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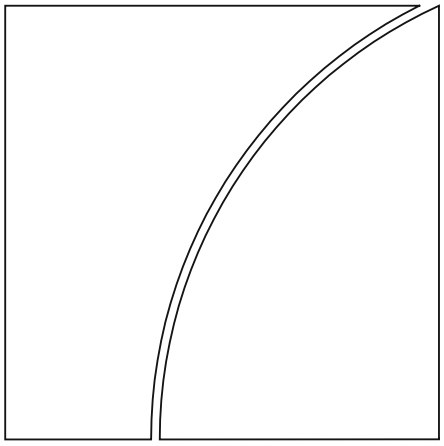

BIS Working Papers

No 773

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Monetary and Economic Department

March 2019, updated April 2023

JEL classification: E44, G15.

Keywords: Emerging market corporate debt, currency mismatch, liability dollarization, carry trades, trade credit

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This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

From Carry Trades to Trade Credit: Financial Intermediation by Non-Financial Corporations

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April 14, 2023*

Abstract

We use unique firm-level data from Mexico to document that non-financial corporations engage in carry trades by borrowing in foreign currency (FX) and lending in domestic currency, largely in the form of trade credit, accumulating currency risk in the process. We show at a quarterly frequency that the practice of borrowing in FX and extending trade credit is more prevalent when foreign currency borrowing is relatively cheaper than local currency borrowing, and it is associated with expansions in both gross trade credit and sales. Firms that were more active in carry-trades, accumulating currency risk, experienced larger reductions in investment and profits following a large depreciation event. Nevertheless, their extension of trade credit remained stable, insulating their trading partners from the shock. A firm-level panel for 20 emerging countries provide external validity for the link between carry trades and trade credit.

JEL-Codes: E44, G15
Keywords: Emerging market corporate debt, currency mismatch, liability dollarization

*We thank our editor Shang-Jin Wei for his guidance. We also benefited from helpful comments by Borağan Aruoba, Stefan Avdjiev, Pierre De Leo, Kinda Hachem, Şebnem Kalemli-Özcan, William Mullins, Hyun Song Shin, Ina Simonovska, Pablo Slutzky, Colin Ward, and Frank Warnock, as well as seminar and conference participants at the BIS, IMF, CBC-IMF-IMFER emerging markets conference, the Washington Area Symposium on International Finance, and especially at the NBER conference on International Fragmentation, Supply Chains, and Financial Frictions. We are also thankful to Victoria Nuguer, Valentina Bruno, and Tim Schmidt-Eisenlohr for excellent discussions that greatly improved this manuscript. All errors are our own. The views expressed here are those of the authors and not necessarily those of the Bank for International Settlements. Contact: bryan.hardy@bis.org, saffieF@darden.virginia.edu

1 Introduction

Non-financial firms are an important provider of financial resources to the economy, including the provision of credit to customers and suppliers. For example, when firm A buys intermediate goods from firm B and the agreement involves a payment after the delivery of the goods, firm A records a liability under accounts payable and firm B records an asset under accounts receivable. In order to finance the provision of trade credit, firm B has to use either internal (e.g. retained earnings) or external funds (e.g. new loans). For emerging market firms, low cost foreign currency (FX) credit is often used as a source of external funds, particularly for large firms with better access to it.[1]

Financing trade credit with FX funds could generate financial stability concerns. Carry trade incentives (cheap FX credit relative to local currency credit) can foster balance sheet mismatches, as firms might use FX credit to fund local currency assets.[2] If used to support value chains with trade credit, FX risk could propagate to other firms via those trade credit links, generating systemic risk in the economy.[3] Despite these risks, regulation and prudential supervision tend to focus primarily on banks and other financial institutions, while non-financial firms are less regulated in their financial intermediation activities and currency risk exposure.[4]

[1] Throughout the paper, we use the term "trade credit" to generally refer to inter-firm credit. Trade credit can be extended (trade credit assets: accounts receivable) or received (trade credit liabilities: accounts payable). Trade credit is different from the term "trade finance", which refers to bank-based finance used to facilitate cross-border trade. Finkelstein Shapiro, González Gómez, Nuguer, and Roldán-Peña (2018) show that trade credit provides over 50% of the external funds used for working capital on average, and 28% of of the external funds used for investment for firms in 13 emerging markets. The data by Chui, Kuruc, and Turner (2016) show that FX debt accounts for 31% of debt on average across these countries.

[2] Klapper, Laeven, and Rajan (2012) document that the effective interest rate associated to trade credit is 54% on average and 31% for the median. Where the effective interest rate is defined as the implied interest rate if firms pay at the due date instead of paying early and getting a discount. Therefore, trade credit is a profitable use for cheap FX funding.

[3] See for instance Altinoglu (2021), which presents a theoretical model showing shocks propagating via trade credit networks, and Alfaro, Garcia-Santana, and Moral-Benito (2019), which shows empirical evidence that credit supply shocks propagate to downstream firms, potentially via trade credit. Similarly, Jacobson and Von Schedvin (2015) shows that trade credit default can generate risk along the supply chain.

[4] Recent regulatory efforts have started to account for firm FX risk, though this typically is done through regulation on banks.

We use detailed quarterly financial data for Mexican non-financial corporations to study the interplay between carry trade behavior and trade credit provision and document four key relationships. First, we directly show that FX liabilities are used to fund short-term peso assets. Second, the main destination of FX liabilities that fund short-term assets is the financing of account receivables. Third, this link between FX borrowing and trade credit extension is particularly prominent when carry trade incentives are high (FX borrowing is relatively cheap). Specifically, during favorable carry trade times, firms accumulate currency mismatch by borrowing in FX and accumulating short-term peso assets, including accounts receivables, exposing their balance sheet to currency risk. Fourth, quite interestingly, during the 2008 Peso depreciation, inter-firm lending behaved more as a buffer than a magnifier for systemic risk as firms adjusted more their investment decisions than their trade credit provision to related parties.

