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Lessons from the Asian Crisis: An Open Economy Credit Channel Model where Export Status Matters*

by

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Abstract

There are some surprising parallels between the 1997-8 Asian crisis and the recent financial crisis that provide lessons for policymakers. This paper provides a theoretical model of an open economy credit channel including currency mismatch and financial fragility where exporting firms have access to international credit but non-exporting firms do not. We propose three channels through which exporters and non-exporters are affected by the crisis. We test and confirm the predictions of the model on a panel of Korean firms over the sample 1990–2006. As our model predicts, exporters are more likely to obtain foreign currency loans and experience significantly higher sales after the crisis compared to non-exporters.

Keywords: open economy credit channel, exports, bank lending, Asian crisis

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1. Introduction

There are many surprising parallels between the Asian crisis of 1997-98 and the recent financial crisis. Prior to both crises, banks in their search for yield were prepared to invest in assets without a full appreciation of the risks involved; in both cases reassurance was offered by third parties (governments prior to 1997, ratings agencies prior to 2007) that investments were safe. Exposure to risk was larger than it otherwise might have been due to light touch financial regulation, and overconfidence. A sudden loss of confidence caused stock market and property prices to fall, undermining the creditworthiness of firms and financial institutions that scrambled to establish their losses. Post crisis instability of the financial sector shifted policymakers priorities towards shoring up weak financial institutions through restructuring, recapitalizing and deleveraging. In spite of these measures the real economy slumped for a while, but exporters did better than non-exporters.

What did we learn from the 1997 experience? One very important lesson from the Asian crisis was the impact of 'original sin' (Eichengreen and Hausmann 1999), and currency mismatch on the balance sheets of banks and firms.[1] This has provided a fertile ground for new models of currency crises and contagion that have embedded these features in open economy credit channel models.[2] Another important lesson for policymakers was the importance of domestic financial markets and as a result many Asian countries have encouraged the development of local currency bond markets (Burger and Warnock, 2006, 2007; Burger *et al.* 2010; Mizen and Tsoukas, 2012; and Mizen *et al*., 2012). A third lesson is the importance of retained profits for firms: since 1997 Asian firms have increased their cash stocks in order to invest from internal sources (see Almeida *et al*., 2004; Lee and Song, 2011; Guariglia *et al*. 2011; and Arslan *et al*., 2012), suggesting a strong precautionary motive for cash (see Kim *et al*., 1998; Opler *et al*., 1999). Finally, some firms in electronics, precision equipment and transport industries continued to borrow in local currency but hedged their exposure to foreign income streams while the exchange rate was appreciating after the crisis, shifting the exchange rate risk to the banks or their counterparties in FX swap contracts (He and Ng, 1998). As a result, Asian firms suffer from currency mismatch to a lesser extent, although they still require some external finance to invest and grow.

[1] When commercial bank credit inflows of $50bn to the region in 1996 shifted to outflows of $21bn in 1997 the mismatch in currencies led to a substantial difference on the balance sheet between the domestic currency value of assets backing the borrowing and the debts built up by escalating commitments to loans obtained in foreign currency.

[2] For the former see Goldfajn and Valdes (1997), Krugman (1998), Furman and Stiglitz (1998), Radlett and Sachs (1998), Chang and Velasco (1998), (1999), (2001) and Bleaney *et al*. (2008) and for models of open economy credit channels see Cespedes (2001), Devereux and Lane (2003), Gertler *et al*. (2003), Choi and Cook (2004), Cook (2004), Devereux and Cook (2006).

Firms are not completely immune to all financial shocks however. The recent revival of interest in the globalized bank lending channel (see Schnabl, 2012; Cetorelli and Goldberg 2010, 2012 and forthcoming; de Haas and Lelyveld, 2010; Puri *et al.* 2008; and Khwaja and Mian, 2008) has underlined that financial shocks can be transmitted to domestic banks and then to firms. For example, Popov and Udell (2012) recently document considerable exposure to international financial shocks among small and medium sized firms in Central and Eastern Europe, that remain dependent on finance from local banks, which are 80% foreign owned; while Schnabl (2012) shows a similar exposure of Peruvian firms to bank liquidity shocks. Hence the local credit supply can be undermined by bank balance sheet shocks emanating from foreign countries, through cross-border lending, even though loans are made in local currency to firms with earnings in local currency. However, just as some firms with matched assets and liabilities were shielded from the effects of the currency mismatch after the depreciation of the exchange rate, so firms with foreign revenue streams can be shielded from the shocks to local credit supply in a crisis through access to foreign currency loans, which allows them to continue to invest and produce output.

Few papers have emphasized the connection between exports, access to foreign currency borrowing and sales performance.[3] Therefore, in this paper we build a simple theoretical model using Bolton and Scharfstein (1990) and Caballero and Krishnamurthy (2001) to illustrate the different effects of credit constraints on firms serving domestic markets, and those that export.[4] The dichotomy between domestically-oriented firms and exporters derives mainly from the fact that domestic producers' credit is more constrained because they have domestic currency collateral assets that deteriorate in value after a crisis and are dependent on local banks that may face a decline in funds to on-lend.[5] Banks face a form of currency mismatch when obtaining funds from abroad to lend to domestic producers. We refer to this as a *global bank lending channel* of the crisis and it is linked to Popov and Udell (2012), Schnabl (2012), and Khwaja and Mian (2008) as an explanation of the international transmission of domestic shocks through

[3] There has been quite a lot of research on the output costs of the crisis focusing on aggregate effects (see for example, Park and Lee, 2003; Hutchinson and Noy, 2005). Claessens *et al.* (2000) use firm-level data to compare corporate performance before the crisis across a sample of East-Asian countries that includes economies both affected and unaffected by the crisis. Claessens *et al.* (2012) do a similar exercise for the 2007-09 crisis.

[4] Our open economy model of the credit channel is a natural extension of the closed economy version (Diamond, 1991, Holmstrom and Tirole, 1997, Hoshi *et al*, 1992, and Repullo and Suarez, 2000).

[5] It is possible that foreign banks face a decline in capital, equity as well as losses on their financial assets and reduce their cross border lending as a result, as documented by Popov and Udell (2012) for local banks in Central and Eastern Europe in the recent crisis. Equally, direct lending by foreign banks or by foreign bank subsidiaries may be the root of a contraction in credit supply.

foreign banks' activities in local lending.[6] The key insight here is that access to sustained foreign currency borrowing is closely tied to exporter/non-exporter status because exporters can pledge export revenues while non-exporters cannot, therefore non-exporters face a financial disadvantage that is likely to be greater in crises when domestic banks themselves are constrained. This exploits a firm-characteristic (export sales in total sales) to separate the fate of exporters and non-exporters. Both exporters and non-exporters face increased costs of production, our *cost of production channel*, after a crisis as raw material costs rise, but exporters have the advantage that they can sell on more favourable terms following a depreciation, our *competitiveness channel*. Also, because they have international sources of credit that are justified on collateralized export revenues that do not deteriorate, they are more likely to be able to increase sales after a crisis. Within this framework we can explicitly account for firm heterogeneity and thus analyze how a firm's specific characteristics such as size and balance sheet affect its post-crisis performance. Perhaps most critical of all is its exposure to export markets, which allows it to borrow in foreign currency and benefit from improvements in competitiveness.

We test the predictions of our model using a panel of about 30,000 observations for 5,000 Korean manufacturing firms between 1990 and 2006, distinguishing between pre-crisis, crisis and post-crisis outcomes for firms identified as exporters and non-exporters, through destination of sales data in our dataset.[7] Our data are provided by the Korean Information Service, and document both the export share of sales and the foreign currency liabilities of individual firms. By investigating the probability that exporting firms will obtain foreign currency loans compared to non-exporting firms, and using the change in sales pre- and post-crisis for exporters versus non-exporters, we are able to document the difference in performance between these types of firms. We find evidence that exporters are more likely to obtain foreign currency loans and that they have larger, positive, differences in sales after the crisis compared to non-exporters, which is mostly due to their export status. This supports the predictions of our model, and provides new

[6] The main difference between these papers and those of Cetorelli and Goldberg (2010, 2012 and forthcoming) and Claessens *et al.* (2012) is that the former stress *shocks that emanate from the domestic economy* affecting local lending while the latter consider *shocks that emanate from the balance sheet of the foreign (US) bank*. For the latter the modes of operation of foreign banks for management of liquidity are very important for the understanding of transmission of such shocks but in our model the shocks in the domestic location would tend to reduce funding to the domestic economy irrespective of the mode of operation for liquidity allocation.

