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Trade Credit and Bank Credit:

Evidence from Recent Financial Crises♦

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ABSTRACT

This paper studies the effect of financial crises on trade credit in a sample of 890 firms in six emerging economies. We find that although provision of trade credit increases right after the crisis, it consequently collapses in the following months and years. We observe that firms with weaker financial position (for example, high pre-crisis level of short-term debt and low cash stocks and cash flows) are more likely to reduce trade credit provided to their customers. This suggests that the decline in aggregate credit provision is driven by the reduction in the supply of trade credit, which follows the bank credit crunch. Our results are consistent with the "redistribution view" of trade credit provision, in which bank credit is redistributed via trade credit by the firms with stronger financial position to the firms with weaker financial stand.

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The financial crises experienced by emerging markets during the nineties present extreme cases of collapse of institutional financing and, consequently, can be useful in studying the role of alternative sources of financing during periods of severe monetary contraction. Previous evidence suggests that trade credit could play an important role by compensating for unavailable bank credit. Petersen and Rajan (1997) find that firms with weaker banking relations use more trade credit; Nilsen (2002) shows that small firms and large firms without bond ratings increase reliance on trade credit during monetary contractions; Fisman and Love (2003) argue that in countries with undeveloped financial intermediaries trade credit provides an alternative source of funds, which allows higher growth rates in industries that can be characterized as intense trade credit users. Wilner (2000) claims that suppliers tend to assist customers in distress to maintain long-term commercial relationships. This paper contributes to the previous literature by studying the ability of trade credit to provide an alternative source of financing during financial crises.[1]

We study the effects of the 1997 Asian Crisis on firms operating in Indonesia, South Korea, Malaysia, Philippines and Thailand, and the impact of the 1994 Peso devaluation on Mexican firms. We create a panel of about 890 large, publicly traded firms, and analyze their trade credit behavior around the crisis time. We are most interested in examining whether trade credit can compensate for contracted bank credit during the credit crunch that characterizes financial crises.

We find that trade credit provided and received by the firms in our sample increases immediately after the crisis. More surprisingly, we find that the trade credit

[1] Papers by Krugman (1999), Aghion, Bacchetta and Banerjee (2000a, b and 2001), Chang and Velasco (1999), Ding, Domac and Ferri (1998), Ding and Domac (1998), Calomiris and Beim (2001) and Bris at al. (2002) among others study financial crisis.

provided by our firms (as opposed to what they receive) collapses in the aftermath of the crisis and continues to contract for several years. Because we measure trade credit provided as a ratio of accounts receivable to sales, the decline in credit provision is not simply driven by decline in sales. In other words, we find that credit provided by our firms declines more than their sales, in percentage terms.

As in any study of credit provision, the interpretation of our results is inherently difficult because of the familiar "identification problem". The prolonged decline in trade credit provided by the firms in the aftermath of the crisis could be due to the unwillingness of customers to take on more credit (a demand effect), or to the inability of the suppliers of goods to provide such a credit (a supply effect). Thus, a declining pattern of trade credit provision does not automatically mean that trade credit cannot play an important role in compensating for contracted bank credit.[2]

To understand what is driving the equilibrium patterns of trade credit, we study firms' heterogeneous responses to the crisis events. More specifically, we analyze trade credit policy as a function of firms' relative financial health. If the reduction of trade credit provision is significantly higher for firms that have weaker financial conditions, it would imply that the contraction of such credit is most likely driven by a supply effect. Using several crisis-specific indicators of firms' relative financial strength, we find that this is indeed the case.

The main financial indicator we use is reliance on short-term debt. Firms with high share of short-term debt are likely to be the most disadvantaged by the crises, due to increased interest rates and difficulties in rolling over their debts. We observe that before

[2] In other words, if the trade credit provided in equilibrium falls after the crises because customers demand less trade credit, then this pattern does not say anything about the ability of trade credit to compensate for contracted bank credit. If, on the other hand, trade credit provision falls because firms reduce their credit

crises, when short-term debt is abundant and (relatively) cheap, firms with higher percentage of short-term debt provide more credit to their customers and rely less on credit from suppliers. However, after the crisis, these firms face a disadvantaged financial position, and consequently they significantly cut the credit extended to their customers, and use more credit from suppliers. That is, firms with higher reliance on short-term debt are the main suppliers of trade credit during non-crisis periods, but they reduce trade credit provision relatively more as a response to the aggregate collapse of bank credit.

We also use two indicators of liquidity (using cash stocks and cash flow) as an alternative measure of firm's financial health. We find that firms with relatively lower liquidity also show a larger decrease in their trade credit provision after crises. We avoid endogeneity problem by using pre-crisis measures of financial health to study the post-crisis trade credit policy.

While it is likely that some firms benefit from the crisis, on average most firms are hurt by it. The result that firms with relatively weaker financial stand are more likely to reduce trade credit provision, coupled with the prevalent deterioration in firms' financial conditions around crises, suggests that the prolonged contraction in aggregate trade credit could be, to a large extent, attributed to the supply effect.

The identification of the temporary increase of trade credit at the peak of financial crisis is, however, different. Given the collapse of alternative sources of financing (which suddenly dry out or become very expensive), it is natural to expect an increase in trade credit demand in the immediate aftermath of the crisis, as firms move down in the

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supply without regarding for a similar or even increased demand, this pattern of trade credit would indeed imply that this instrument has only limited potential to compensate for bank credit.

pecking order.[3] What we do not know is whether suppliers willingly allow customers to take longer to repay (i.e. increasing supply to meet a higher demand) or they simply cannot avoid payments delays by their customers (i.e. unintended increase in supply). While we cannot decisively disentangle intended from unintended credit, our study makes it apparent that trade credit can provide a very short-term source of "emergency capital" due to the flexibility in credit terms, which allow for temporary extension of credit maturity. In line with this argument, Cuñat (2002) argues that this assistance in case of temporary illiquidity is one of the reasons why trade credit is so expensive.

In sum, our findings suggest that while trade credit could serve as a source of very short-term "emergency credit", it could not fully substitute for contracted bank credit in the longer aftermath of the crisis. We use the finding that firms with weaker financial position are showing the highest decline in the provision of credit to their customers to argue that the prolonged decline in trade credit provision we observe during post crisis periods is most likely driven by a supply effect. .

Our results are broadly consistent with the redistribution view of trade credit. This view posits that firms with better access to capital will redistribute the credit they receive to less advantaged firms via trade credit. This view was first proposed by Meltzer (1960) and further supported by Petersen and Rajan (1997) and Nilsen (2002) among others. We note that for actual "redistribution" to take place some firms need to be able to raise external finance, which they would pass on to less privileged firms.[4] However, during a financial crisis, alternative sources of finance are likely to dry out – stock

[3] Petersen and Rajan (1997)´s results imply that trade credit comes lower on the pecking order, suggesting that "borrowing from trade creditors, at least for longer periods of time, is a more expensive form of credit".