Emerging markets have significant foreign currency debt in their corporate sector, as well as prominent use of inter-firm credit. Our unique dataset provides an ideal opportunity to study these relationships. It provides five advantages over the existing literature studying carry trade behavior of non-financial corporations. First, we build a panel database at a quarterly frequency, which captures the short-maturity dynamics of carry trade and trade credit activities, these dynamics are typically missed by studies relying on annual data. Second, our dataset includes detailed information of the currency composition of both liabilities and assets, allowing us to directly connect FX liabilities to their funding of peso assets, a behavior only implied or indirectly observed in previous studies. Third, we independently capture all sources of FX and Peso borrowing (e.g. bonds, loans, etc.) and the internal cash flow generated by the firm each quarter, allowing us to do a complete accounting decomposition of all sources and uses of funds by the firm.[5] Fourth,

[5]This stands in contrast to the existing literature which examines only one source of funds (e.g. bonds) and one use of funds (e.g. cash), our analysis can provide an accounting decomposition of all sources and uses of funds by the firm. Examining only one source tacitly assumes that its use and allocation are independent of other sources and uses. The only source of external funding that we do not observe is stock issuance. This long-term and infrequent financing strategy is unlikely to play a role in carry trades or trade credit behavior.

the data also include a detailed breakdown of short-term assets by instrument, allowing us to examine how firms adjust their extension of trade credit and benchmark it against other assets (e.g. inventories). The final advantage is the inclusion of real outcomes such as sales, investment, and employment, making it possible to connect carry trade and financial activities of the firm to its real activities. This dimension allows us to study the real effects of a currency depreciation on firms that accumulated currency mismatch due to their carry trade activities.

Using this unique database we document that trade credit is a key component of a firm's balance sheets. In fact, accounts receivable constitute 40% of short-term assets on average, while accounts payable denominated in FX (Peso) make up 32% (23%) of total FX (Peso) liabilities on average. By comparison, accounts payable in any currency are more important than bonds and as important as loans for the Mexican firms in our sample.

Having established the importance of trade credit in firm balance sheets, we use a regression framework to perform an accounting decomposition linking short-term asset changes to changes in internal and external funds. This reveals that each dollar of FX liabilities backs 38 cents of short term assets, 17 cents of which are used to directly accumulate short-term peso assets. We thus provide direct evidence of currency mismatch associated with FX funding. Moreover, when decomposing those 38 cents by instrument, we document that the main destination (40%) of these funds is accounts receivables. Therefore, firms use FX funds to finance trade credit and in the process they generate currency exposure on their balance sheet.

We thus document that non-financial firms act akin to financial intermediaries, with a positive co-movement between financial assets and liabilities - funding peso assets with FX liabilities - but further show the main dimension along which they act as intermediaries is by extending trade credit to other firms. In order to show that this pattern is related to carry trade motives, we examine the main driver of carry trade dynamics in the literature: interest rate differentials. To this end, we leverage the loan level component of our database to build a firm level measure

of the interest differential between FX and Peso loans.[6] Using this measure, we document that firms' tendency to fund peso assets with FX liabilities is correlated with carry trade incentives. When foreign currency borrowing rates are relatively lower, firms' short-term FX liabilities and short-term peso assets, including accounts receivable, are relatively higher.

Carry trade incentives are associated with an expansion of trade credit networks and increased sales.[7] Because investment typically exhibits a lag when affecting production, our use of quarterly data reveals that FX credit funding investment does not drive the sales and trade credit dynamics. Thus our evidence directly links carry trade behavior to production and sales via trade credit linkages.

The granularity of our panel allows us to provide direct evidence linking carry trade behavior to inter firm lending, and the associated build up exposure to currency risk. What are the real effects for these carry-trade firms when the currency risk materializes? Do they transmit their risk along their value chains or absorb most of the impact, providing insurance to their trading partners? We use the real variables of our firm level panel to answer these questions and the 2008 Mexican peso depreciation triggered by the Lehman Brothers' default as a quasi-natural experiment. Large depreciation episodes wreak havoc on firm balance sheets and the macro-economy generally, and the end of 2008 featured a depreciation of the peso of 33% against the US dollar. Prior to that shock, our sample features a period of high carry trade incentives over 2005-2008, with a relatively stable exchange rate and a large and increasing interest rate differential.

We find evidence that the FX risk does not propagate through trade credit networks when a shock arises. Investment and employment fall after the depreciation for all firms, as do trade credit and sales, reflecting the general impact of the shock. Moreover, firms that accumulated

[6] Our baseline analysis computes the interest rate differential from average interest rates across firms to capture general borrowing conditions for non-financial firms in each period. We also show that our results are robust to using a firm specific measure for the sub sample of firms that borrow simultaneously in both currencies, and saturating that regression with time fixed effects.

[7] Firms do not change the amount of each sale sold on credit. Rather, they appear to pass the cost savings from the cheaper FX borrowing on to their customers.

more short-term FX exposure over the carry trade period performed poorly following the depreciation, with lower investment growth than similar firms that did not increase their exposure and lower profits. Interestingly, trade credit (borrowing or lending) for these carry trade firms is not comparatively different following the depreciation shock. Therefore, investment and profits fall after the exogenous exchange rate shock for firms that built up FX exposure through carry trade, but their trade credit remains robust. This asymmetry suggests that firms place a high value on their inter-firm credit and relationships, as they prefer to decrease physical investment or to draw from other financial assets in order not to cut credit to related partners. Interestingly, while the literature typically views banks as propagators of shocks, pulling back credit when they are hit (e.g. the bank lending channel of monetary policy), inter-firm lending behaves more like a buffer.