[7] To our knowledge the only detailed studies of the crisis using firm level data for Korea are Borensztein and Lee (2003), which explores the role of financial intermediaries in providing credit to corporations, and Gilchrist and Sim (2004), which considers the impact of balance sheet factors on investment.

insights into the performance of individual firms after a crisis, which could be usefully interpreted for the present.[8]

What our study highlights is the extent to which exporters versus non-exporters are more or less prone to the real effects of a crisis through the need to finance production. This does not undermine the importance of the open economy credit channel papers mentioned earlier, but it identifies that there are three channels through which the crisis affects exports and non-exporters differently. The greater exposure of non-exporters to the domestic economy and the fact that they borrow from constrained domestic financial institutions after a crisis makes them more dependent on local banks, and the policies that governments pursue to revive the financial sector after the crisis. Exporters, by contrast, are able to offset the costs of the crisis and borrow from foreign banks by pledging export revenues, and as a result they experience higher sales growth. This offers a useful lesson for the current global financial crisis.[9]

The paper is organized as follows. Section 2 presents our theoretical model that is used to explore the influence of firm-specific characteristics on the variation in the composition of external finance as a consequence of the crisis. Section 3 discusses our firm-level panel of data used to evaluate our model, followed by an explanation of our testing methodology in Section 4. Section 5 presents our results, and Section 6 concludes.

2. The Theoretical Model

We build a model with three periods (0, 1, 2). Period 0 is the planning period when all financial contracts are agreed and initial investments are made. Period 1 is an interim period when the returns on short-term technologies are realized and creditors decide on whether to liquidate firms or provide them with new funds. In the final period, the returns of long-term technologies and those on short-term technologies that were extended credit the period before are realized and financial claims are settled. All agents are risk-neutral and they do not discount the future.

There are two countries: a small open economy (domestic economy) and the rest of the world. Let e denote the exchange rate (domestic currency units per unit of foreign currency). We assume that in period 0 the government pegs the exchange rate at e=1 and that all agents expect

[8] Claessens *et al*. (2012) have done something similar for the 2007-09 crisis, observing the business cycle, trade and external finance sensitivities of firms across many countries, but they use data at the 3-digit sector level to approximate the sensitivities of firms. We regard their paper as highly complementary to our own.

[9] In many respects Korea is an apt comparison for the present global financial crisis. The Asian crisis brought about a 6.7 percent contraction of GDP growth in 1998, and a 40 percent reduction in fixed investment – the sharpest decline in real activity since 1950 – which is comparable in many respects to the severity of the recent global financial crisis. After short term rates fell dramatically with the devaluation of the Korean won, credit to the private sector declined, and banks were subject to greater, externally imposed regulation, further diminishing the incentives to lend. The devaluation in the currency provided a competitive advantage to exporters, however, as this paper documents.

that the peg will be maintained for the following two periods. In other words the economy is in its pre-crisis state with no prior knowledge of a crisis in the future.

2.1. Firms and Technologies

There is a continuum of firms located in the small open economy. The only difference between firms is their endowment of capital that has period 1 market value *k*. This endowment captures any fixed assets that firms possess in period 0. The distribution of endowments is represented by the function *F* and has support on the interval $[\underline{k}, \bar{k}]$ and this will be a key determinant of creditworthiness, access to credit and ultimately the ability to produce goods. There are four goods. One is a domestic input that we use as the numeraire. There is a second input that is imported from abroad and each unit costs one unit of foreign currency. The other two are consumption goods; one is consumed domestically, which we refer to as the 'domestic good', and the other is consumed abroad; we refer to this as 'exports'.

It takes one period to complete production of domestic goods. Thus, investments are made in periods 0 and 1 and revenues are realized in periods 1 and 2, respectively. To produce one unit of the domestic good requires one unit of a composite input that consists of a fraction φ of a unit of the domestic input and a fraction 1-φ of a unit of the imported input.[10] There is demand uncertainty in the domestic market. The price of domestic goods in periods 1 and 2 is equal to p_H with probability π while with probability 1-π the price is equal to p_L (where $p_H > p_L$) . The demand shocks are independently distributed across firms and time. All period 1 profits are distributed to firm owners. We assume that investment in the domestic technology is efficient and that loans are risky, i.e. $\pi p_H + (1-\pi) p_L \equiv p > 1 > p_L$.[11] We also assume that high revenues are observed only by firm owners.[12]

Production of exports takes two periods. Our model captures two observations made in the international trade literature: that large firms are more likely to export, and given that a firm exports, its export volume is positively related to its size.[13] To this end we assume that firms that

[10] To keep things simple we assume that the technology is Leontief. It will become clear that allowing for input substitution will only complicate the model without adding any additional insight.

[11] The right-hand side of this condition corresponds to costs given that the exchange rate is pegged.

[12] We can allow creditors to observe revenues, but we require the weaker assumption that revenues cannot be verified by third parties.

[13] There is a large international trade literature that makes a positive link between entry to export markets and firm size through sunk costs c.f. Bernard *et al.* (2003), Bernard and Jensen (2004), Campa (2004), Helpman *et al.* (2004), Roberts and Tybout (1997), Roberts *et al.* (1997) and Tybout (2003). Empirical support for this view is cited in Girma *et al*. (2004) and Greenaway *et al.* (2006) for firms from Germany, Italy, Latin America, Spain, the UK and the US. To our knowledge the only studies that use data from East Asia is Aw and Hwang (1995) and Aw *et al.*

wish to export need an initial investment of θ units of the domestic input. In addition, each unit of exports requires one unit of the domestic input.[14] We further assume that firms face capacity constraints with respect to exports that are directly related to their size, i.e. their ownership of fixed assets. Without any loss of generality we assume that for each unit of assets that they possess they can supply one unit of exports.[15] Export revenues are deterministic but the export market is still subject to uncertainty since collapse of the domestic market can trigger default to domestic and international lenders by exporters. Let p^* denote the price of a unit of exports. We assume that $\pi p^* > 1$.

2.2. Domestic and International Borrowing

We make the conventional assumption that all firms are financially constrained and they need external funds to finance production. They can obtain funds from domestic and foreign creditors. We make two additional assumptions that are justified by the data: First, domestic creditors obtain some of their funds from foreign sources.[16] Second, following Caballero and Krishnamurthy (2001), we assume that firms can pledge to creditors two types of collateral.[17] When a firm is liquidated domestic creditors receive the proceeds from the sales of its assets, *k*. In contrast, foreign creditors are pledged export revenues.[18]

Exporters obtain loans from domestic and international lenders and if domestic creditors liquidate the firm then they cannot fulfil their export obligations and will default on their foreign loans. Clearly, even if there is no uncertainty directly related to the export market, foreign loans are risky. Thus, firms finance domestic sales with domestic loans while they obtain funds from

(2000) that draw the same conclusions from a sample of Taiwanese and South Korean firms and Kraay (1999) for firms from China.

[14] Given that in period 1 there is no purchase of inputs for the production of exports, assuming that only the domestic input is used in the production of exports is inconsequential.

[15] We do this not only to impose a limit on exports but also to relate that limit to firm size. We could instead have introduced a cost function that increases with production but decreases with *k* but our formulation is simpler.

[16] Evidence from the BIS reporting banks' summary of international positions indicates that reporting banks' claims by region/country in 2005Q3 were $110.3bn (Asia Pacific), $9.9bn (Malaysia), $17.0bn (Indonesia), $5.2bn (Thailand) and $11.1bn (Korea) some of which would be to public/public guaranteed bodies including public sector banks as well as private institutions. Domestic money markets are relatively thin in the Asia-Pacific region.

[17] Iacoviello and Minetti (2006) also consider the distinct roles of domestic and foreign lenders but their emphasis is on international business cycles.

[18] Evidence from Campa and Shaver (2001) suggests liquidity constraints for exporters are less binding, and cash flow is more stable because business cycles in foreign markets are not highly correlated. Chaney (2005) suggests that this allows these firms to access more external finance for entry to export markets; Girma *et al*. (2004) and Greenaway *et al.* (2006) show that it is larger and more liquid firms that tend to enter export markets. Our model uses export revenues as collateral, which ensures the positive effects on competitiveness of a depreciation are not offset by a deterioration in foreign currency value of pledged collateral as in Chaney (2005).

abroad to finance exports.[19] They do so because foreign lenders do not wish to participate in bankruptcy procedures and thus do not accept the domestic collateral while domestic lenders cannot verify export revenues. Nevertheless, we need to make sure that firms have an incentive to use the borrowed funds for their intended purpose; namely, to use foreign loans to finance exports and domestic loans to finance the production of goods sold domestically.