[4] For example, during monetary contractions in the US large firms increase the issuance of commercial paper (Calomiris, Himmelberg and Wachtel (1995)) and accelerate bank credit growth while small firms

markets crash and foreign lenders and investors pull out their money. As all potential sources of funds collapse there may be "nothing to redistribute" in terms of trade credit; thus, contraction in the supply of formally intermediated funds lead to contraction in the supply of trade credit finance. Consistent with this argument, we also find that countries that experience a sharper decline in bank credit also experience a sharper decline in trade credit.[5]

The remainder of the paper is as follows. Section II describes the data and presents basic descriptive statistics and graphical analysis. In section III we discuss our empirical strategy. In section IV we present the results and in Section V we conclude.

II. Data

II.1. Sample

We study two of the four major crises that occurred during the nineties, i.e. the Mexican devaluation in late 1994-early 1995, and the South East Asia currency crisis in mid-1997 including Indonesia, Korea, Malaysia, Philippines and Thailand.[6] We use the Worldscope database, which contains data on publicly traded firms around the world and represents about 95% of the world's market value. Since it focuses mostly on the firms for which there is a significant interest of international investors, the sample represents the largest firms in each country. Our study excludes all financial firms.

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reduce it (Gertler and Gilchrist (1994)). Such access to alternative sources of finance in the US is likely to be behind the aggregate increase in trade credit (during monetary contractions) observed by Nilsen (2002).

[5] Our results are also consistent with patterns observed in Demirguc-Kunt and Maksimovic (2001). They find that the provision of trade credit across countries is positively correlated with the level of development of financial intermediaries.

[6] We are not able to include the analysis of the Russian default occurred in 1998 and the Brazilian devaluation in early 1999 due to lack of data. We chose not to include information on China and Taiwan because, even though they also suffered contemporaneous financial crisis, their impact is thought to be less spread and not as pronounced.

The periods of financial crises are usually characterized by high rate of liquidations and consolidations, which creates an unbalanced sample of firms (Worldscope immediately delists all firms that go through any type of reorganization). We present our results using this unbalanced sample to avoid an attrition bias, however, all our results still hold when estimated on two alternative balanced samples.[7] Table 1 Panel A reports the number of firms per country (counted at the crisis year) showing a total sample of 890 firms.

II.2. Crisis timing

Table 1 Panel A reports the time of each crisis considered in our sample. To trace out the timing before and after the crisis we create the timeline variable, which equals to zero for the crisis year and takes values –1, –2, –3 and 1, 2, 3 for the subsequent pre- and post-crisis years respectively. The crisis year is defined for each firm at the fiscal year ending within the 12-month interval after the crisis hit. Thus, for example, for the Asian countries that were hit by the crisis in July 1997, the crisis year is defined as 1997 for those firms which fiscal year ends from August to December 1997, and as 1998 for those closing between January and July 1998.

II. 3. Dependent Variables

Our main variables of interest are accounts payables and accounts receivables, which show the amount of trade credit that firms obtain from suppliers and provide to customers, respectively. We scale these trade credit variables using sales (for receivables)

[7] The first sample, called "balanced 5", contains all firms that are present in the Worldscope database for at least 2 years before and after the crisis (therefore covering 5 years around the crisis time); and the second sample, "balanced 7", contains firms that are in the dataset for at least 7 years around the crisis time.

and cost of goods sold (for payables).[8] These ratios capture the importance of trade credit in the financing of the economic activity. One advantage of using ratios scaled by flow variables is that these measures control for decline in economic activity (i.e. sales) that are commonly associated with crises. Thus, whenever we find a declining ratio of accounts receivables to sales, we know that accounts receivables have declined *more* than sales, in percent terms.

There are two ways these ratios could be interpreted. If trade credit were extended for the whole year, the ratio of receivables to sales would show what percent of sales is done on credit. However, as trade credit usually has much shorter maturity, the alternative interpretation of such a ratio is the number of days the customers take to repay the credit (assuming all customers receive 100% of credit).[9] In reality, the ratios are likely to capture both, the percent of the goods sold on credit and the time it takes before the credit is repaid. We follow tradition and multiply these ratios by 360 and interpret them in terms of the number of days credit is extended and received (keeping the above caveat in mind).

We also study net credit as the difference between receivables and payables, again, scaled by sales. Firms that obtain more credit from suppliers are likely to be more willing to extend credit to their customers. In this sense, net credit shows the relative willingness to extend trade credit, *net* of the credit firms receive themselves.

Thus, we use the following set of three dependent variables:

TRECTOS: Trade Receivables / Total Sales

[8] It would be best to scale payables by the cost of materials purchased rather than total cost of the goods sold, which includes labor costs, but such data is not available in our dataset (neither it is in most other datasets used in previous papers). As a second best approach (also used in other studies) we scale payables by the total cost.

TPAYTOC: Trade Payables / Cost of Goods Sold

NTCS: (Trade Receivables – Trade Payables)/ Total Sales

To ensure the robustness of our results, we examined the distribution of our key variables and removed outliers. We removed all figures that appeared to be misreported (such as negative numbers for trade credit or assets). For our trade credit ratios we eliminated all values that implied trade credit of over one year long (this eliminated about 2-3% in the top tail of the distribution).

II.4. Descriptive analysis

Figure 1 presents the medians of trade credit ratios and the aggregate bank credit figures around the crisis time. We observe that all trade credit ratios exhibit very similar patterns – a slight increase in the crisis year and sharp declines in post crisis times. The decline is most pronounced for net trade credit (from the highest to the lowest point the drop is about 36%) and is much less dramatic for payables (with a change of only about 15%). We also see that trade payables start to go up in the second year after the crisis and almost fully recover in the third year; receivables, on the other hand, stay low for all 3 years after the crisis.[10] Interestingly, we observe that bank credit growth declines in the two consecutive years after the crisis hit, clearly resembling the behavior of trade credit.

[9] In the US, for example, the most often term for extension of trade credit is about 30 days, and it varies by industry, from about 10 days to 60 days (see Ng, Smith, and Smith (1999) and Mian and Smith (1992)). Rarely, if ever, trade credit is extended for over 6 months.

[10] We also plot ratios scaled by assets, for comparison. We referred to them as *trectoa, tpaytoa* and *ntca* for receivables, payables and net trade credit respectively. When the graphs are done separately for each country, we find that most countries follow the same aggregate patterns. The most uniform behavior is observed for receivables and net credit, while payables seem to exhibit more variation across countries. Reproducing these graphs for mean ratios generates identical patterns.

Table 1, Panel C presents tests for statistical significance of the differences in trade credit figures between crisis and post-crisis periods relative to the pre-crisis time. The outcome is very consistent with our graphical analysis: both payables and receivables show a significant increase in the crisis year, but only trade receivables and net credit show a persistent decline in subsequent periods relative to the pre-crisis one. In the next section we present the empirical models we use to study these patterns more formally.