The richness of our data comes at the cost of one limitation: our results are based on a sample of Mexican firms. To address concerns about external validity, we use the Capital IQ capital structure data for firms in 20 emerging markets to document the link between carry trade and trade credit. We generate a quarterly firm-level panel with almost 8000 firms. One limitation of this data-set is that there is no information about the currency of the assets, only the debt liabilities. Therefore, it cannot be used to directly measure currency exposure. Consistent with our Mexican results, our analysis shows that 1) the main destination among short-term assets of firm's borrowing is trade credit finance; 2) cash, potentially in local currency (Bruno & Shin, 2017), and account receivables are financed by FX debt; and 3) carry trade incentives increase FX borrowing, decrease local currency borrowing, and expand trade credit and sales. Therefore, we confirm the link between trade credit and carry trade beyond the case of Mexico.

Related Literature

Evidence of carry trade behavior in non-financial firms has been shown in the literature in the case of emerging market firms, borrowing via USD bonds and holding cash with the proceeds. Using a

cross-country annual panel of firms, Bruno and Shin (2017) show that emerging market economy (EME) firms issue USD bonds when the carry trade is favorable. These firms use the proceeds to disproportionately accumulate more cash, suggesting a carry trade motive. By assuming that cash is denominated in local currency and that FX bond issuance is orthogonal to every other source of external finance, Bruno and Shin (2017) provide granular evidence of non-financial firms engaging in carry trade. Caballero, Panizza, and Powell (2014) complement these findings for a sample of emerging economies and study the role of capital controls in promoting this behavior. Similarly, Acharya and Vij (2017) uses yearly data for India and study the effects of macro-prudential policy on firm's FX borrowing. Instead of holding cash after issuing FX bonds, a dominant strategy would be to invest the proceeds in high return local currency assets. In this vein, and closer to our study, Huang, Panizza, and Portes (2018) perform a country specific analysis for China using yearly bond data, they show that firms respond to carry-trade incentives using FX bond proceeds to fund accounts receivable.

We contribute to this literature by studying for the first time *all* sources of external funding and directly observing the currency composition of the *whole* balance sheet at *quarterly* frequency. Because we can decompose assets by instrument and currency, we can relax the assumption that all cash holding is denominated in local currency and that funding sources are uncorrelated by directly showing that firms use carry trade proceeds (i.e. FX borrowing) to fund short-term assets in pesos, taking into account all sources of funding. Interestingly, although we can replicate the FX bond-cash correlation documented by the literature (Bruno & Shin, 2017), the more important destination for FX liabilities are non-cash assets (especially accounts receivable), driven by FX bank loan and FX accounts payable instead of FX bonds. Because carry trade strategies are short maturity, it is natural for short-term financial instruments (whose dynamics are better captured at a quarterly frequency) to be the key drivers of this behavior. Thus, these firms not only borrow at low FX rates, but they use trade credit, a high yielding asset (Klapper et al., 2012), to benefit from the interest rate differential.

Our results provide important evidence for how credit conditions can affect production via supply chains and production networks. When productions chains are long, credit shocks can amplify recessions by disrupting the trade credit linkages that sustain the chain (Alfaro et al., 2019; Kalemli-Özcan, Kim, Shin, Sørensen, & Yeşiltaş, 2014).[8] Bruno and Shin (2018) show that with a stronger dollar, credit conditions tighten and leads to a reduction in international supply chains. Thus, FX credit conditions may synchronize trade credit by increasing the flow of credit through the network of firms. We build a bridge between the value chain literature and the studies on exchange rate related balance sheet shocks by showing that carry trade incentives can increase both the FX exposure and trade credit network of firms.[9]

Uncovered interest rate parity (UIP) conditions are often violated in emerging markets, biasing borrowing towards foreign currency (Burnside, Eichenbaum, & Rebelo, 2007; Gilmore & Hayashi, 2011; Hassan, 2013; Niepmann & Schmidt-Eisenlohr, 2022) and exposing their economies to currency crises.[10] Bruno and Shin (2020a) show that firms that exploit carry trade opportunities see their share price affected during currency depreciation episodes. Consistent with their results, we show that firms involved in carry trade see decreased investment and profits. However, our results suggest that inter-firm trade credit networks are valuable to the firm, as they are maintained despite declines in investment and other resources in the event of an adverse shock to the firm.

[8] Garcia-Marin, Justel, and Schmidt-Eisenlohr (2022) provides a model and evidence showing that firms with higher markups benefit more from extending trade credit, as bank credit is only needed to cover production costs rather than the full sale price. We provide a complementary view that cheaper bank credit can make it easier for a firm to extend more trade credit to their trading partners.

[9] FX borrowing and balance sheet exposure generally result in lower investment following a depreciation (Aguiar, 2005; Cowan, Hansen, & Óscar Herrera, 2005; Hardy, 2018; Kalemli-Özcan, Kamil, & Villegas-Sanchez, 2016; Serena Garralda & Sousa, 2017).

[10] See di Giovanni, Kalemli-Özcan, Ulu, and Baskaya (2018); Salomao and Varela (2018) for more recent evidence on UIP deviations. Monetary policy of the local or foreign currency can affect the interest rate differential and thus, the incentives to borrow and lend in each currency (Avdjiev, Koch, McGuire, & von Peter, 2018; Ongena, Schindele, & Vonnak, 2016). Capital controls can also influence the FX borrowing of firms (Keller, 2018). Bocola and Lorenzoni (2018); Gabaix and Maggiori (2015); Gopinath and Stein (2018) provide models which microfound deviations from UIP and provide frameworks to understand risk of currency exposure. Our results suggest that inter-firm lending is an important element yet to be included in these models.

