_p}$, at which all buyers will make a purchase. Note that *all* the gains from the additional trade in this case go to the seller. Indeed, if the trade credit interest rate is reduced below $\hat{r}$, the buyer can only lose, because the seller's price is increased

correspondingly. The reason is that the seller has to give some surplus (information rents) to the buyer when there is uncertainty concerning the buyer's interest rate.

But before endorsing trade finance subsidies on the basis of asymmetric information, it is necessary to ask why the seller would be unwilling to provide funding.⁷ Suppose for concreteness that the seller can borrow a fraction φ of the value of the receivables at interest rate r_1 , and that the remainder would have to be funded internally, at the opportunity cost r_2 .⁸ One possibility is that r_2 is just too large for the seller to want to extend trade credit. If so, the current model (like the model in the previous section) suggests that the problem is alleviated by relaxing the seller's financial constraint. Alleviating it through trade finance subsidies is then only justified if the government believes that provision of general loans is likely to attract borrowers whose projects are less socially desirable than those borrowers who need to fund trade credit extension.

Another possibility is that φ has dropped, in which case the optimal intervention depends on the causes of the drop. If it is due to the general credit crunch, the answer is to recapitalize intermediaries, not to target trade credit.

8. SPILLOVERS FROM TRADE AND FDI

Altogether, we think that the incomplete information model helps to explain why uncertainty about trading partners' financial conditions can create inefficiencies in the non-financial sector, and not only in the financial sector. Our point here echoes Blanchard and Kremer (1997). In the context of the reorganization of production in transition countries, they note that transition creates asymmetric information about valuations. Blanchard and Kremer also observe that such uncertainty about trading

⁷We shall not here discuss in detail the features of an optimal trade credit contract in case the seller can raise the necessary funds; for a seminal analysis of this issue see Brennan, Maksimovic and Zechner (1988).

⁸It is well known that φ tends to be well below 1 even in normal times. A likely explanation is that intermediaries fear that firms try to borrow against fake invoices.

partners' valuations is particularly detrimental in long supply chains. The vertical separation of production that we have seen in recent years (e.g. Helpman, 2006) therefore magnifies the inefficiencies that we have discussed here.

There is substantial evidence showing that being part of an international supply chain, either as an exporter or as a local supplier to MNCs, generates positive productivity effects, in particular among producers in LDCs.⁹ Breaking up such supply chains because of short-term credit constraints can therefore have severe long-term negative repercussions. Again, the value generated in the supply chain can in principle be extracted by extending trade credit among trading partners. If trading partners are credit constrained, the best course of action is to relax those constraints by measures aimed directly at the financial system in general. This argument has to be qualified, however.

First of all, the literature suggests that not only firms within the supply chain benefit from international integration. By generating spillovers in the form of technologies and know-how it also improves the productivity of firms outside the supply chain. The value of such spillovers cannot be captured by firms extending trade credit and it is thus a general argument in favor of government interventions in the trade finance sector.

Second, there is a question how long it will take for policies aimed at the general financial system to have an effect. Time is of importance as valuable knowledge and connections are lost permanently when firms in an international supply chain go out of business. Trade finance interventions have the advantage of being easily implementable and of working more or less directly.

Third, firms that are part of international supply chains are in general the most productive ones. Targeting trade finance is therefore a way to target firms with the best long-term opportunities, with a minimum of bureaucratic involvement.

⁹See Görg and Strobl (2001), Saggi (2002), and Javorcik (2004) for surveys of the literature.

9. CONCLUSIONS

To summarize, sponsoring trade finance is desirable during a liquidity squeeze primarily because the extension of credit is tied to actual current transactions. Thus, the additional credit cannot be hoarded. In the above discussion we show that these problems are particularly severe in international transactions as it is more difficult to make credible pledges across borders than within borders.

A second reason why multilateral organizations ought to support trade finance specifically, rather than providing funding more broadly, is that domestic policy initiatives are likely to place a relatively low weight on foreigners' gains (see Economist, 2009). Since the support of trade finance typically involves supplying funds to the buyer's bank, while primarily benefiting the seller, it is easy to see how these transactions will suffer under purely domestic policies.

Sponsoring trade finance may also in general help to alleviate insufficient trade due to incomplete information among non-financial firms, but we think that unless there is a liquidity squeeze trade finance subsidies have no obvious advantage over general financial measures.