III. Empirical Strategy

To study the effects of the crisis and the post-crisis on trade credit, we employ a standard panel-data approach utilizing a firm fixed effects model. The fixed effects capture the unobserved heterogeneity in the firm-specific (i.e. time-invariant) levels of trade credit and allow us to isolate the effects of crisis and post-crisis relative to the pre-crisis behavior.

III.1. Aggregate behavior

Our first test studies the aggregate behavior of firms during and after crises. To implement it we define dummy variables for the crisis and post-crisis years, labeled as CRISIS and POST, respectively. Combined with the fixed effects, these two dummies capture the changes in trade credit relative to several years of pre-crisis data.

We use the following model:

$$TC_{it} = \alpha_i + \beta_1 * CRISIS_{ct} + \beta_2 * POST_{ct} + \beta_3 X_{it} + \varepsilon_{it} \quad (1)$$

Where TC is one of the three trade credit measures described in the data section, X is a vector of firm and country time-specific control variables, α is a firm fixed effect and ε is an error term.

The CRISIS and POST-crisis dummies show the difference of trade credit ratios in the crisis and post-crisis years relative to the average of pre-crisis years. In the reported regressions we use two dummies: POST12 and POST3, which equal one for the first two years and the third year following the crisis, respectively.[11]

We estimate the model using a technique that allows for extra care in treating the error term. In particular, to make sure our results are robust to any possible temporal correlation among the firms in each country-year period, we define a "clustering" variable as a combination of country *and* time. Introducing a "cluster" option in our methodology allows for an unspecified correlation structure of errors within the "clusters". This is important since during the crisis and post-crisis years, the errors (i.e. unexplained variation) could be correlated for the firms within the country. However, the correlation might be different for pre-crisis, crisis or post-crisis years.

Causal factors that are either time-invariant (for example industry) or slowly changing (for example size) would be mostly captured by the fixed effects. To control for factors that vary significantly over time we use several control variables (included in the vector X in model 1) that have been suggested by the trade credit literature.[12] We use the ratio of cash flow to total assets, the ratio of cash balances to total assets (measured at the beginning of the period), and the firm-level sales growth rate in the previous year.

[11] We also run all regressions with a separate set of dummies (i.e. POST1, POST2 and POST3), all results remain consistent and are available on request.

[12] See Petersen and Rajan (1997) and Calomiris, Himmelberg and Wachtel (1995) for discussion of the variable choice.

Finally, we control for the depreciation of the exchange rate to capture the country-time differences in the magnitude of the crisis and recovery.

We removed observations with extreme values of sales growth, cash and cash flows ratios (outside of the 1% tails in the distribution).[13] Summary statistics for these variables are reported in Table 1, Panel B.

III.2. Heterogeneous firm responses

To understand what is driving the aggregate results, we analyze firms' heterogeneous responses to crisis events as a function of their relative financial positions. We use several indicators of the firm's financial strength.

First, we use a ratio of short-term debt to assets. Firms with a high proportion of short-term debt are likely to be the most disadvantaged by the crisis because they need to roll-over their debt when it is either impossible or extremely costly. While high share of short-term debt is not necessarily an indication of strong financial position before the crisis, it is clearly an indication of weak financial position right after it.

Second, we use more "standard" proxies for liquidity position of the firm: firm's cash flow and cash stock (both relative to firm's assets). We conjecture that firms with larger pre-crisis stock of cash holdings (i.e. liquidity) as well as those with larger cash flow generation can fall back on this cushion during the crisis times, and are therefore likely to be in a better financial position to provide trade credit to their customers (as well as to avoid making use of expensive financing from their suppliers).

To study differences in firm's responses to crisis, we interact our financing variables with crisis and post crisis dummies. One may worry about the endogeneity of

contemporaneous financing variables, such as short-term debt and liquidity measures, given that they are likely to be affected by the firm's trade credit policy. To address this potential concern, we use pre-crisis levels of our financing variables in the interaction terms. Thus, we study responses to crisis in firms with different pre-crisis financial health.

We use the following extension of the model in equation (1):

$$TC = \alpha_i + \beta_1 * CRISIS_{ct} + \beta_2 * POST_{ct} + \\ + \beta_3 FIN_{i(-1)} * CRISIS_{ct} + \beta_4 FIN_{i(-1)} * POST_{ct} + X_{it} + \varepsilon_{it} \quad (2)$$

where $FIN_{i(-1)}$ represents one of the above described indicators of financial position. Since FIN is not time-varying (because it is measured at the pre-crisis level), the level of FIN is subsumed into the fixed effects.

In this model, the effect of crisis on TC depends on the level of financial indicator, FIN. For firms with FIN equal to zero, the difference in trade credit ratios during crisis and post-crisis years (relative to pre-crisis average) will be given by β_1 and β_2, respectively; same as in model (1). However, the effect of crisis on TC will vary for firms with different levels of FIN: e.g. for firms with a financial indicator equal to F, the difference in trade credit levels during the crisis (relative to pre-crisis) will be given by $\beta_1 + \beta_3 * F$.

III.3. Heterogeneous country-level response to crisis

[13] To preserve our sample size we do not drop outlier observations but simply set them to missing, As a result the number of actual observations used is somewhat different from model to model.

Our final test explores the variation in bank credit growth across years and countries in our sample.[14] To test the effect of bank credit growth on trade credit behavior before, during and after the crisis, we use the following model:

$$TC_{it} = \alpha_i + \beta_1 * CRISIS_{ct} + \beta_2 POST_{ct} + \beta_3 CREDITGR_{ct} + \beta_4 CREDITGR_{ct} * CRISIS_{ct} + \beta_5 CREDITGR_{ct} * POST_{ct} + X_{it} + \varepsilon_{it} \quad (3)$$

Where CREDITGR is the country-year growth rate in the private credit to GDP ratio (obtained from the IFS). The coefficients β_3, β_4 and β_5 show the reaction of trade credit to bank credit growth during the pre-crisis, crisis and post-crisis respectively. As before, we allow for the same set of control variables for robustness checks. Finding positive coefficients on β_3, β_4 and β_5 would suggest that increase in bank credit leads to more trade credit provided and/or received by firms in our sample, consistent with the redistribution story.

IV. Results

IV.1. Aggregate patterns

We present our main results using the unbalanced sample.[15] All tables show the first three regressions without control variables and the following three including the set of time varying control variables.