This accords with evidence on the value of trade relationships in the context of international trade, which finds that disruptions to trade relationships is costly to both the firm and the macroeconomy (Monarch & Schmidt-Eisenlohr, 2020). Thus, while FX credit conditions may influence the volume of trade credit and production in supply chains, shocks to individual firms tend to be absorbed rather than transmitted via trade credit links.[11]

The remainder of the paper proceeds as follows: in Section 2, we describe our data and sample; Section 3 examines the borrowing and saving of firms by currency and instrument; Section 4 provides evidence of carry trade activity in firm short-term FX positions; the real consequences for firms of that exhibit carry trade behavior is explored in Section 5; Section 6 provides evidence of external validity linking carry trade incentives to trade credit using firm level data for 20 emerging markets; and Section 7 concludes.

2 Data and Sample

We use a novel dataset of listed non-financial firms in Mexico that includes detailed information on both asset and liability FX exposure. This dataset is derived from quarterly financial statements made by companies listed on the Mexican Stock Exchange (BMV).[12] This is a quarterly firm-level dataset of 183 firms (unbalanced) over 2005q1-2015q2. Table 1 summarizes the available breakdowns of the FX liabilities and assets in the data.

[11] Trade credit may involve non-financial motives (Klapper et al., 2012) or be used to smooth customer prices (Finkelstein Shapiro et al., 2018). Such trade credit is especially important to firms without access to bank credit (Minetti, Murro, Rotondi, & Zhu, in press).

[12] See Hardy (2018) for more detail on the dataset.

Table 1: Currency Composition Data

	FX and Peso Liabilities				FX and Peso Assets	
	Total	by Maturity	by Instrument	by Inst. & Mat.	Total	by Maturity
2005q1-2007q4	✓	✓			✓	
2008q1-2011q4	✓	✓	✓	✓	✓	
2012q1-2015q2	✓	✓	✓	✓	✓	✓

The data is more flexible on the liability than on the asset side. In fact, we can directly observe a firm's liability by instrument, currency, and maturity (e.g., short term bonds in FX), but we cannot simultaneously decompose assets by currency and instrument (e.g, total cash or total FX assets).[13] The instrument breakdown on the liability side includes bank credit, market credit (bonds), accounts payable (trade credit received), and other. The assets can also be split by instrument, with short term assets split into cash, financial assets, inventories, accounts receivable (trade credit extended), and other. This detail in the balance sheet data is unique in the literature and makes it possible to directly examine how the accumulation of FX debt correlates with the accumulation of FX and peso assets, as well as connect these currency movements to trade credit borrowing and lending.[14] The dataset also includes data on interest rates at the loan level for 87% of our loan observations. Using this data, we compute firm-level interest rates for 87% of firms in either currency. 47% of firms borrow in peso and FX interest rates simultaneously, this coincidence enables us to directly examine carry-trade opportunities faced by non-financial firms.[15] Finally, the dataset also includes standard balance sheet information, as well as data on employment, physical investment, and exports.[16]

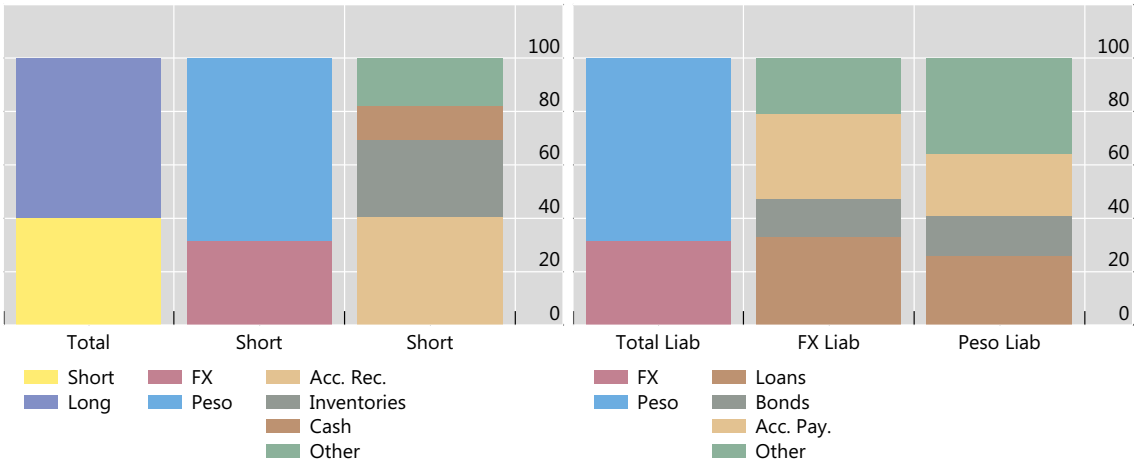
[13]The maturity breakdown of liabilities in the data is based on remaining maturity, with short term defined as having a remaining maturity at 1 year or less.

[14]While we can only examine the maturity of FX assets over 2012-2015, more than 90% of the FX assets in our sample are short term over this period, so we make the simplifying assumption that all FX assets are short term for the remainder of our analysis.

[15]While many firms borrow in both currencies, few firms borrow from a given bank simultaneously in both currencies.

[16]We define as exporters firms having the median of the export share of sales greater than 15%. Appendix

Figure 1: Balance Sheet Structure



(a) Assets (b) Liabilities

Average shares for each firm, computed over 2008q1-2015q2.