We assume that financial markets are competitive and we set the interest rate equal to zero. First, we consider the domestic financial contract. The domestic financial environment is very similar to the one considered by Bolton and Scharfstein (1990). Let q denote the level of production. Given that in period 2 domestic revenues are not verified and assets are completely depreciated a firm will always choose to default rather than make any repayment higher than $p_L q$. However, the firm might have an incentive to make repayments in period 1 if the creditors always liquidate the firm's assets when the firm defaults. If the firm meets its financial obligations in period 1 then the lenders offer a new loan of the same size to finance next period's production.[20]

Let R denote the period 1 repayment. The repayment together with the level of production must satisfy the incentive compatibility constraint $(p_H q - R) + \pi p_H q \geq p_H q$. Given that demand is high in period 1, the left-hand side shows the firm's profits when it does not default. The first term shows period 1 revenues net of loan repayments and the second term shows the period 2 expected revenues. The right-hand side shows the firm's profits when it defaults (in that case the creditors liquidate the firm). The constraint can be simplified to

$$\pi p_H q \geq R \qquad (IC_d)$$

where the subscript d stands for domestic. The repayment must also satisfy the creditor's individual rationality constraint $q(1+\pi) = \pi R + (1-\pi)k + (1+\pi)p_L q$. The left-hand side equals to the expected value of loans and the right-hand side shows expected pledgeable income. The constraint can be written as

$$R = [q(1+\pi-(1+\pi)p_L) - (1-\pi)k]/\pi \qquad (IR_d)$$

Combining the two constraints we get $q[\pi^2 p_H - (1+\pi-(1+\pi)p_L)] \geq -(1-\pi)k$. Notice that if p_H is sufficiently high the last constraint will be satisfied for any choice of output. As profits are increasing in output the optimal strategy would be to borrow as much as possible irrespective of

[19] When there is a banking crisis exporters can also be affected by lack of trade finance; for evidence see Amiti and Weinstein (2011) who use 1990s data from Japan and in relation to the recent crisis see Bricogne *et al.* (2012; France) and Chor and Manova (2012, US).

[20] A key difference between the Bolton and Scharfstein economy and ours is that they consider the case of a fixed project size while we allow the firm to choose its level of production.

the level of fixed assets (firm size); therefore, we impose the restriction that $\pi^2 p_H - (1+\pi-(1+\pi)p_L) < 0$ which together with the above constraint implies that

$$q \leq \frac{1-\pi}{(1+\pi-(1+\pi)p_L)-\pi^2 p_H} k \equiv mk \qquad (1)$$

Clearly in equilibrium the constraint will be binding. Intuitively, for high values of p_H the repayment can be set sufficiently high to cover the value of the loans: in that case a firm would be able to borrow even if it did not possess any collateral. However, this is not the case for low values of p_H and as result the value of collateral sets a limit to a firm's borrowing capacity.

Next, we turn our attention to the export market and international financial constraints. Let R^* denote the repayment of foreign loans that must satisfy the following individual rationality constraint of the foreign creditor

$$R^* = [\theta + k]/\pi \qquad (IR_f)$$

where $\theta + k$ equals the size of the loan and the subscript f stands for foreign. Note that the creditor is repaid with probability π since with probability 1-π the firm is liquidated and therefore is unable to meet its obligations in the foreign market. For a firm with assets, *k*, expected profits from exports are equal to $\pi p^* k - \theta - k$. Setting this expression equal to zero and solving for *k* we find that only those firms with a level of domestic collateral higher than

$$\underset{\#}{k} \equiv \frac{\theta}{\pi p^* - 1} \qquad (2)$$

can profitably invest in the export market.

As we mentioned above, we also need to make sure that firms have an incentive to use domestic loans to finance domestic sales and foreign loans to finance exports. It is clear that firms do not have an incentive to use domestic funds to finance exports since they already produce 'exports' at capacity.[21] However, this is not the case with foreign funds which introduces moral hazard. A firm may use foreign loans to finance domestic sales but if it does so it will default in period 1. This is because if it stays active, the absence of export revenues will reveal the misuse of international funds. Misdirection of funds is not in the international lenders' interests since there will not be export revenues to repay them. The following proposition determines which firms will obtain loans from international creditors:

Proposition 1:

a) If $\pi(p^* - p_H) \leq 1$ *none of the firms will receive a foreign loan, and*

[21] A similar conclusion would be obtained had we assumed that they face an increasing cost function. In that case foreign lenders would be willing to finance the first-best optimum level.

b) If $\pi(p^* - p_H) > 1$ *only those firms with* $k \geq \underset{\sim}{k} \equiv \dfrac{\theta(\pi p_H + 1)}{\pi(p^* - p_H) - 1}$ *will receive foreign loans.*

Proof: The expected total profits of a firm that uses the foreign funds to finance exports are given by $\pi[(p_H q - R) + \pi p_H q] + \pi(p^* k - R^*)$ while the corresponding profits when the firm uses the funds to finance domestic sales and defaults in period 1 are given by $\pi p_H(q + k + \theta)$. By substituting (IR_d), (IR_f) and (1) in the two expressions and then subtracting the second expression from the first one we derive the expression for $\underset{\sim}{k}$. Notice that if the denominator is negative this implies the technology for 'exports' is not profitable enough to overcome the moral hazard; part (a) of the proposition. In addition, if $\underset{\sim}{k} > \bar{k}$, there will also be no foreign loans but in this case the constraint is due to lack of assets.

Thus, there are two conditions that must be satisfied in order for foreign creditors to provide loans. The first is that the return on exports must be sufficiently high to ensure the firm can repay foreign creditors in period 2. The second is the incentive compatibility condition

$$k \geq \underset{\sim}{k} \equiv \frac{\theta(\pi p_H + 1)}{\pi(p^* - p_H) - 1} \qquad (IC_f)$$

Notice that $\underset{\sim}{k} > \underset{\#}{k}$, which implies that the incentive compatibility constraint binds. Only those firms with high production capacity earn sufficiently high profits from exports to have an incentive to use the funds appropriately.[22]

2.3. Currency Crisis

Suppose that in period 1 the government is forced to abandon the peg. Let the new value of the exchange rate be e=1+x, so that $x > 0$ captures the rate of depreciation. Our interest is in the post-crisis economy over the remainder of period 1 and period 2.

The devaluation of the domestic currency will affect firms through three distinct channels. We refer to the first channel as the *global bank lending channel*. This raises the distinction between domestic lenders that remain solvent and those that become insolvent. Devaluation can deteriorate a bank's balance sheet in several ways. It can cause a currency mismatch in the post-crisis period – this occurs because domestic banks obtain their funds from foreign investors and

[22] There are a few papers that use a similar moral hazard problem to analyze how the firm's net worth (Holmstrom and Tirole, 1997, Hoshi *et al.*,1992, and Repullo and Suarez, 2000) or reputation capital (Diamond, 1991) determines

these liabilities (foreign loans owed by domestic banks) are denominated in foreign currency, but their assets (loans owed by domestic firms) are in domestic currency. Equally, direct loans from foreign banks, or from their subsidiaries, might be affected by a crisis (Popov and Udell, 2012; Schnabl, 2012; Cetorelli and Goldberg, 2010, 2012, and forthcoming; de Haas and Lelyveld, 2010; and Khwaja and Mian, 2008). Devaluation can also affect a bank's assets through its negative impact on the value of collateral.[23] The drop in collateral value implies that even if the number of firm failures remains constant banks will incur losses from the sale of their assets but also those firms that survive will not be able to borrow as planned.[24] These effects imply that after the unexpected collapse of the currency the value of bank assets might fall short of the value of their liabilities driving them to insolvency. This has a further implication for firms. Suppose a firm borrowed from a bank that turned out to be insolvent after the crisis. Despite the fact that the firm was successful in period 1 it would not receive any new funds in period 1 for production in period 2.

Even those firms that received funds from banks that remained solvent will be affected by the crisis. This is because the devaluation of the currency increases production costs because of the higher cost of imported inputs. Given that the size of the second period loan is fixed in domestic currency units, firms have to cut down production and thus profits.[25] We refer to this second channel as the c*ost of production channel* because it has some similarities with the Barth and Ramey (2001) *cost channel*. In Barth and Ramey (2001) a tightening of monetary policy has supply-side implications for firms, which must borrow at higher interest rates, and consequently produce at higher cost. In our model the currency crisis has a supply-side implication because the devaluation increases the cost of imported inputs and with a fixed loan size reduces production levels. A third *competitiveness channel* refers to the effects of increased competitiveness as the devaluation makes exports cheaper and improves creditworthiness for firms that have access to export markets. In what follows, we examine in detail the effects of each of these channels in the post-crisis period.[26]

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its access to market and bank finance. In these papers firms can misuse funds by investing them in a high-risk technology that also yields some private benefits.

[23] In our model this can be captured by reducing the value of collateral below k when there is a currency crisis. Given that our model is static this change will not affect our qualitative results. See Kiyotaki and Moore (1997) for a dynamic model that analyzes the relationship between collateral values and business cycles.

[24] Shleifer and Vishny (1992) demonstrate that collateral values are lower when the assets are more likely to be traded, i.e. during recessions.

[25] Given that banks face a liquidity crisis they are unable to adjust the size of the loan.

[26] Since our analysis is carried within a partial equilibrium framework it ignores any indirect effects of devaluation on prices.

We first notice that a proportion $1-\pi$ of all firms would have been liquidated with the domestic creditors receiving *k*, whether or not a crisis occurred. These firms would have failed even if the peg had been maintained and from now on we concentrate only on those firms that did not fail. We assume that a proportion *z* of all firms borrowed funds in period 0 from banks that were forced to insolvency by the depreciation. We further assume that the distribution of initial endowments of this set of firms is identical to the distribution for all firms.