Table 2 presents our basic results. The coefficients on the crisis and post-crisis dummies show the difference in trade credit during these stages relative to the pre-crisis

[14] Since we only have 6 countries and at most 7 years, we are concerned about the degrees of freedom. Therefore these results should be interpreted with caution.
[15] Results for the "balanced 5" and "balanced 7" samples are very similar and are available on request.

period. We observe the same pattern shown in the graphical analysis. In particular, accounts receivables increase immediately after the crisis and then drop sharply in the post-crisis time. Account payables, however, after increasing at the peak of the crises, do not exhibit a significant decline (relative to pre-crisis figures). In terms of the magnitude, we observe that during the crisis year both payables and receivables increase by about a week, relative to the pre-crisis period. In the post-crisis, however, the receivables drop by the same amount in the first two years (again, relative to pre-crisis figures) and continue dropping well into the third year.[16]

As discussed earlier, there could be several alternative explanations for these patterns. On the one hand, the decline in trade credit provided could be the result of a supply effect: the firms that suffer from lack of access to intermediated credit reduce the supply of credit they are willing to provide to their customers. On the other hand, this pattern would be also consistent with a demand-side story: the customers of our firms become less willing to take on more credit. To understand these aggregate patterns, below we explore the firms' heterogeneous responses to crisis.

We focus on deciphering the reasons for the aggregate decline in trade credit provided by our firms in the post-crisis years as this result is both more surprising and more prolonged (as it continues for several years after the crisis) than the short-term increase in trade credit provided during the crisis year. In addition our data are not well-suited to study the reasons for temporary increase in trade credit (for example, we do not

[16] Because the trade credit maturity is usually much shorter than one year, the temporary spike in both ratios is not simply caused by a mechanical relationship due to contraction in the scaling factor (i.e. sales or cost of goods sold). Suppose the crisis occurred several months before the end of the fiscal year and the maturity of receivables is less than one year. Then, the mechanical relationship would actually run in reverse – if accounts receivable decline as much as sales do, the ratio of receivables to sales would go *down* because the numerator will reflect a post-crisis low level of receivables (extended on post-crisis low level of sales), while the denominator would reflect the whole year of sales (i.e. high pre-crisis level and low post-crisis level).

have the data on non-performing loans, or the data on reclassified receivables), while we do have enough data to shed some light on the reasons for decline in trade credit after the crisis.

IV.2. Heterogeneous firm responses

In this section, we study firms´ trade credit policy as a function of their relative financial health. The supply-driven reason for decline in trade credit provision after the crisis would be caused by the unwillingness (or inability) of suppliers to provide credit to their customers. In this case, we would expect that those firms in more difficult financial position would be the most likely to cut the supply of credit to their customers. The supply-driven reason for reduction in trade credit provided to firms' customers would imply that such a reduction is relatively higher for firms with weaker pre-crisis financial conditions. This argument forms our main identification strategy.

IV.2.1. Short-term debt.

As suggested earlier, firms that enter the crisis with a high proportion of short-term debt are likely to be particularly disadvantaged by the credit crunch, because of the higher costs of short-term debt and difficulties in rolling it over. Even though the contemporaneous short-term debt to assets ratio is likely to be endogenous, we initially run the regressions using this figure, because it allows us to observe the effect of short-term debt in the pre-crisis period. We estimate model (2) and present results in Table 3, Panel A.

The coefficient on *Stdtoa* shows the effect of short-term debt on firms´ pre-crisis trade credit provision: We find that firms with higher percent of short-term debt provide more credit to their customers during non-crisis times. To get a sense on the order of

magnitude in which the reliance of short-term debt affects trade credit policy, we focus on the results presented in Column 4 (which includes controls for time-invariant firm characteristics). The coefficients imply that firms with a ratio of short-term debt to assets equal to one[17] extend credit for about 50 more days relative to firms with zero short-term debt. Alternatively, an increase in short-term debt to assets by one standard deviation (0.18, as reported in Table 1, Panel B), would imply an increase in trade credit provided of about 9 days, which is an economically significant effect.

The CRISIS coefficient shows the effect of crisis on firms with zero short-term debt: these firms increase trade credit provided by about 11 days during the crisis, relative to the pre-crisis period. The coefficient on the interaction of *Stdtoa* and CRISIS shows how the response to crises changes as firms increase reliance on short-term debt. We find that firms with the maximum ratio of short-term debt to assets actually shorten the credit provided by about 16 days, relatively to pre-crisis levels (calculated as 11.32-27.81).

Finally, the post-crisis dummies (POST12 and POST3) show the difference in the post-crisis trade credit provision relative to pre-crisis for firms with zero short-term debt. Interestingly, these dummies are not significant, which suggests that firms with zero short-term debt do not experience a decline in trade credit provided in the aftermath of the crisis (relative to pre-crisis period). Thus, the decline in the aggregate trade credit observed in the post-crisis could be mostly attributed to firms with *some* short-term debt.

Looking at the interaction of *Stdtoa* and post-crisis dummies we analyze the differential effect of post-crisis on firms with different levels of short-term debt. The results imply that firms with a maximum amount of short-term debt cut the credit

[17] We use this extreme ratio of Stdtoa for illustration only. In our sample the maximum value for Stdtoa is

provided to their customers by about 50 days in the first two years after the crisis relative to what these firms provided in the pre-crisis period.[18] Hence, firms without short-term debt do not experience a significant decline in the credit provided to their customers in the post-crisis, while firms with more short-term debt experience a significant decline.

The above discussion focused on the effects of crisis and post-crisis on firms with different levels of short-term debt. An alternative interpretation could focus on the effects of short-term debt in different time periods. Thus, we see that while at the pre-crisis firms with a maximum amount of short-term debt extend credit for 50 more days (relative to firms with zero short-term debt), during the crisis these firms extend credit for only 21 more days (i.e. 48.99-27.81); finally, after the crisis, the trade credit policy of these firms is no longer different from that of firms with zero short-term debt (i.e. 48.99 – 50.68). In other words, all the extra credit that firms with a maximum amount of short-term debt provided at the pre-crisis (relative to firms with zero short-term debt) is eliminated in the post-crisis.

In addition to the effect of short-term debt on receivables, we see that firms with more short-term debt experience an increase in payables during and after the crisis. These results are consistent with the idea that firms with high short-term debt have a preferable financial position before the crisis (and therefore provide more credit to their customers) and a disadvantaged financial position after the crisis hit (which leads them to provide less credit to their customers and rely more on credit from suppliers).

As we already suggested, potential endogeneity could arise because short-term debt could be influenced by the trade credit policy. To control for such potential

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equal to 0.99.

[18] We calculate this effect by taking the coefficient on Post12*Stdtoa interaction, which is equal to –50.68 and assuming that Post12 dummy is equal to zero, since it is not significant.

endogeneity, we re-estimate our model using only pre-crisis values of short-term debt in interactions. The results are reported in Table 3, Panel B. There, the pre-crisis level of short-term debt is subsumed in fixed effects (because it is no longer time-varying) and we are only able to see the differential responses to the crisis events. We find the same response: firms with high pre-crisis level of short-term debt decrease trade credit provision during and after crises and increase reliance on credit from suppliers.