The literature has typically studied bonds and loans as a source of funding and cash and inventories as the main categories for short-term assets. Because we see all elements of a firm's balance sheet in exhaustive details, we can compare the relative importance of each instrument. Figure 1 summarizes the average balance sheet structure of the firms in the sample. Panel 1a shows that on average about 40% of the assets in a firm's balance sheets are short-term assets. About one-third of the short-term assets are in foreign currency. And trade credit (accounts receivable) is the most important component of short-term assets, coming in at 40% on average. Therefore, by focusing on cash and inventories the literature has mostly ignored the most important use of short-term funds: between firm credit.

A similar picture is painted for the liability side of the balance sheet in Panel 1b. Nearly one-third of all liabilities are in foreign currency on average. Among the foreign currency liabilities, loans and trade credit (accounts payable) account for about one-third each. For peso liabilities,

A provides summary statistics for the balance sheet positions for firms in our data, with detail by currency, instrument, and maturity.

loans and trade credit compose about a quarter each. The key message is that trade credit as a source of funding (accounts payable) is comparable to bonds or loans in either currency.[17] Figure 1 illustrates the richness of the data and highlights the importance of FX borrowing and trade credit finance for non-financial firms. Section 3 exploits within firm variation through the lens of an accounting identity to study currency mismatch and trade finance.

3 FX Borrowing, Currency Mismatch, and Trade Credit

We first examine how changes in the liabilities of the firm correlate with changes in the short term assets of the firm. That is, how much of a firm's incoming financial resources co-move with their short term assets, and how do these patterns vary by the currency of both the financial liability created and the asset that is accumulated. We examine changes in bond, loan, and trade credit liabilities of the firm, as well as changes in total FX and peso liabilities.[18] To have an accurate decomposition of the sources and uses of funds and to get an accurate measure a firm's FX exposure, it is paramount to capture all liabilities in every currency. We examine the relationship between firm liabilities and short term assets with the following regression:

$$\frac{\Delta STAsset_{it}}{TotalAssets_{it-1}} = \alpha_i + \alpha_t + \gamma \frac{CashFlow_{it}}{TotalAssets_{it-1}} + \sum_{type} \beta^{type} \frac{\Delta Borrowing_{it}^{type}}{TotalAssets_{it-1}} + \epsilon_{it} \tag{1}$$

CashFlow is the net income of the firm over the quarter, which captures non-debt funds which the firm could use to acquire assets. $Borrowing^{type}$ is one section of the firm's liability structure, such as bonds, FX liabilities, etc. *STAsset* is one section of the firm's short term assets, such as FX assets, cash, etc. Time fixed effects are included to capture any common shocks to all firms. Firm fixed effects allow us to draw inference from within firm variation and abstract from time-

[17] Figure A1 shows that these conclusions also holds when we group firms by size. Trade credit as an asset and as a liability is relevant across size groups.

[18] We also include "other" liabilities (e.g. tax deferrals, derivatives) in the regression.

invariant firm characteristics. Standard errors are clustered at the firm level.[19] This approach is an expansion of those considered in Bruno and Shin (2020a) and Acharya and Vij (2017) in that it considers all types of funding by currency, instead of a subset (e.g., USD bonds), and examines all short term uses of those funds, instead of a subset (e.g., cash). It therefore tracks the co-evolution of both sides of the balance sheet together, including the sources and uses of funds by currency at quarterly frequency. Because of the completeness of the data used, this regression framework constitutes an accounting identity connecting all funding sources to all balance sheet assets. Intuitively, a firm accumulates assets either by using internal funds (cash flows from its current operations) or by tapping on external funds (increasing its liabilities) to fund increases in their assets.[20]

Table 2 shows seven variations of equation (1). Let's focus on the use of internal funds to illustrate how the different columns relate to each other. Column (1) shows that, firms accumulate on average 53 cents out of each dollar of internal funds towards short-term assets. Columns (2) and (3) decompose short term assets by currency. For instance, out of the 53 cents of new short term assets generated by a dollar of internal funds, 35 cents are in short-term peso assets while the other 18 cents are accumulated in short-term FX denominated assets. Columns (4) to (7) constitute a decomposition by instrument instead of currency. In particular, the 53 cents are accumulated in the form of cash (14 cents), accounts receivable (13 cents), and inventories (26 cents).[21] Because the regression also includes the total change in every FX and peso liabilities (loans, bonds, trade credit, and others), we can discard substitutions between internal and external sources of funds.

[19] The R^2 reported in this paper is the within-R^2.

[20] The error term captures some potentially omitted sources of funds like new equity issuance. Because this is a minor source of funding for short-terms assets, we do not expect any omitted variable bias from this source. Moreover, because this is an accounting relationship, the co-movement should not be interpreted as causal. This is, the firm could have decided to increase assets and because of that it has to increase liabilities, or the firm could have increased their liabilities and then decided where to allocate them in the other side of the balance sheet.

[21] A column for the residual "other" short-term assets are included in the table for completeness, though these tend to be small.