We first examine the impact of devaluation on the firms that received loans from solvent banks and, for the moment, we restrict attention to those firms with $k < \tilde{k}$; i.e. firms that do not produce exports and hence are influenced only by the first and second channels. The domestic contract is designed so that, given that the peg is maintained, these firms are indifferent between repaying *R* to domestic creditors and defaulting. The devaluation of the currency implies that the unit cost of the domestic good has risen to $1+(1-\varphi)x$. Given that the size of the second loan is fixed at *q*, period 2 production and hence profits must decline. Indeed, the new production level is equal to $\frac{q}{1+(1-\varphi)x}$ and the corresponding decline of expected profits is equal to $pq\left(\frac{(1-\varphi)x}{1+(1-\varphi)x}\right)$. The above argument implies that firms will default on their domestic loans unless creditors accept to renegotiate.

Proposition 2: *Consider those firms that received loans from solvent banks with endowments* $k < \tilde{k}$. *If* $m\left(1+\pi p_H - p\frac{(1-\varphi)x}{1+(1-\varphi)x}\right) > 1$ *the contracts will be renegotiated; otherwise firms default and liquidation follows.*

Proof: When creditors liquidate a firm they receive $k + p_L q$ while if they renegotiate their return will be equal to $R - pq\frac{(1-\varphi)x}{1+(1-\varphi)x} - q + p_L q$. The first term equals the initial agreed repayment, the second term equals the amount by which the repayment must be reduced (which equals the decline in profits) in order to induce firms to stay in business, the third term is the size of the new loan and the last term is the verifiable income that will be obtained either in period 1 or period 2. The proposition follows by substituting the equilibrium solutions for *R* and *q* in the above expressions and rearranging.

Next, we turn our attention to those firms that produce exports among those firms who received loans from solvent banks. These are firms that also benefit from the third channel and we make two observations. First, these firms benefit from the abandoning of the peg because the

domestic currency value of exports increases. Second, if export profits are sufficiently high then the threat of default is not credible. We can show the following:

Proposition 3: *Consider those firms that received loans from solvent banks with endowments* $k \geq \underset{\sim}{k}$ *and suppose that the inequality in proposition 2 is not satisfied. If* $\underset{\sim}{k} \geq \dfrac{\theta}{\left[\pi p^{*}(1+x)-1-p\dfrac{(1-\varphi)x}{1+(1-\varphi)x}\right]m}$ *loans will not be renegotiated as firms do not have an incentive to default.*

Proof: The fixed cost θ means firms' export profits are increasing at an increasing rate in *k*. Export profits of the smallest firm capable of producing 'exports' are given by $\pi p^{*}(1+x)\underset{\sim}{k}-\theta-\underset{\sim}{k}$. If these profits are higher than the decline in domestic profits (which are increasing at a constant rate with *k*) then firms will not have an incentive to default.

For these firms profits might either increase or decrease with the abandoning of the peg because domestic profits decline while profits from exports increase. Nevertheless, overall profits increase with firm size.

Now, consider those firms that received loans from insolvent banks. These are firms that will not receive new loans in period 1. It is clear that firms that do not produce exports will default and hence will be liquidated. For firms that produce exports we have the following proposition:

Proposition 4: *Consider the firms that received loans from insolvent banks with endowments* $k \geq \underset{\sim}{k}$. *There exists a cut off level for the value of assets* $\hat{k}$ *such that those firms with* $k \geq \hat{k}$ *repay their loans in period* 1 *and are not liquidated while those firms with* $\underset{\sim}{k} \leq k < \hat{k}$ *default and are liquidated.*

Proof: A firm that defaults avoids making the repayment *R* but sacrifices export profits. Therefore a firm defaults if and only if $\pi p^{*}(1+x)k-\theta-k<R$. The solution of the critical value can be obtained by substituting for *R* in the above expression and rearranging terms.

The firms that received loans from insolvent banks will cease supplying the domestic market. The firms that will remain active after the currency crisis are firms that are sufficiently large and profitable and will service only the foreign market.

3. Data and Descriptive Statistics

We test the predictions of our model using a dataset drawn from the KIS-Value Database containing firms' financial statement data maintained by the Korea Information Service. We

focus on firms in the manufacturing sector and formulate a panel dataset from Korean statutory audited firms for the period from 1990 to 2006. We remove the 1% tails for the variables to exclude outliers. Our data include 28,684 observations for 4,933 listed and unlisted firms.

A major advantage of the KIS database is the detailed record of the destination of sales, distinguishing between exported and non-exported goods at the level of the individual firm. First, we investigate whether firms' access to foreign currency denominated loans (FDL=1) is influenced by the export status of firms. We construct several measures of the export status of firms using these data: a dummy (DEX=1) that indicates whether a firm has engaged in any exporting activity in the current year, or not. Then we consider firms that are majority exporters, (DEX50=1) indicates that a firm exports more than 50% of goods sold. Finally, we measure the export share in total sales (EXPSHARE = exports/total sales).

For firm-specific controls we measure the leverage by the total debt to total asset ratio (LEV), the liquid assets of the firm to total assets (LIQ), costs of sales over total sales (COSTS), the log of the real total assets (SIZE) and the years since incorporation of the firm (AGE). These are likely to determine access to finance and the extent to which a firm can expand its sales. Table 1A reports the descriptive statistics of the balance sheet variables we use in our analysis while Table 2 reports the correlations between variables. We observe by comparison of the mean values in pre-crisis and post crisis periods that the Asian crisis reduced the average size (SIZE), leverage (LEV), foreign borrowing (DF) and raised both cost of sales (COSTS) and liquidity (LIQ) for firms in our sample. These differences are not significant, however, which suggests we cannot deduce the effects of the crisis from firm averages alone.

Second, we take advantage of the detailed information in our dataset and construct several ratios of the borrowing by individual firms in foreign currency to determine their impact on sales. We construct ratios of short term borrowing in foreign currency in relation to total assets (SBR1), short term borrowing in foreign currency in relation to short term total borrowing (SBR2), and long term borrowing in foreign currency in relation to total borrowing (LBR). Short-term debt comprises the sum of bank overdrafts, short-term borrowings in foreign currency, short-term borrowings-notes and short-term other borrowings. Total borrowing is composed of short-term debt, the current portion of long-term liabilities and long-term borrowing including bonds. These data are important for the testing of our model since we argue that firms that cannot borrow (in foreign currency) will not be able to produce (exports). Table 1B gives the descriptive statistics for these ratios, and the difference between them. We see that there is not much change in the

mean values of SBR1 and LBR between 1996 and 1999, but the short term borrowing in foreign currency over short term total borrowing rises by 70% over this period.

Finally, we allow for the fact that some large politically connected conglomerates (Chaebols) were able to obtain domestic finance through state owned banks or their financial affiliates. We compile a list of the largest 30 Chaebols form the Korea Fair Trade Commission 2007 definition of business groups. There are 535 firms and 5,809 firm-year observations for these 30 largest Chaebols. While we allow for 30 of these groups, in practice the top 5 or 10 groups are the most powerful, accounting for a large share of manufacturing output and GDP. They include firms such as Daewoo, Hyundai, Kia Motors, LG, Samsung and SK. Borenzstein and Lee (2003) document that these firms experienced faster sales growth pre-crisis, and a smaller decline in sales in the crisis period itself than other firms. Arguably Chaebols could have different sensitivities to the Korean business cycle due to their size, conglomerate structure and their financial connections.

4. Empirical methodology

Our first proposition identifies the types of firms that will obtain foreign currency debt. Firms that meet the criteria are significant exporters, with sufficient profitability (or low enough cost of sales) and capital to meet the incentive compatibility condition. Therefore we expect that the level of assets (SIZE), cost of sales (COST) and export status to be significant determinants of access to foreign currency loans. Export status of the firm is measured by the dummy variables DEX or DEX50, or the continuous export share measure (EXPSHARE). We control for a number of other influences on the probability of accessing foreign currency loans, including beginning of period leverage (LEV) and liquidity (LIQ), age (AGE) of the firm. Our Probit model is

$$Prob\ (FDL_{it}=1) = F(\alpha + \delta X_{it} + Z_{it}\phi) \qquad (3)$$

where FDL_{it} is foreign currency loans for firm i and time t, X_{it} is a scalar that captures export status and Z_{it} is a matrix of firm characteristics used as control variables. The Probit estimator assumes that $F(.)$ is a Normal distribution. Our model predicts that $\delta > 0$: which says that exporters will have a higher probability of obtaining foreign currency loans.