These results suggest that firms with high pre-crisis level of short-term debt are in a more difficult financial position after the crisis and, therefore, the decrease in trade credit they provided to their customers is driven by their unwillingness (or inability) to extend (i.e. supply) more credit. It is quite unlikely that the decrease in customer's demand for trade credit after the crisis would be related to the firm's financial position before the crisis. This allows us to rule out the demand-driven explanation for the decline in aggregate trade credit in favor of the supply-driven story. In other words, the disruption to the redistribution mechanism typically provided by trade credit comes from the special difficulties inflicted upon the most traditional suppliers of this type of credit, namely, the firms with higher exposures to short-term borrowing.

IV.2.2. Cash flows and liquidity

To test the robustness of our previous result, we use two other indicators of firms´ financial health. Firms that arrive at the crises with a large liquidity cushion (represented either by larger cash stocks or cash flow generation) are better fitted to financially support profitable commercial operations (by extending more credit to their customers) as well as to temporarily reduce reliance on credit from suppliers.

In Table 4 we estimate model (2), using the pre-crisis cash flow to net assets ratio as an alternative indicator of firms´ financial position. The interaction terms are positive and highly significant for receivables, with or without the subset of additional control variables. Thus, firms with high pre-crisis cash flow generation provide more financing to their customers both during and after crises. More specifically, the magnitudes of the coefficients imply that firms with cash flow ratios below the 86 percentile (about .13 in the data) reduce the credit provided to their customers after the crisis, while firms with cash flows ratios above the 86 percentile actually increase the credit they provide in the post-crisis. There is no evidence that firms with high cash flow make less use of trade credit during and after crises.

The next test includes the interaction of the crisis and post-crisis indicators with the pre-crisis cash to assets ratio. Results are presented in Table 5. There we observe that firms with higher pre-crisis cash to assets ratios tend to give more credit to their customers during crisis and post-crisis times. Finally, we also find that firms with larger stocks of cash rely less on credit from suppliers; this is only true, however, for the two years following the crisis hit.

Since we construct the interactions using pre-crisis cash flows and cash stocks, the results imply that firms that come to the crisis with a strong financial position are less affected by the crisis and consequently provide more credit to their customers, relative to firms that arrived at the crises with a weaker financial position. These two sets of results reinforce our conclusion above that the decline of trade credit observed after crises is mainly driven by a supply effect.

IV.3. Heterogeneous country-level response to crisis: Bank Credit Growth

To deepen our understanding of trade credit patterns during crisis and post-crisis times, we study the differences in response of trade credit to aggregate bank credit behavior. A further confirmation of the supply side story would suggest that countries that experience a sharper decline in bank credit should also experience a sharper decline in trade credit. In other words, the supply of intermediated credit would affect the supply of trade credit.

We use the model (3) and report the results in Table 6.[19] First, we observe a clear positive relationship between bank credit growth and extension of trade credit during the crisis period. Again, the positive response is the most significant for receivables, and not so much for payables, where coefficients are positive but non-significant. We also find that the post-crisis drop in trade credit provided by the firms in our sample (and therefore the drop in the net credit) is sharper for countries that experienced larger contractions in bank credit. Despite the potential limitations of this analysis, the results are consistent with the supply-driven explanation: Contractions in bank credit are at least partially responsible for contractions in trade credit. Since most of the contraction in bank credit is likely to come in the form of short-term debt not being rolled over (since long-term debt would not be immediately affected by the crisis), this result bodes well with our earlier results for firms with higher shares of short-term debt. These results are also consistent with Demirguc- Kunt and Maksimovic (2001) and Meltzer (1960).

V. Conclusions

We study the behavior of trade credit around the time of financial crises. The simple inspection of trade credit patterns shows a significant increase of trade credit at

the peak of financial crises, followed by a subsequent collapse of this source of financing right after the crisis events. This is also confirmed in a more thorough regression analysis.

Given that these findings could be explained by either supply- or demand-side stories, we study firms´ heterogeneous responses to crises, and characterize changes of trade credit policy around crises as a function of firms´ relative financial health. Specifically, we analyze two alternative indicators of firms' financial strength: reliance on short-term debt and liquidity.

We find that before the crises, firms with high proportion of short-term debt are significant providers of trade credit. However, after the crisis, these firms sharply cut the amount of credit they provide and increase reliance on credit from suppliers. In other words, what is a preferred financial position before the crisis (i.e. short-term debt) turns into a heavy disadvantage right after it, with the corresponding change in trade credit policy. We also find some evidence that more liquid firms (i.e. those with high cash stock or cash flow) extend more credit to their customers and rely less on credit from their suppliers.

Given that the reduction of trade credit provision is significantly higher for firms exhibiting weaker financial conditions, we conclude that the contraction of such a credit is most likely driven by a supply effect. Our findings show that even though trade credit could potentially serve a role of emergency assistance, this assistance is very short-term. In the long aftermath of the crisis, trade credit contracts as a result of overall shortage of funds and difficulties experienced by firms with high reliance on short-term debt. Our

[19] We use the country and time variation in the credit growth. However, since we only have 6 countries and 7 periods the degrees of freedom might be a concern. Therefore these results should be interpreted with a caution and would require more scrutiny in the subsequent research.

results highlight the importance of the aggregate bank credit availability, especially during the times of the crisis.

Although a useful start, our paper leaves many areas for future research. Our data includes only few crises in a small set of countries and consequently, leaves us with some concern regarding degrees-of-freedom. In addition, the patterns observed for largest publicly traded firms may not generalize to the rest of the firms' population. More research is needed to test whether the patterns we find hold for different firms' sizes and are robust in a different sample of crisis episodes. Finally, our paper does not answer the question of whether trade credit helps the firms to survive the crisis, or increase market share and profitability. These are important questions to warrant more future research on this topic with better-suited data.