Table 2: Corporate Saving by Currency and Instrument

	(1) Total	(2) FX	(3) Peso	(4) Cash	(5) AR	(6) Inv	(7) Oth
Cash Flow$_{it}$	0.525***	0.176**	0.349**	0.138*	0.131***	0.261**	0.00688
	(0.127)	(0.0700)	(0.157)	(0.0708)	(0.0395)	(0.118)	(0.0180)
Δ FX Liab$_{it}$	0.381***	0.215***	0.166***	0.0878***	0.150***	0.120***	0.0206***
	(0.0506)	(0.0330)	(0.0521)	(0.0198)	(0.0222)	(0.0286)	(0.00653)
Δ Peso Liab$_{it}$	0.438***	0.0351	0.403***	0.106***	0.149***	0.148***	0.0308***
	(0.0521)	(0.0238)	(0.0486)	(0.0216)	(0.0285)	(0.0340)	(0.00999)
Observations	3889	3889	3889	3868	3889	3889	3889
R^2	0.233	0.0662	0.130	0.0470	0.0696	0.115	0.00458
Firms	152	152	152	152	152	152	152
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is change in short term assets, column (2) is change in short term FX assets, column (3) is change in short term peso assets, column (4) is change in cash and financial assets, column (5) is change in accounts receivable, column (6) is change in inventories, and column (7) is change in other short term assets. Cash flow is net income over the previous quarter; FX Liab is the change in FX liabilities over the previous quarter; Peso Liab is change in peso liabilities over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The same decomposition can be applied for external sources of funds, which is our focus. Column (1) shows that firms accumulate 44 cents of short-term assets out of every dollar of peso denominated external funds. Interestingly, Column (2) shows that Peso borrowing, on average, does not accumulate FX assets. Therefore, no currency mismatch is triggered by local currency borrowing. This is not the case for FX borrowing. In fact, while Column (1) shows that every dollar of funding from FX denominated liabilities generate 38 cents of short-term assets, Column (3) shows that 45% of these funds (17 cents) are in Peso denominated assets. Thus the first key result of Table 2 is to provide direct evidence that FX borrowing is used to accumulate not only FX assets but also Peso assets. This is the first direct evidence in the carry-trade literature of currency mismatch at the firm level. Although, the propensity to accumulate Peso and FX assets out of FX borrowing is very similar, the currency mismatch created by the accumulation of Peso assets exposes the firm to exchange rate risk.

Bruno and Shin (2020a) assume that all cash is held in local currency and show that FX bond issuance correlates with cash accumulation. Consistent with their results, Column (4) shows that FX funding correlates with cash accumulation. Note that Column (3) shows that 17 cents of every dollar denominated external finance are accumulated in Pesos while Column (4) shows that less than 9 cents are used to accumulate cash. Therefore, FX liabilities must also be allocated to other assets in Pesos. In fact, Column (5) shows that 40% of FX denominated external funds (15 cents out of 38 cents) and 34% (14.9 cents out of 43.8 cents) of the Peso denominated external funds are use to finance account receivables. In contrast, cash and inventories are mostly financed using current cash flows. Thus, the second key result of Table 2 is that the most important use of external funding, in any currency, is the accumulation of account receivables. This is because accounts receivables support greater scale of operations and output.

FX and Peso liabilities do not have a differential co-movement with each instrument, but as seen in column (3), FX funding does create currency risk. Because trade credit is an important destination of these funds, currency risk can potentially flow along a firm's value chain.

Table 3 decomposes the sources of external funding in equation (1) to show that different instruments are used to accumulate different classes of assets. In particular, we study how the proceeds of bonds, loans, accounts payable, and other sources are allocated to different asset categories. First, Column (1) shows that for every dollar of bond's funding 36 cents are used to accumulate short-term assets. Columns (2) and (3) decompose this allocation by the the currency of the assets, with 10 cents being accumulated in FX currency and the remaining 26 cents being allocated to Peso assets. The decomposition in Columns (4) to (7) shows that bonds proceeds are mostly used to accumulate cash and financial assets, consistent with Bruno and Shin (2020a, 2017). Given the short-maturity of trade credit, it is not surprising that bonds are not used to fund it. Rather, among the 37 cents of short term assets funded by bank loans, Column (5) shows that 16 cents are allocated to accounts receivable. Therefore, the literature focusing on bond finance has naturally dismissed accounts receivable as an important use of external finance. Second, Column (1) shows that for every dollar funded by account payable—trade credit as a source of external funding—76 cents are allocated to short-term assets. This is the most short-term oriented source of funds, even more than the cash flow. Therefore, trade credit as a source of funds cannot be ignored when studying the accumulation of short-term assets. Moreover, accounts payable is mainly divided between inventories and account receivables. Because account payable is the delayed payment of good and services already received, it is natural to see it funding inventories. More interesting is the use of account payable to fund account receivables. Therefore, the granularity of the data allows us to directly document how financial resources flow through firms providing liquidity across the value chain, and how tight the financial linkages may be from firm to firm.

Appendix B shows additional results and robustness. In particular, Table B1 shows that the results are largely similar before and after the global financial crisis. Table B2 shows that exporters and non-exporter firms use FX liabilities to fund accounts receivables and Peso assets. Consistent with their natural hedge, exporters are more prone to fund peso assets with FX liabilities. Table B3 shows that, while in every sector firms use FX borrowing to fund account receivables, outside the

Table 3: Corporate Saving by Instrument of Borrowing

	(1) Total	(2) FX	(3) Peso	(4) Cash and Financial	(5) Accounts Receivable	(6) Inv	(7) Oth ST
Cash Flow$_{it}$	0.507***	0.185***	0.322**	0.137*	0.129***	0.245*	0.00758
	(0.135)	(0.0665)	(0.157)	(0.0728)	(0.0384)	(0.129)	(0.0177)
Δ Bond$_{it}$	0.364***	0.102***	0.262***	0.227***	0.0790**	0.0373	0.0157
	(0.0941)	(0.0361)	(0.0854)	(0.0544)	(0.0340)	(0.0303)	(0.0112)
Δ Loan$_{it}$	0.372***	0.170***	0.202**	0.0976***	0.163***	0.0752***	0.0276**
	(0.0521)	(0.0536)	(0.0798)	(0.0282)	(0.0243)	(0.0287)	(0.0126)
Δ AccPay$_{it}$	0.761***	0.127***	0.635***	0.0965***	0.219***	0.446***	0.00177
	(0.0502)	(0.0378)	(0.0654)	(0.0260)	(0.0362)	(0.0478)	(0.0101)
Δ Other$_{it}$	0.329***	0.0193	0.310***	0.0583**	0.131***	0.0984*	0.0420***
	(0.0667)	(0.0383)	(0.0635)	(0.0252)	(0.0456)	(0.0517)	(0.0157)
Observations	3889	3889	3889	3868	3889	3889	3889
R^2	0.254	0.0415	0.123	0.0617	0.0755	0.183	0.00542
Firms	152	152	152	152	152	152	152
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