The second main prediction of the model is that the crisis had mainly negative effects on firms that produce only for the domestic market but mixed effects for firms that also export, as the effects of the crisis work through the three channels in our model. Other things equal, we would expect that export participation before the crisis predicts better post-crisis performance. Proposition 2 indicates that after a crisis those non-exporters that continue to operate will have to

cut down production, while exporters are less likely to default (propositions 3 and 4).[27] A critical linkage in our model is the connection between access to external finance and production in the next period. Failure to obtain sufficient credit will result in curtailed output: some firms will not produce output at all, others will obtain only sufficient domestic finance to produce domestic goods, while others will obtain sufficient domestic and international finance to produce domestic and export goods. Credit may not be offered even to creditworthy firms if financial intermediaries cannot obtain the funds to on-lend and this will particularly affect domestic firms borrowing from domestic banks. Exporters on the other hand will be able to pledge export revenues to secure funding from foreign banks in foreign currency. In the post-crisis conditions exporters are also likely to benefit from improved competitiveness, while non-exporters will face tougher conditions.

We can test this prediction using the following difference-in-differences model including firm characteristics as controls:

$$S_{it} = \alpha_i + \beta X_i + \gamma P_t + \delta X_i P_t + Z_{it}\theta + \varepsilon_{it} \qquad (4)$$

where S_{it} denotes sales of firm i at time t, X_i is scalar that denotes the export status prior to the crisis, P_t is a dummy taking the value 1 post crisis and the interaction term $X_i P_t$ measures the impact of the crisis on exporters versus non-exporters. We include firm specific intercepts α_i to control for unobservable firm specific effects, while Z_{it} refers to the matrix of observable firm characteristics that were included in the Probit estimates in equation (3). The export status has no subscript t because what matters for the predictions of the model is the initial status of the firm regarding exports. We expect $\beta > 0$, i.e. firms that export before the crisis to have on average higher sales over the entire period. Our main prediction is that exporters benefit from the devaluation as well as incur higher costs, but non-exporters just incur higher costs. In other words, the difference-in-differences estimate $\delta > 0$: exporters will do better than non-exporters after the crisis.

The source of the shock in our analysis is the Asian crisis in 1997-1998. Korean banks were overexposed to large domestic borrowers at a time when a similar situation in Thailand had prompted a devaluation of the Thai Baht in July 1997. Nationalization of Kia Motors led to two

[27] By assuming that inequalities in propositions 2 and 3 are satisfied, then, abandoning the peg pushes firm failures up to $1-\pi+\pi z\hat{F}(k)$. The mass of non-exporters that survives is equal to $\pi(1-z)\underset{\sim}{F}(k)$, while the mass of exporters remaining active is equal to $\pi[z(1-\hat{F}(k)+(1-z)(1-\underset{\sim}{F}(k)]$. Note that if the inequality in proposition 2 is not

downgrades of Republic of Korea sovereign debt by Moody's in November and December 1997, which would have raised the cost of external finance for Korean firms, lowered the value of domestic collateral pledged to domestic banks, and acted as a trigger for the withdrawal of foreign capital. This was therefore a well-defined funding shock for firms similar to the type of exogenous shock used by Khwaja and Mian (2008) to explore lending in Pakistan and by Schnabl (2012) in Peru. While we do not model changes in individual loans made to firms directly, we do observe changes to sales which are dependent through the production channel on access to loans in our model. We rely on the fact that exporters and non-exporters funding sources were heterogeneously affected.

We believe export status will be important because exporters have access to foreign loans by virtue of their ability to earn income in foreign currency, while non-exporters do not. Therefore the sign and significance of δ is the key observation in this equation. Export status will have a significant influence on the difference in sales between pre-crisis and post-crisis periods. This is identical to the difference-in-difference argument (see Hill *et al*., 2012).

Correlation between the unobserved firm specific effects α_i and the regressors in equation (4) would lead to biased estimates. For this reason, we estimate equation (4) in differenced form:

$$S_{it+1} - S_{it} = \gamma + \delta X_i + (Z_{it+1} - Z_{it})\theta + u_{it} \qquad (5)$$

Here we take t = 1996 (immediately before the crisis) and t+1 = 1999 (immediately after the crisis). Using reasoning similar to Claessens *et al*. (2012) we compare sales following the devaluation of the currency with sales before the crisis allowing for export status and other characteristics in the *pre-crisis period*, which are exogenous. Thus the influence of *ex ante* characteristics on *ex post* performance can be properly evaluated.

Our model relies on the fact that domestically oriented firms experienced an exogenous shock for which they could not substitute alternative sources of finance. Exporters were not wholly reliant on domestic banks and could substitute away from domestic banks by pledging export revenues to foreign banks; the improvement to their competitiveness would enhance this source of collateral after the crisis.

Borensztein and Lee (2003) note that the large Korean conglomerates (Chaebols) have historically had preferential access to credit prior to the Asian crisis, but credit was reallocated to other more efficient firms in the post crisis period. It is likely that Chaebols behaved differently to other firms because they had preferential access to credit, therefore we control for the fact that

satisfied then there will be no small firms surviving the abandoning of the peg. If the inequality in proposition 3 is not satisfied then there will be some exporters that received funds from solvent banks and did not survive.

a firm is a Chaebol in our sample. However, it is not immediate clear whether Chaebols are likely to be advantaged or disadvantaged by their status as large politically-connected conglomerates. Many of the Chaebols such as Hyundai, Kia Motors, Daewoo, LG, SK, Samsung, etc. were international companies with large export sales, but equally they were also heavily dependent on state industrial banks, other domestic banks and their own financial services subsidiaries prior to the crisis. This may have ensured that they were not credit constrained, but because they were relatively inefficient, it may not have resulted in substantial advantages in terms of sales growth.

5. Results

5.1 Access to foreign currency borrowing

We begin with an analysis of foreign currency borrowing for production using a Probit model described in the previous section. According to our model, exporters with a foreign revenue stream are more likely to obtain funding in foreign currency because the foreign revenue allows the lender to avoid currency mismatch between the revenue stream and the loan, both of which are partly in domestic and partly in foreign currency. If a firm is an exporter, and meets the conditions in proposition 1, we expect them to be able to borrow internationally, produce outputs and increase sales, some of which will be exports. Tables 3, 4 and 5 report the Probit estimates. The three panels in each table refer to an indicator that the firm is an exporter (DEX), an indicator that exports comprise more than 50% of total sales (DEX50), and a measure of the share of exports in total sales (EXPSHARE). Table 3 includes a measure of the size of the firm using log of real assets, indicating that the firm has reached sufficient scale necessary to export and therefore to borrow in foreign currency. Table 4 replaces size with the Chaebol dummy (CHAEBOL), indicating the status of those firms that were among the 30 largest conglomerates. We are aware that while size can proxy for many influences on firm behaviour it is potentially correlated with export status, therefore we re-estimate our model in Table 5 using age in place of size. Age is not included in our model explicitly, but we consider firms that are older to be established, and to have had time to reach sufficient scale.

The results in Tables 3, 4 and 5, are substantially similar and show that the firm characteristics included in our model have the expected signs. Each regression is estimated for four different time periods: the full sample (1990-2006), the pre-crisis period (pre 1997), the crisis period (1997 and 1998) and the post-crisis period (after 1998). Size has a positive impact on the probability of obtaining foreign borrowing. Our model indicates that there is a threshold for firm assets that will allow profitable access to the export market, and our finding confirms

that a firm with more real assets has a higher probability of access to foreign loans. Chaebols have a higher probability of obtaining foreign currency loans than other firms possibly due to their size, name recognition, and their exporter status. However, the export status continues to be important as an independent influence on access to foreign currency borrowing. Age also has a positive effect, due to reputational considerations.

Firms that have greater leverage (LEV) have higher probability of borrowing in foreign currency and the coefficient associated with this variable is significant at the 1% level. We also find that firms with higher liquidity (LIQ) are less likely to borrow in foreign currency. Although our model assumes firms have insufficient funds to self-finance their projects, which is why they must borrow in order to produce, a larger stock of liquid assets reduces the external funds they will need to borrow. The relationship with these variables holds irrespective of the specification of the estimated equations, and for most of the time periods. There is no reason to think that the impact of these variables should vary before and after the crisis.

We expect firms with higher costs of sales (COSTS) to have lower probability of foreign currency. Costs include operating costs, and also the costs of raw materials, which will be influenced by any change in the exchange rate, therefore this variable does vary between different sample periods. It reflects the effect of currency depreciation on firms' total costs – our *cost of production channel* – inducing firms to reduce production levels and lower the demand for borrowing in the post-crisis period. This is why we expected to see a lower probability of borrowing in foreign currency as costs increase. We find negative coefficients in the post-crisis period, but the effect is relatively weak and not always significant, indicating that this channel is less important as a determinant of foreign currency borrowing than others.

We turn now to the impact of exports. Looking at columns 1-4, export status (DEX) has a coefficient that is positive and significant for the full sample, and for the post crisis period. The importance of the period 1998–2006 suggests that export status counts after the crisis, when these firms benefit from the devaluation as their foreign currency revenue stream increases. This is our *competitiveness channel*, and to the extent that firms produce more goods to sell in their export markets, we expect them to borrow more in foreign currency. Therefore, we are not surprised to find that export status is a significant determinant of foreign currency borrowing in the post-crisis period, and for the full sample. It is not significant in the pre-crisis or crisis periods because in these periods the competitiveness channel does not have any influence. When we consider the majority exporters (DEX50) in columns 5-8, we see that this indicator is not significant at all in Table 3, but in Table 4 we find it is significant for the full sample and the post-crisis period as it

was for DEX. If there is an advantage from being a majority exporter the post-crisis period is when it is most influential. When we view the results for the share of exports in total sales (EXPSHARE) in columns 9-12, we find exactly the same pattern of positive and significant coefficients in the full sample and the post-crisis sample period.