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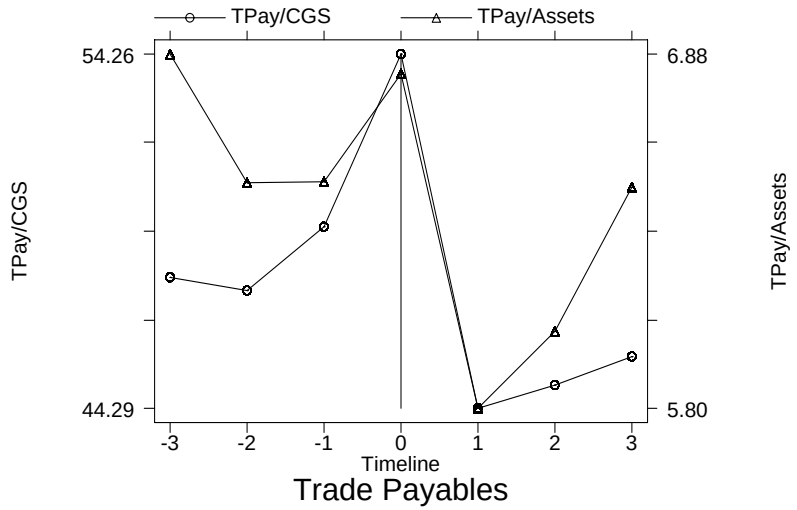
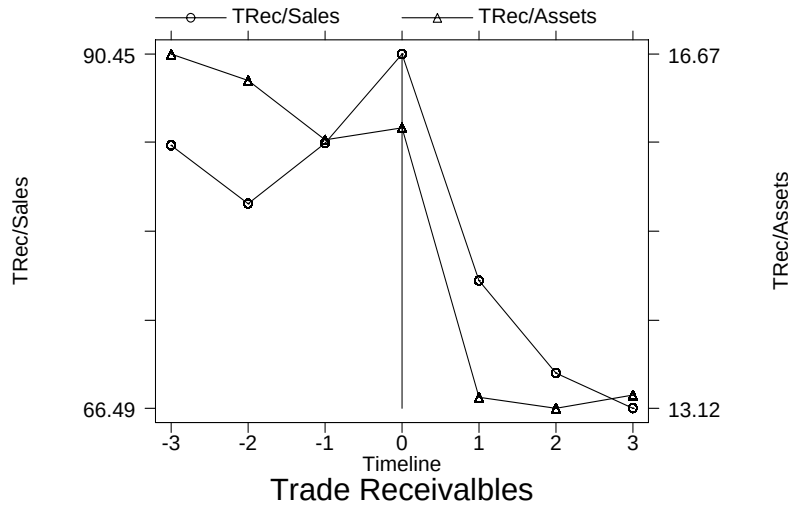
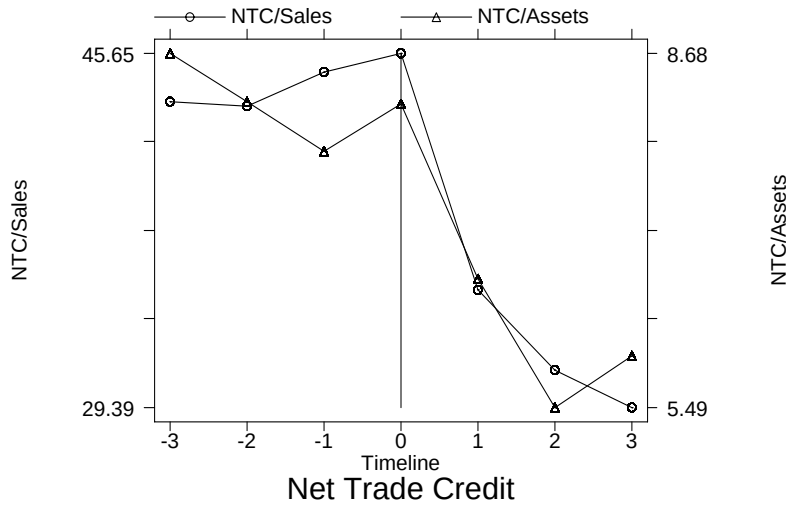
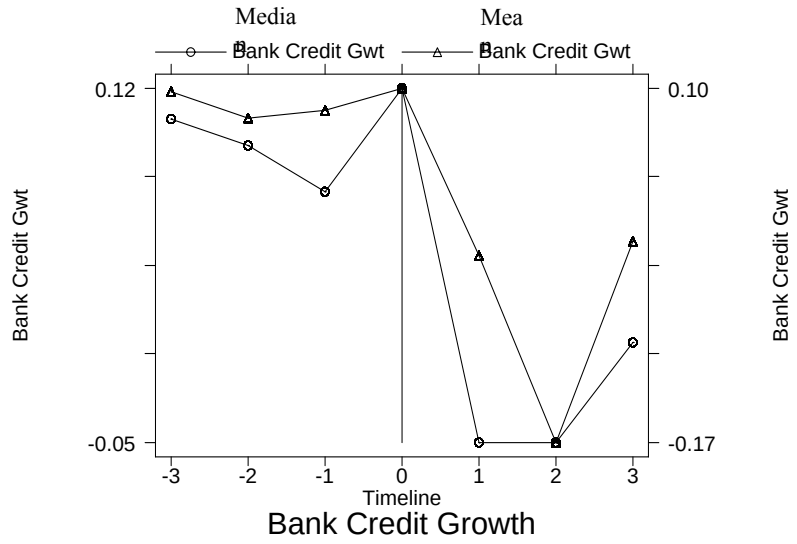

TPay/CGS
TPay/Assets
54.26
44.29
6.88
5.80
-3
-2
-1
0
1
2
3
Timeline
TPay/CGS
TPay/Assets
Trade Payables


TRec/Sales
TRec/Assets
90.45
66.49
16.67
13.12
-3
-2
-1
0
1
2
3
Timeline
TRec/Sales
TRec/Assets
Trade Receivalbles


NTC/Sales
NTC/Assets
45.65
29.39
8.68
5.49
-3
-2
-1
0
1
2
3
Timeline
NTC/Sales
NTC/Assets
Net Trade Credit


Media
Mea
Bank Credit Gwt
Bank Credit Gwt
0.12
-0.05
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-0.17
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Timeline
Bank Credit Gwt
Bank Credit Gwt
Bank Credit Growth

Table 1 Panel A: Number of Observations by Country

This table presents the number of observations by country, based on the number of non-missing values of the variable **Trectos** (computed as trade receivables / net sales), counted at the crisis time. The second column presents the Crisis Date for each country.

Country	Number of Observations	Crisis Date
Indonesia	102	Jul-97
Korea	236	Oct-97
Malaysia	261	Jul-97
Mexico	59	Dec-94
Philippines	54	Jul-97
Thailand	178	Jul-97
Total	890	

Table 1 Panel B: Summary Statistics

Trectos is measured as trade receivables / net sales, **Tpaytoc** is trade payables / cost of goods sold, and **Ntcs** is net trade credit (i.e. receivables minus payables) / net sales. **Cfw** is operating cash flow to assets, **Growth** is computed as lagged growth of sales, **Cashta** is cash/assets, **Exchrgr** is the country's devaluation of the currency in the last year, and **Stdtoa** is short term debt/total assets. The sample is the unbalanced panel of firms three years before and after each crisis.