REFERENCES

- [1] Anderson, J. and Marcoullier, D. (2002): "Insecurity And The Pattern Of Trade: An Empirical Investigation," *Review of Economics and Statistics* 84, 342-352.
- [2] Antràs, P. and Rossi-Hansberg, E. (2009): "Organizations and Trade," *Annual Review of Economics*, forthcoming
- [3] Auboin, M. (2009): "The Challenges of Trade Financing," *VoxEU* 28 January, www.voxeu.org/index.php?q=node/2905.
- [4] Blanchard, O., and Kremer, M. (1997): "Disorganization," *Quarterly Journal of Economics* 112, 1091-1126.

- [5] Brennan, M.J., Maksimovic, V. and Zechner, J. (1988): “Vendor Financing,” *Journal of Finance* 43, 1127–1141.
- [6] Burkart, M. and Ellingsen, T. (2004): “In-kind Finance: A Theory of Trade Credit,” *American Economic Review* 94, 569-590.
- [7] Boston Consulting Group (2008): “Collateral Damage, Part I: What the Crisis in the Credit Markets Mean for Everyone Else,” (authors: David Rhodes, Daniel Stelter, Shub Saumya, André Kronimus), www.bcg.com/impact-expertise/publications/files/Collateral-Damage_Part_I_Oct08.pdf
- [8] Chaney, T. (2005): “Liquidity Constrained Exporters,” mimeo University of Chicago.
- [9] Chor, D., Foley, F. and Manova K. (2008): “Host Country Financial Development and MNC Activity,” mimeo Stanford University.
- [10] Dorsey, T (2009): “Trade Finance Stumbles,” *Finance and Development* March, 18-19.
- [11] *Economist, The* (2009): “Homeward Bound,” February 7-13, 69-70.
- [12] Giannetti, M., Burkart, M. and Ellingsen, T. (forthcoming 2009): “What You Sell is What You Lend: Explaining Trade Credit Contracts,” *Review of Financial Economics*.
- [13] Görg H. and Strobl E. (2001): “Multinational Companies and Productivity Spillovers: A Meta-Analysis,” *Economic Journal* 111, 723-739.
- [14] Guiso, L. Sapienza, P. and Zingales, L. (2008): “Cultural Biases in Economic Exchange,” forthcoming *Quarterly Journal of Economics*.
- [15] Helpman, E. (2006): “Trade, FDI, and the Organization of Firms,” *Journal of Economics Literature* 44, 589-630.

- [16] Holmström, B. and Tirole, J. (forthcoming 2009): *Inside and Outside Liquidity*. MIT Press.
- [17] IMF (2009): *World Economic Outlook Database*, April 2009.
- [18] Javorcik, B.S. (2004): “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages,” *American Economic Review* 93, 605-627.
- [19] Javorcik, B.S. and Spatareanu, M. (2009): “Liquidity Constraints and Linkages with Multinationals,” forthcoming *World Bank Economic Review*.
- [20] Edlin, A.S. and Jaffee, D.M. (2009): “Show Me The Money,” *The Economists’ Voice* 6:4, Article 8.
- [21] Krugman, P. (1998): “It’s Baaack! Japan’s Slump and the Return of the Liquidity Trap,” *Brookings Papers on Economic Activity* 2, 137-187.
- [22] Manova, K. (2008): “Credit Constraints, Equity Market Liberalizations and International Trade,” *Journal of International Economics* 76, 33-47.
- [23] Love, I., Preve, L.A. and Sarria-Allende, V. (2007): “Trade Credit and Bank Credit: Evidence From Recent Financial Crises,” *Journal of Financial Economics* 83, 453-469.
- [24] Rauch, J. (2001): “Business and Social Networks in International Trade,” *Journal of Economic Literature* 69, 1177-1203.
- [25] Rodrik, R. (2000): “How Far Will International Economic Integration Go?,” *Journal of Economic Perspectives* 14, 177-186.
- [26] Saggi K. (2002): “Trade, Foreign Direct Investment, and International Technology Transfer: A Survey,” *World Bank Research Observer* 17, 191-235.

- [27] Svaleryd, H. and Vlachos J. (2002): “Markets for Risk and Openness to Trade: How are They Related?,” *Journal of International Economics* 57, 369-395.
- [28] Svaleryd, H. and Vlachos J. (2005): “Financial Markets, the Pattern of Specialization, and Comparative Advantage: Evidence From OECD Countries,” *European Economic Review* 49, 113-144.
- [29] Tirole, J. (2005) *The Theory of Corporate Finance*, Princeton: Princeton University Press.