To demonstrate the economic effects in our model, we report the marginal effects for the final specification in Table 6.[28] Liquidity (LIQ) has the greatest economic impact on foreign currency borrowing, since a 1% increase in liquid assets lowers the probability by 25% in the full sample (column 1), and 30% in the post crisis period (column 4). LEV also has a high economic impact, raising the probability of foreign currency borrowing by 10% in the full sample and the post-crisis period for every percentage point increase. COSTS has a negative economic impact that is between a third and a half as large as leverage, while export status (DEX and DEX50) has an effect about a half to two thirds as large as leverage. Export share (EXPSHARE) has a much stronger influence, since a 1% rise in export share of total sales raises the probability of foreign currency borrowing by 13% in the full sample and by 17% in the post crisis sample.

5.2 Sales growth

Our next set of results refers to the impact of the crisis on the total sales growth for firms that are exporters compared to those that are not. Table 7 reports results for differences in log sales for 1999 compared to 1996, explained by the characteristics that we discussed previously, such as size, age, leverage, costs and liquidity. We report the results for majority exporters and for the export share, and allow foreign debt ratios to affect sales growth. The ratios we use are short term borrowing in foreign currency in relation to total assets (SBR1), short term borrowing in foreign currency in relation to short term total borrowing (SBR2), and long term borrowing in foreign currency in relation to total assets (LBR). The results for each of these ratios are reported in panels A, B and C of Table 7.

Our model indicates that differences in the control variables between 1996 and 1999 should influence the difference in sales between 1996 and 1999 for similar reasons to those given above. Unobserved (fixed) effects are removed by differencing. A key influence on sales is expected to be the export status in 1996. This is the variable that tells us how much difference the export status made to the difference in sales between the two periods, for firms that are majority exporters (DEX50) and the export share (EXPSHARE). We also control for Chaebol status in 1996 as a potential influence on sales growth.

[28] Marginal effects for other models are comparable and are omitted for brevity. They are available on request.

We find three consistent results. First, export status has a positive and significant effect on the difference in sales between 1996 and 1999 especially for the majority exporters. The positive and strongly significant coefficient, δ in equation (5), shows that export status was a very important influence on sales for firms, since exporters had higher sales than non-exporters after controlling for all other effects. This is the most important finding in our results, which strongly supports the hypothesis in our model that exporters have higher sales following a crisis. It differs from the Claessens *et al.* (2012) result, which finds firms more exposed to trade experience a decline in sales, because their analysis refers to a global crisis which adversely affected export markets, while ours discusses a regional crisis that did not affect the global demand for exports. Our result is consistent with the *competitiveness channel* in our model, which argues that sales improve following a currency depreciation for exporters while sales for non-exporters are unaffected by currency changes. By contrast, the difference in our measure of COSTS does not affect the difference in sales; although we expect a depreciation to increase the costs of inputs, reduce output and sales through the *cost of production channel*, it would have done so for exporters and non-exporters alike. We would not expect the cost of sales between the two periods of time to be different for exporters and non-exporters.

Second, the foreign debt ratio, defined in three difference ways to reflect short term foreign currency borrowing to total asset or other short term borrowing, and long term foreign currency borrowing to total assets, has a positive effect on sales. Firms that obtained positive differences in their ratios of foreign currency borrowing (ΔSBR1, ΔSBR2, and ΔLBR in Panels A, B, and C) had greater differences in sales between 1999 and 1996. Our earlier results in Tables 3, 4 and 5 showed that exporters were more likely to obtain foreign currency loans than non-exporters, so again this demonstrates the benefit of being an exporter. Exporters can borrow from foreign banks because there is no currency mismatch if loans and revenue streams are in foreign currency. They are also less constrained because they are not restricted to borrow only from domestic banks, in contrast to non-exporters that may fail to produce because they depend entirely on domestic banks. These banks may suffer from restricted access to foreign funds after a crisis as Cetorelli and Goldberg (2010, 2012 and forthcoming), Popov and Udell (2012), Schnabl (2012) have demonstrated. This is our *global bank lending channel*. The coefficients on foreign debt ratios are generally less significant than the coefficients associated with export status, but this varies across the different ratios. Panel A referring to short-term foreign currency borrowing over total assets has the least significance, while panel B referring to short-term borrowing in foreign currency over total short term borrowing has the greatest significance. Firms with greater

foreign borrowing, especially short term borrowing, may face greater rollover risk associated with refinancing around the time of the crisis. This was a key finding of Benmelech and Dvir (2012) which explored the importance of debt maturing around the time of the Asian crisis. This would explain why firms with more foreign currency borrowing in the short term (most likely to be exporters) had larger differences in sales than firms that had lower foreign currency borrowing.

Other factors have a relatively minor influence on the difference in sales. Older firms have smaller differences in sales due to the negative coefficient associated with age. This is likely to reflect the fact that young firms grow faster than older, more established firms. It is not a prediction of our model, but it is consistent with findings in the wider literature on determinants of growth in sales. The inclusion of a variable for the top 30 Chaebols did not have a great influence over the growth of sales in this period. The variable was occasionally significant at the 5 or 10 percent level, and its magnitude was quite small. It suggests that our results are not biased by the impact of the largest firms in the Korean economy.

6. Discussion and Conclusions

The main message from our paper is that export status had an impact on the sales prospects for Korean firms when they were compared before and after the Asian crisis. Theoretically and empirically, we show that domestically focused firms that borrow from the domestic financial sector are hit hardest by the crisis because their markets are undermined by the crisis and their lenders are more likely to withhold funds as their own balance sheets are hit by shocks. Exporters on the other hand find their markets benefit from the *competitiveness channel* which improves their sales prospects after the initial impact of the crisis. They also benefit from the *global bank lending channel* because they are able to obtain funds from international lenders and continue to produce exports because they can pledge collateral in the form of export revenues in foreign currency. Both exporters and non-exporters are affected by the *cost of production channel* in equal measure.

What lesson should we draw from our results for the current financial crisis? Currency mismatch is important, it is closely aligned to export status, and operates through three channels, the strongest of which are the competitiveness and the global bank lending channels. Our key finding is that foreign currency borrowing is closely tied to exporter /non-exporter status, and this allows exporters to increase sales relative to non-exporters. Exporters can pledge export revenues while non-exporters cannot, therefore non-exporters face a financial disadvantage that is greater

in crises when domestics banks themselves are constrained. Second, we offer confirmation that the global bank lending channel in the face of a domestic shock documented by Khwaja and Mian (2008) and Schnabl (2012) had a significant effect in Korea around the time of the Asian crisis. While there is a growing literature that documents the effects of the international transmission of financial shocks through large multinational banks on lending by local banks in the recent crisis (c.f. Paravisini, 2008, Ivashina and Scharfstein, 2010, Puri *et al.* 2011, Cetorelli and Goldberg 2012; Claessens *et al*. 2012; Hale 2012; and Popov and Udell, 2012), only Claessens *et al.* (2012) makes the direct connection with export status that we discuss in this paper. Our paper provides a theoretical framework of the open economy credit channel in which export status matters, and using firm-level data for Korea shows that export oriented firms were less adversely affected than those that are non-export oriented in the Asian crisis, indeed they may have benefitted from such conditions.

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Table 1A. Descriptive Statistics – Balance Sheet Characteristics

	Whole sample		Pre-crisis		1997-1998		Post-crisis	
	mean	sd	mean	sd	mean	sd	mean	sd
DFL	0.805	0.396	0.955	0.208	0.867	0.340	0.752	0.432
LEV	0.645	0.198	0.717	0.169	0.730	0.171	0.610	0.200
COSTS	0.812	0.110	0.799	0.114	0.803	0.110	0.818	0.109
LIQ	0.367	0.154	0.350	0.136	0.361	0.146	0.372	0.160
SIZE	17.138	1.267	17.621	1.219	17.207	1.266	16.987	1.244
AGE	16.370	11.519	18.625	11.042	17.062	11.003	15.606	11.647
DEX	0.630	0.483	0.831	0.375	0.596	0.491	0.578	0.494
DEX50	0.183	0.386	0.213	0.410	0.180	0.385	0.174	0.379
EXPSHARE	0.214	0.291	0.261	0.293	0.211	0.292	0.201	0.289
Observations	28684		5645		3355		19684	

Note: The table presents means and standard deviations. DFL is a dummy equal to 1 if the firm has foreign currency denominated loans, 0 otherwise. LEV is the total debt to total asset ratio at the beginning of the year, LIQ is the ratio of liquid assets of the firm to total assets at the beginning of the year, COSTS represents costs of sales over total sales, SIZE is measured as the log of the real total assets AGE is the number of years since firm incorporation. DEX is a dummy equal 1 if a firm has engaged in any exporting activity in the current year, 0 otherwise. DEX50 takes value 1 if the firm exports more than 50% of goods sold, 0 otherwise. EXPSHARE is the ratio of exports/total sales.