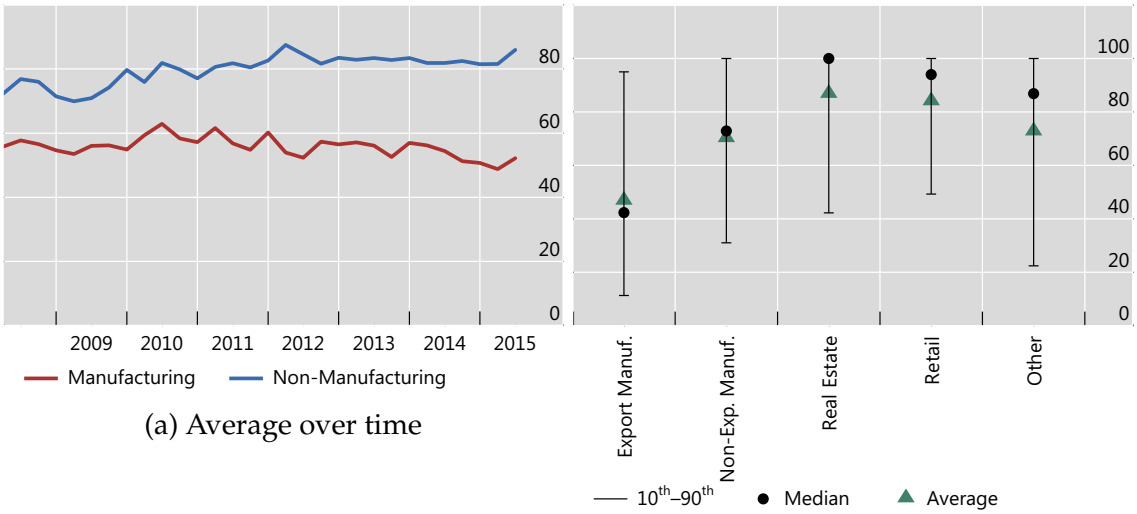
Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is change in short term assets, column (2) is change in short term FX assets, column (3) is change in short term peso assets, column (4) is change in cash and short term financial assets, column (5) is change in accounts receivables, column (6) is change in inventories, and column (7) is change in other short term assets. Cash flow is net income over the previous quarter; Δ Bond is the change in bond debt over the previous quarter; Δ Loan is change in bank debt over the previous quarter; Δ AccPay is the change in trade credit liabilities (accounts payable) over the previous quarter. Δ Other is the change in all other liabilities (besides bank, trade, and bond credit) over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

manufacturing sector, firms do not mismatch their FX currency liabilities, suggesting that currency mismatch is especially prominent in sectors with longer value chains. Table B4 digs deeper into the manufacturing sector and shows that these firms use loans and accounts payable denominated in FX to fund Peso liabilities and account receivables.

Summarizing, we uncover two important financial patterns at the firm level. First, we provide direct evidence that firms use FX liabilities to fund peso assets generating currency exposure. Second, we show that most of the FX and Peso borrowing put towards short-term assets is used to finance account receivables, an item usually ignored by the literature studying currency mismatch. These two results are key for studying the potential transmission of currency risk through value chains. In fact, if the FX funded trade credit extended to related parties is denominated in Peso, then the firm that provides credit is retaining the currency risk, while, if the account receivables are denominated in FX, then the firm is passing the currency risk to its related parties. Although we cannot directly observe the share of accounts receivable that are denominated in each currency, we can directly see this decomposition for accounts payable, the trade credit liabilities of the firms in the sample.

Figure 2 shows the currency denomination of accounts payable for the firms in our sample. Panel 2a shows that for manufacturing firms 50-60% of account payable every year are denominated in Peso, with that number being even higher (around 80%) for non-manufacturing firms. Panel 2b shows that not only the mean but also the median firm across every industry has a significant share of their account payable denominated in Peso, including exporting firms. Therefore, there is potential for both, contagion and insurance through value chains. Note that, even if all trade credit is denominated in Peso, the lender firm can increase the Peso borrowing cost to cover their financial losses. Section 5 will use the Mexican peso depreciation during the Great Recession as a laboratory to see whether contagion or insurance dominates in inter-firm lending. Before studying the effect of FX backed trade credit during a currency depreciation, Section 4 solidifies the link between trade credit and carry trades by showing that firm accumulate FX liabilities to

Figure 2: Share of Accounts Payable denominated in Peso



(a) Average over time

(b) Distribution by sector

Exporting firms are defined as having their median share of sales to foreigners greater than 15%. Real Estate consists of firms in real estate and construction. Retail consists of firms in retail, wholesale, restaurants, and hotels. Other consists of firms in healthcare, IT, energy, and transportation.

fund accounts receivable when FX rates are relatively low.