Variable	N. Obs.	Mean	Min	Median	Max	St. Dev.
Dependent Variables						
Trectos	5552	94.03	0.00	80.86	290.67	60.68
Tpaytoc	5554	57.54	0.00	49.59	210.00	38.97
Ntcs	5325	51.42	-114.15	41.43	275.75	56.88
Control Variables						
Cfw	5651	0.05	-0.58	0.06	0.31	0.11
Growth	5255	0.05	-0.90	0.05	0.90	0.26
Cashta	5868	0.10	0.00	0.06	0.94	0.11
Exchrgr	5441	0.10	-0.24	0.03	1.24	0.23
Stdtoa	5755	0.21	0.00	0.17	0.99	0.18

Table 1 Panel C: ANOVA Analysis

This table reports the difference in means between the two periods and the corresponding p-values (computed using the Bonferroni-adjusted significance levels). **Trectos** is computed as trade receivables / net sales, **Tpaytoc** is trade payables / cost of goods sold, and **Ntcs** is net trade credit / net sales. The sample is the unbalanced panel of firms three years before and after each crisis.

Variable	Crisis vs. Pre-Crisis	Post-Crisis-vs. Pre-Crisis
Trectos	5.2930	-13.2226
	0.080	0.000
Tpaytoc	6.9031	0.5190
	0.000	1.000
Ntcs	0.0496	-14.93
	1.000	0.000

Table 2: Trade Credit in Aggregate

The dependent variables are the trade credit measures: **Trectos** is trade receivables / net sales, **Tpaytoc** is trade payables / cost of goods sold, and **Ntcs** is net trade credit (i.e. receivables minus payables) / net sales. **Crisis** is a dummy for crisis year, **Post12** is a dummy for first two years after the crisis and **Post3** is dummy for third year after the crisis. **Cfw** is operating cash flow to assets, **Growth** is lagged growth of sales, **Cashta** is cash/assets measured at the beginning of the year, **Exchrgr** is the rate of currency devaluation. The models are estimated with firm-fixed effects (see model (1) in the paper) using the unbalanced sample. The standard errors were obtained using clustering on country and time as explained in the paper. ***, ** and * represent coefficients significant at the 1%, 5% and 10% level. Absolute value of t-stats in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	7.58**	7.02**	2.07	6.85**	7.21**	1.64
	[2.04]	[2.12]	[0.82]	[2.03]	[2.11]	[0.63]
Post12	-6.29**	0.31	-7.56***	-7.57**	-0.31	-8.33***
	[2.02]	[0.22]	[2.63]	[2.28]	[0.19]	[2.88]
Post3	-13.94***	1.21	-15.04***	-14.16***	1.15	-14.63***
	[3.19]	[0.26]	[4.82]	[3.73]	[0.28]	[5.09]
Cfw				2.89	-9.26*	18.12**
				[0.28]	[1.66]	[2.09]
Growth				-4.69	-6.48***	0.08
				[1.40]	[3.11]	[0.03]
Cashta				4.41	3.31	4.38
				[0.49]	[0.37]	[0.33]
Exchrgr				7.82	-5.13	11.02***
				[1.58]	[1.23]	[3.07]
Observations	5552	5554	5325	4256	4244	4091
R-squared	0.74	0.63	0.72	0.79	0.69	0.76

Table 3: Trade Credit and Short-Term Debt

The dependent variables are the trade credit measures. See header to Table 2 for variable definitions. The **Stdtoa** is the ratio of short-term debt to assets measured at the individual firm level. This table shows the interactions of **Stdtoa** with the **Crisis, Post12** and **Post3** dummies. The models are estimated with firm-fixed effects (see model (2) in the paper), using the unbalanced sample. The standard errors were obtained using clustering on country and time as explained in the paper. ***, ** and * represent coefficients significant at the 1%, 5% and 10% level. Absolute value of robust t-stats in brackets.

Panel A: Contemporaneous levels of short-term debt.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	9.56**	5.02	4.31	11.32***	3.95	9.02***
	[2.24]	[1.22]	[1.31]	[3.08]	[0.94]	[3.12]
Post12	3.32	-0.01	3.29	3.1	-2.59	5.16*
	[1.04]	[0.01]	[1.15]	[0.83]	[1.19]	[1.73]
Post3	-2.4	-0.05	-2.45	-1.14	-0.93	0.99
	[0.59]	[0.01]	[0.95]	[0.27]	[0.17]	[0.36]
Stdtoa	49.91***	6.82	50.07***	48.99***	-11.11	64.57***
	[4.63]	[0.84]	[5.56]	[4.31]	[1.31]	[7.69]
Crisis * Stdtoa	-19.22**	6.14	-20.23**	-27.81***	14.55**	-41.00***
	[2.03]	[0.84]	[2.20]	[3.74]	[2.04]	[6.42]
Post12 * Stdtoa	-47.55***	0.28	-51.36***	-50.68***	12.03*	-64.02***
	[4.70]	[0.04]	[5.34]	[4.54]	[1.65]	[6.83]
Post3 * Stdtoa	-62.92***	5.9	-66.21***	-66.66***	9.27	-78.57***
	[5.09]	[0.49]	[4.68]	[5.27]	[0.89]	[6.66]
Cfw				-1.59	-10.37*	16.60*
				[0.15]	[1.89]	[1.86]
Growth				-4.66	-6.17***	-0.28
				[1.29]	[2.91]	[0.09]
Cashta				6.62	4.42	7.13
				[0.80]	[0.49]	[0.53]
Exchrgr				7.25	-5.25	10.05***
				[1.56]	[1.31]	[3.23]
Observations	5455	5460	5243	4194	4187	4036
R-squared	0.75	0.64	0.73	0.8	0.69	0.78

Panel B: Pre-crisis level of short-term debt.

The **Stdtoa1** is the firm-level ratio of short-term debt to assets computed one year before the crisis.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	11.22***	4.34	7.67**	14.36***	3.85	13.08***
	[2.81]	[1.18]	[2.23]	[3.26]	[1.01]	[3.55]
Post12	5.75	-0.64	5.93*	5.19	-3.78	7.51**
	[1.58]	[0.28]	[1.90]	[1.14]	[1.54]	[2.12]
Post3	-0.22	6.94	-3.26	0.03	3.28	0.63
	[0.04]	[1.13]	[0.81]	[0.01]	[0.55]	[0.18]
Crisis*Stdtoa1	-17.04*	13.67***	-27.12***	-33.90***	15.93***	-52.58***
	[1.85]	[2.96]	[3.20]	[2.82]	[3.08]	[5.47]
Post12*Stdtoa1	-61.93***	4.58	-69.33***	-61.01***	16.46**	-75.25***
	[5.64]	[0.73]	[7.05]	[4.41]	[2.33]	[6.66]
Post3*Stdtoa1	-72.02***	-29.20**	-61.93***	-70.23***	-11.88	-74.67***
	[3.94]	[2.20]	[4.20]	[3.89]	[1.01]	[4.86]
Cfw				4.18	-8.17	19.45**
				[0.40]	[1.44]	[2.21]
Growth				-5.25	-6.83***	-0.54
				[1.50]	[3.18]	[0.19]
Cashta				4.38	3.02	4.03
				[0.49]	[0.33]	[0.30]
Exchrgr				7.23	-4.81	10.28***
				[1.40]	[1.18]	[3.02]
Observations	5385	5377	5168	4183	4170	4021
R-squared	0.75	0.63	0.72	0.79	0.69	0.77