Table 1B. Descriptive Statistics – Foreign Currency Borrowing Ratios

Variable	SBR1			SBR2			LBR		
	1996	1999	difference	1996	1999	difference	1996	1999	difference
Mean	0.013	0.015	0.002	0.070	0.119	0.049	0.100	0.095	-0.005
SD	0.039	0.041	0.032	0.179	0.254	0.190	0.132	0.130	0.121
Observations	794			681			799		

Note: The table presents means and standard deviations. SBR1 is the ratio of short term borrowing in foreign currency to total assets, SBR2 is short term borrowing in foreign currency in relation to short term total borrowing, and LBR is long term borrowing in foreign currency relative to total borrowing.

Table 2. Correlation matrices

Whole sample	DFL	LEV	COSTS	LIQ	SIZE	AGE	DEX	DEX50
LEV	0.0273	1.0000						
COSTS	0.0037	0.1191	1.0000					
LIQ	-0.1717	-0.1529	-0.1264	1.0000				
SIZE	0.4125	-0.1384	0.0103	-0.1423	1.0000			
AGE	0.2321	-0.1756	0.0060	-0.1282	0.5644	1.0000		
DEX	0.2001	-0.0909	-0.0114	-0.0856	0.2950	0.1934	1.0000	
DEX50	0.0886	-0.0847	0.0995	-0.0814	0.1336	0.0567	0.3624	1.0000
EXPSHARE	0.1327	-0.0941	0.1269	-0.1156	0.1915	0.0863	0.5632	0.8737
Before the crisis	DFL	LEV	COSTS	LIQ	SIZE	AGE	DEX	DEX50
LEV	0.0506	1.0000						
COSTS	0.0209	0.0591	1.0000					
LIQ	-0.0597	-0.1355	-0.2544	1.0000				
SIZE	0.2254	-0.0926	-0.0164	-0.0429	1.0000			
AGE	0.0898	-0.1767	-0.0537	-0.0244	0.5316	1.0000		
DEX	0.0287	-0.0630	0.1770	-0.1309	0.1005	0.0495	1.0000	
DEX50	0.0013	-0.1136	0.2001	-0.1915	-0.0121	-0.0014	0.2352	1.0000
EXPSHARE	-0.0009	-0.1208	0.2845	-0.2375	-0.0034	-0.0161	0.4020	0.8694
During the crisis	DFL	LEV	COSTS	LIQ	SIZE	AGE	DEX	DEX50
LEV	-0.0106	1.0000						
COSTS	0.0616	0.1014	1.0000					
LIQ	-0.1718	-0.1666	-0.1246	1.0000				
SIZE	0.4388	-0.1368	0.0319	-0.0851	1.0000			
AGE	0.2679	-0.1901	-0.0014	-0.0482	0.5712	1.0000		
DEX	0.0333	-0.1242	0.0183	-0.0461	0.2118	0.1605	1.0000	
DEX50	0.0192	-0.0434	0.0231	-0.0751	0.0809	0.0286	0.3865	1.0000
EXPSHARE	0.0490	-0.0736	0.0795	-0.1015	0.1445	0.0696	0.5957	0.8778
After the crisis	DFL	LEV	COSTS	LIQ	SIZE	AGE	DEX	DEX50
LEV	-0.0362	1.0000						
COSTS	0.0138	0.1712	1.0000					
LIQ	-0.1774	-0.1429	-0.1013	1.0000				
SIZE	0.4159	-0.2262	0.0350	-0.1634	1.0000			
AGE	0.2323	-0.2196	0.0350	-0.1568	0.5629	1.0000		
DEX	0.2025	-0.1540	-0.0415	-0.0705	0.3127	0.2079	1.0000	
DEX50	0.1072	-0.1001	0.0847	-0.0509	0.1797	0.0731	0.3924	1.0000
EXPSHARE	0.1507	-0.1202	0.0961	-0.0823	0.2384	0.1065	0.5937	0.8752

Table 3. Probit Estimates of Foreign Currency Borrowing

VARIABLES	(1) 90-06	(2) Pre 97	(3) 97-98	(4) Post 98	(5) 90-06	(6) Pre 97	(7) 97-98	(8) Post 98	(9) 90-06	(10) Pre 97	(11) 97-98	(12) Post 98
LEV	1.306***	3.879***	1.576***	1.258***	1.288***	3.889***	1.581***	1.234***	1.298***	3.872***	1.584***	1.249***
	(0.104)	(0.645)	(0.570)	(0.123)	(0.104)	(0.653)	(0.566)	(0.123)	(0.104)	(0.653)	(0.567)	(0.123)
COSTS	-0.359*	1.119	0.913	-0.243	-0.383**	1.035	0.910	-0.291	-0.405**	1.103	0.911	-0.310
	(0.191)	(0.932)	(0.828)	(0.227)	(0.191)	(0.942)	(0.822)	(0.228)	(0.191)	(0.950)	(0.823)	(0.228)
LIQ	-1.411***	-1.384**	-3.861***	-1.526***	-1.429***	-1.363**	-3.803***	-1.547***	-1.417***	-1.381**	-3.805***	-1.534***
	(0.115)	(0.626)	(0.657)	(0.136)	(0.116)	(0.628)	(0.643)	(0.136)	(0.115)	(0.630)	(0.645)	(0.136)
SIZE	1.182***	1.946***	2.338***	1.212***	1.200***	1.941***	2.320***	1.240***	1.189***	1.941***	2.323***	1.225***
	(0.0300)	(0.197)	(0.242)	(0.0362)	(0.0299)	(0.201)	(0.239)	(0.0361)	(0.0299)	(0.201)	(0.239)	(0.0361)
DEX	0.185***	0.00207	-0.107	0.246***								
	(0.0416)	(0.235)	(0.194)	(0.0494)								
DEX50					0.0771	0.130	-0.0513	0.0974				
					(0.0562)	(0.255)	(0.252)	(0.0679)				
EXPSHARE									0.279***	0.0209	-0.0217	0.348***
									(0.0797)	(0.352)	(0.343)	(0.0966)
Observations	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684
Nr of firms	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263

Note: The table presents coefficients and standard deviations in parenthesis. The dependent variable is DFL = 1 if the firm has foreign currency denominated loans, 0 otherwise. LEV is the total debt to total asset ratio at the beginning of the year, LIQ is the ratio of liquid assets of the firm to total assets at the beginning of the year, COSTS represents costs of sales over total sales, SIZE is measured as the log of the real total assets AGE is the number of years since firm incorporation. DEX is a dummy equal 1 if a firm has engaged in any exporting activity in the current year, 0 otherwise. DEX50 takes value 1 if the firm exports more than 50% of goods sold, 0 otherwise. EXPSHARE is the ratio of exports/total sales. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

Table 4. Probit Estimates of Foreign Currency Borrowing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	90-06	Pre 97	97-98	Post 98	90-06	Pre 97	97-98	Post 98	90-06	Pre 97	97-98	Post 98
LEV	0.312***	1.668***	-0.799	0.292**	0.247**	1.683***	-0.791	0.212*	0.285***	1.664***	-0.958	0.264**
	(0.0967)	(0.478)	(0.518)	(0.116)	(0.0973)	(0.483)	(0.508)	(0.117)	(0.0971)	(0.468)	(0.875)	(0.117)
COSTS	-0.0871	0.402	1.525**	0.175	-0.142	0.466	1.616**	0.0672	-0.204	0.534	0.891	0.00312
	(0.187)	(0.749)	(0.753)	(0.226)	(0.189)	(0.756)	(0.746)	(0.229)	(0.188)	(0.744)	(1.037)	(0.228)
LIQ	-1.637***	-1.673***	-4.328***	-1.884***	-1.678***	-1.650***	-4.422***	-1.940***	-1.650***	-1.668***	-4.210***	-1.906***
	(0.111)	(0.535)	(0.623)	(0.133)	(0.112)	(0.543)	(0.602)	(0.134)	(0.112)	(0.533)	(1.377)	(0.133)
CHAEBOL	1.528***	1.424	1.566**	1.664***	1.647***	1.670*	1.655**	1.803***	1.595***	1.059	1.222	1.736***
	(0.231)	(1.259)	(0.769)	(0.281)	(0.234)	(0.985)	(0.805)	(0.281)	(0.233)	(0.786)	(1.184)	(0.282)
DEX	0.507***	0.199	0.138	0.648***								
	(0.0404)	(0.198)	(0.185)	(0.0486)								
DEX50					0.334***	0.125	0.304	0.402***				
					(0.0542)	(0.219)	(0.229)	(0.0664)				
EXPSHARE									0.849***	0.0204	0.671	1.031***
									(0.0787)	(0.299)	(0.589)	(0.0966)
Observations	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684
No of firms	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263

Note: The table presents coefficients and standard deviations in parenthesis. CHAEBOL is 1 if the firm is part of a chaebol, 0 otherwise. See also notes to Table 3.