Table 4: Trade Credit and Cash Flows

The dependent variables are the trade credit measures. See header to Table 2 for variable definitions. The **Cfw1** is the measure of cash flow to total assets computed at the year prior to the crisis. This table shows the interactions of **Cfw1** with the **Crisis, Post12** and **Post3** dummies. The models are estimated with firm-fixed effects (see model (2) in the paper) using an unbalanced sample. The standard errors were obtained using clustering on country and time as explained in the paper. ***, ** and * represent coefficients significant at the 1%, 5% and 10% level. Absolute value of robust t-stats in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	4.54	6.72**	-2.37	3.95	8.66***	-4.46*
	[1.25]	[2.13]	[1.04]	[1.32]	[2.76]	[1.82]
Post12	-16.29***	-0.27	-18.05***	-17.49***	0.72	-19.92***
	[4.64]	[0.15]	[5.69]	[5.00]	[0.28]	[6.48]
Post3	-25.76***	-4.08	-24.46***	-27.73***	-3.13	-26.65***
	[4.84]	[0.70]	[8.16]	[5.83]	[0.59]	[9.81]
Crisis * Cfw1	50.83**	2.12	68.02***	48.75*	-21.71	84.75***
	[2.21]	[0.11]	[3.97]	[1.74]	[1.11]	[3.19]
Post12 * Cfw1	140.93***	6.24	144.94***	131.49***	-16.38	151.32***
	[5.84]	[0.29]	[6.62]	[4.83]	[0.67]	[5.92]
Post3 * Cfw1	159.10***	72.03*	123.73***	169.35***	51.2	144.48***
	[4.60]	[1.89]	[6.19]	[4.97]	[1.40]	[7.07]
Growth				-4.26	-6.59***	1.03
				[1.23]	[2.83]	[0.33]
Cashta				2.89	2.43	3.54
				[0.31]	[0.28]	[0.26]
Exchrgr				6.27	-3.45	8.65**
				[1.10]	[0.91]	[2.18]
Observations	5330	5326	5122	4291	4289	4122
R-squared	0.75	0.63	0.72	0.78	0.68	0.76

Table 5: Trade Credit and Cash Stock

The dependent variables are the trade credit measures. See header to Table 2 for variable definitions. The **Cashta1** is the ratio of cash to assets computed at the pre-crisis time. This table shows the interactions of **Cashta1** with the **Crisis, Post12** and **Post3** dummies. The models are estimated with firm-fixed effects (see model (2) in the paper) using an unbalanced sample. The standard errors were obtained using clustering on country and time as explained in the paper. ***, ** and * represent coefficients significant at the 1%, 5% and 10% level. Absolute value of robust t-stats in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	6.36*	7.16**	0.56	3.72	7.45**	-1.79
	[1.90]	[2.27]	[0.23]	[1.39]	[2.33]	[0.75]
Post12	-9.77***	1.39	-11.63***	-10.45***	2.29	-12.97***
	[2.64]	[0.73]	[3.24]	[2.86]	[1.40]	[3.80]
Post3	-18.71***	1.49	-19.60***	-18.57***	2.53	-20.47***
	[4.16]	[0.25]	[6.44]	[5.00]	[0.49]	[7.11]
Crisis*Cashta1	16.03	-1.63	18.98**	37.39**	-4.68	41.98**
	[1.21]	[0.15]	[2.17]	[1.98]	[0.32]	[2.42]
Post12*Cashta1	36.08**	-11.84*	41.60***	34.50*	-31.08***	54.68***
	[2.57]	[1.67]	[2.79]	[1.84]	[2.81]	[2.82]
Post3*Cashta1	47.44***	-1.49	43.81**	48.94**	-16.17	64.22***
	[2.82]	[0.12]	[2.57]	[2.29]	[1.18]	[2.80]
Cfw				4.5	-9.22*	20.53**
				[0.43]	[1.73]	[2.28]
Growth				-5.17	-6.79***	-0.53
				[1.49]	[3.20]	[0.17]
Exchrgr				7.72	-4.91	10.90***
				[1.51]	[1.25]	[2.95]
Observations	5388	5377	5171	4184	4170	4022
R-squared	0.74	0.63	0.72	0.79	0.69	0.76

Table 6: Trade Credit and Bank Credit Growth

The dependent variables are the trade credit measures. See header to Table 2 for variable definitions. The **Creditgr** is the annual growth of bank credit to the private sector scaled by GDP, for each country-year. This table shows the interactions of **Creditgr** with the **Crisis, Post12** and **Post3** dummies. The models are estimated with firm-fixed effects (see model (3) in the paper) using an unbalanced sample. The standard errors were obtained using clustering on country and time as explained in the paper. ***, ** and * represent coefficients significant at the 1%, 5% and 10% level. Absolute value of robust t-stats in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
	Trectos	**Tpaytoc**	**Ntcs**	**Trectos**	**Tpaytoc**	**Ntcs**
Crisis	-3.33	0.82	-4.1	-5.44	4.34	-8.96
	[0.45]	[0.15]	[0.70]	[0.62]	[0.68]	[1.24]
Post12	-8.33**	0.55	-9.91***	-10.96**	0.57	-12.39***
	[2.34]	[0.31]	[2.66]	[2.29]	[0.22]	[2.75]
Post3	-18.86***	0.31	-19.28***	-19.86***	0.1	-19.44***
	[4.60]	[0.07]	[6.46]	[4.77]	[0.02]	[5.77]
Credgr	-48.10*	-10.15	-41.01*	-66.37*	-14.03	-55.54*
	[1.81]	[0.74]	[1.79]	[1.76]	[0.57]	[1.87]
Crisis*Credgr	113.33**	63.58*	65.67	140.53**	38.19	116.54**
	[2.06]	[1.90]	[1.35]	[2.04]	[0.91]	[1.99]
Post12*Credgr	67.79***	20.19	52.05**	78.77**	26.67	58.11**
	[2.63]	[1.54]	[2.38]	[2.22]	[1.13]	[2.09]
Post3*Credgr	16.67	6.44	8.5	39.43	8.15	31.52
	[0.50]	[0.26]	[0.31]	[0.93]	[0.25]	[0.92]
Cfw				5.51	-6.87	18.61**
				[0.60]	[1.30]	[2.33]
Growth				-3.77	-5.62**	0.42
				[1.09]	[2.49]	[0.15]
Cashta				5.08	3.29	5.01
				[0.55]	[0.37]	[0.37]
Exchrgr				5.95	-7.79**	11.28**
				[1.00]	[2.27]	[2.18]
Observations	5529	5531	5302	4256	4244	4091
R-squared	0.75	0.63	0.72	0.79	0.69	0.77