Table 5. Probit Estimates of Foreign Currency Borrowing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	90-06	Pre 97	97-98	Post 98	90-06	Pre 97	97-98	Post 98	90-06	Pre 97	97-98	Post 98
LEV	0.657***	2.665***	0.707	0.651***	0.606***	2.670***	0.736	0.593***	0.657***	2.665***	0.707	0.651***
	(0.0976)	(0.544)	(0.587)	(0.118)	(0.0978)	(0.551)	(0.574)	(0.118)	(0.0976)	(0.544)	(0.587)	(0.118)
COSTS	-0.193	0.517	1.463*	-0.0193	-0.245	0.547	1.413*	-0.119	-0.193	0.517	1.463*	-0.0193
	(0.184)	(0.804)	(0.839)	(0.223)	(0.185)	(0.812)	(0.823)	(0.224)	(0.184)	(0.804)	(0.839)	(0.223)
LIQ	-1.446***	-1.430***	-4.344***	-1.654***	-1.478***	-1.433***	-4.164***	-1.691***	-1.446***	-1.430***	-4.344***	-1.654***
	(0.110)	(0.540)	(0.643)	(0.132)	(0.111)	(0.545)	(0.627)	(0.132)	(0.110)	(0.540)	(0.643)	(0.132)
AGE	0.0603***	0.0862***	0.156***	0.0607***	0.0633***	0.0870***	0.151***	0.0653***	0.0603***	0.0862***	0.156***	0.0607***
	(0.0029)	(0.0147)	(0.0158)	(0.0034)	(0.0029)	(0.0150)	(0.0158)	(0.0035)	(0.0029)	(0.0147)	(0.0158)	(0.0034)
DEX	0.439***	0.127	-0.0268	0.552***								
	(0.0400)	(0.207)	(0.198)	(0.0482)								
DEX50					0.305***	0.0687	0.260	0.366***				
					(0.0536)	(0.223)	(0.247)	(0.0656)				
EXPSHARE									0.439***	0.127	-0.0268	0.552***
									(0.0400)	(0.207)	(0.198)	(0.0482)
Observations	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684	28,684	5,645	3,355	19,684
No of firms	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263	4,933	1,451	2,318	4,263

Note: The table presents coefficients and standard deviations in parenthesis. See also notes to Table 3.

Table 6. Random Effects Probit Marginal Effects (relating to Table 5)

VARIABLES	(1) 90-06	(2) Pre 97	(3) 97-98	(4) Post 98	(5) 90-06	(6) Pre 97	(7) 97-98	(8) Post 98	(9) 90-06	(10) Pre 97	(11) 97-98	(12) Post 98
LEV	0.1091	0.0249	0.0267	0.1199	0.1020	0.0226	0.0351	0.1116	0.1070	0.0222	0.0337	0.1191
COSTS	-0.0321	0.0048	0.0553	-0.0036	-0.0413	0.0046	0.0674	-0.0223	-0.0498	0.0051	0.0610	-0.0317
LIQ	-0.2401	-0.0134	-0.1643	-0.3046	-0.2488	-0.0121	-0.1987	-0.3181	-0.2428	-0.0121	-0.1852	-0.3103
AGE	0.0100	0.0008	0.0059	0.0112	0.0107	0.0007	0.0072	0.0123	0.0104	0.0007	0.0068	0.0118
DEX	0.0729	0.0012	-0.0010	0.1018								
DEX50					0.0514	0.0006	0.0124	0.0688				
EXPSHARE									0.1276	-0.0003	0.0254	0.1711

Table 7

Panel A

VARIABLES	(1) SBR1	(2) SBR1	(3) SBR1	(4) SBR1	(5) SBR1	(6) SBR1	(7) SBR1	(8) SBR1
Δ SBR1		1.094*	1.034**	0.941*		1.074*	1.022**	0.926*
		(0.558)	(0.521)	(0.527)		(0.557)	(0.518)	(0.525)
Δ COSTS		0.0667	0.0814	0.0349		0.0847	0.111	0.0679
		(0.355)	(0.342)	(0.336)		(0.357)	(0.344)	(0.337)
Δ LEV			-0.185				-0.200	
			(0.122)				(0.122)	
AGE1996			-0.009***	-0.007***			-0.009***	-0.007***
			(0.002)	(0.002)			(0.002)	(0.002)
Δ LEV (-1)				0.069				0.069
				(0.121)				(0.121)
DEX50 1996	0.155***	0.162***	0.145***	0.153***				
	(0.040)	(0.04)	(0.040)	(0.039)				
EXPSHARE1996					0.245***	0.254***	0.237***	0.243***
					(0.063)	(0.065)	(0.062)	(0.059)
CHAEBOL1996	0.021	0.029	0.092*	0.089*	0.016	0.023	0.086*	0.084
	(0.052)	(0.053)	(0.052)	(0.052)	(0.053)	(0.053)	(0.052)	(0.053)
Observations	616	616	616	584	616	616	616	584
R-squared	0.024	0.032	0.098	0.080	0.029	0.036	0.103	0.085

Panel B

VARIABLES	(1) SBR2	(2) SBR2	(3) SBR2	(4) SBR2	(5) SBR2	(6) SBR2	(7) SBR2	(8) SBR2
Δ SBR2		0.194**	0.216***	0.203**		0.203**	0.225***	0.213**
		(0.090)	(0.083)	(0.085)		(0.0909)	(0.0832)	(0.0847)
Δ COSTS		-0.014	-0.066	-0.056		-0.00468	-0.0434	-0.0340
		(0.385)	(0.368)	(0.352)		(0.387)	(0.371)	(0.353)
Δ LEV			-0.083				-0.101	
			(0.136)				(0.136)	
AGE1996			-0.009***	-0.007***			-0.009***	-0.007***
			(0.002)	(0.002)			(0.002)	(0.002)
Δ LEV (-1)				0.167				0.159
				(0.154)				(0.154)
DEX50 1996	0.160***	0.162***	0.144***	0.145***				
	(0.043)	(0.043)	(0.042)	(0.040)				
EXPSHARE1996					0.250***	0.256***	0.238***	0.230***
					(0.067)	(0.068)	(0.065)	(0.061)
CHAEBOL1996	0.039	0.028	0.096*	0.085	0.034	0.023	0.091	0.082
	(0.057)	(0.058)	(0.057)	(0.057)	(0.058)	(0.059)	(0.057)	(0.058)
Observations	548	548	548	525	548	548	548	525
R-squared	0.027	0.036	0.094	0.087	0.031	0.041	0.100	0.092

Table 7 (cont)

Panel C

VARIABLES	(1) LBR	(2) LBR	(3) LBR	(4) LBR	(5) LBR	(6) LBR	(7) LBR	(8) LBR
Δ LBR		0.342**	0.271**	0.267**		0.340**	0.268**	0.263*
		(0.138)	(0.135)	(0.134)		(0.139)	(0.136)	(0.134)
Δ COSTS		-0.202	-0.130	-0.277		-0.185	-0.100	-0.255
		(0.319)	(0.310)	(0.297)		(0.321)	(0.312)	(0.299)
Δ LEV			-0.225*				-0.239**	
			(0.118)				(0.118)	
AGE1996			-0.008***	-0.007***			-0.009***	-0.009***
			(0.002)	(0.002)			(0.002)	(0.002)
Δ LEV (-1)				-0.008				-0.008
				(0.099)				(0.099)
DEX50 1996	0.137***	0.138***	0.120***	0.127***				
	(0.038)	(0.039)	(0.038)	(0.036)				
EXPSHARE1996					0.212***	0.211***	0.195***	0.196***
					(0.0597)	(0.061)	(0.059)	(0.055)
CHAEBOL1996	0.037	0.040	0.0998**	0.101**	0.033	0.036	0.096*	0.098*
	(0.051)	(0.051)	(0.050)	(0.050)	(0.052)	(0.052)	(0.050)	(0.051)
Observations	626	626	626	596	626	626	626	596
R-squared	0.020	0.031	0.096	0.073	0.023	0.033	0.100	0.075

Note: The table presents coefficients and robust standard deviations in parenthesis. The dependent variable is the difference in firm sales (log) between 1999 and 1996 in all panels. The financial variable is SBR1 (the ratio of short term borrowing in foreign currency to total assets) in panel A, SBR2 (short term borrowing in foreign currency in relation to short term total borrowing) in panel B, and LBR (long term borrowing in foreign currency relative to total borrowing) in Panel C. Δ is the first difference indicator (post- minus pre-crisis level) while 1996 denotes the pre-crisis level of the variable. The other variables are defined as in the notes to Tables 3 and 4.