4 Carry Trade Incentives

Having documented (1) how firms use FX liabilities to accumulate short-term peso assets, exposing their balance sheets to currency risk, and (2) the central role of trade credit as both a source and destination of funds, we turn our attention to the determinants of foreign currency borrowing. In particular, we document that carry trade incentives (cheap dollar funds) tilt firm's short-term portfolios toward FX liabilities and fuels inter-firm lending and sales.[22] Thus, providing a novel link between carry trade and trade credit behavior at the firm level. To study these regularities,

[22] Di Giovanni, Kalemli-Özcan, Ulu, and Baskaya (2022) and Niepmann and Schmidt-Eisenlohr (2022) among others have documented that firms exploit UIP deviations by borrowing in dollars. When firms do not hedge, this exposure triggers currency risk (Céspedes, Chang, & Velasco, 2004).

we consider the following empirical model:

$$\frac{\Delta Position_{it}}{TotalAssets_{it-1}} = \alpha_i + \lambda \frac{\Delta IRD_t}{Vol_t} + X_{it}\beta + \epsilon_{it}, \tag{2}$$

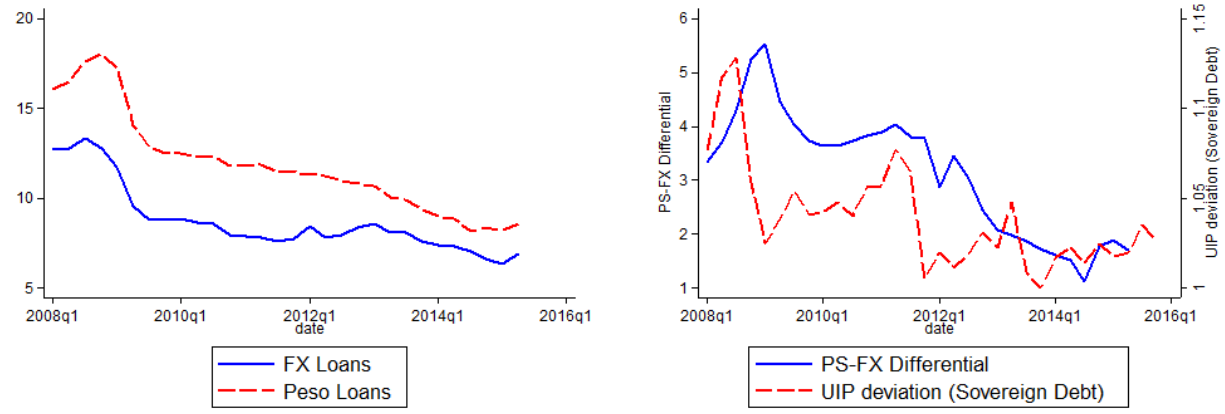
where *Position* is the relevant balance sheet position (e.g. short-term FX liabilities, cash holdings, etc.). For positions in foreign currency, we adjust the change in position for exchange rate movements by converting the position into US dollars using the contemporaneous exchange rate for the current and lagged periods, taking the difference, and then converting back into pesos using the current period exchange rate. On the right-hand side of the equation, IRD is the interest rate differential between peso and FX borrowing; Vol is the standard deviation of the daily peso depreciation rate (vis-à-vis the US dollar) over the quarter; X is a vector of controls that includes one period lags of firm size (log assets), cash to assets ratio, share of sales to foreigners (both exports and sales by foreign subsidiaries), and sales to assets ratio;[23] and also includes contemporaneous real GDP growth for Mexico and the US, which may separately affect firm activity and their trade credit (i.e. control for time series variation driven the real macroeconomic environment). The use of quarterly data improves upon the previous literature by requiring reactions in the data to be at a higher frequency. In particular, prices and business conditions have time to change but productive capacity due to changes in investment is unlikely to change.

To construct the IRD measure, we use data on loan-level borrowing of firms to build firm and aggregate level interest rates. In particular, we construct the IRD by computing a weighted average of each interest rate, separately by currency, for each firm, with the weights determined by the remaining volume of the loan. This creates an effective interest rate for each firm in each currency. We have interest rate data for 87% of loan observations in our sample, which results in firm-level interest rate data in either currency for 87% of firm observations. From these firm-level interest rates, we compute simple averages across firms to construct the "aggregate" average effective in-

[23] Winsorization levels selected to reduce the effect of outliers in each variable, lowering kurtosis below 10. Results are robust to winsorizing all variables at 1% or 2%.

terest rates in FX and peso for these firms. Our aggregate carry-trade measure normalizes the change in IRD by the the standard deviation of the daily peso depreciation rate. Hence, when this measure increases, either due to cheaper FX borrowing, more expensive peso borrowing, or less volatile exchange rate fluctuations, the incentive for firms to take carry trade positions (short foreign currency and long domestic currency) increases. We also compute firm-specific interest rate differentials. We can calculate this firm specific variable for 47% of observations in our sample, as many firms borrow in both currencies but do not carry both FX and peso loans simultaneously on their balance sheet. We document our main results using both, aggregate and firm level rates. When using firm level rates we can further improve our identification by including sector-time fixed effects that absorb any sector specific dynamics.

Figure 3: Average Interest Rates, 2008q1-2015q2



(a) Average Interest Rates by Currency

(b) Interest Rate Differential vs UIP Deviations

Interest Rates take loan/bond level interest rates by currency, computes a loan/bond volume weighted average up to the firm level, and then takes a simple average of those rates across firms in each quarter. PS-FX Differential is the difference between the average Peso rate and the average FX rate on loans. UIP Deviation defined as $(s_t/E[s_{t+1}]) * ((1+r_t)/(1+r_t^*))$, where s_t is the exchange rate expressed as dollars per peso, $E[s_{t+1}]$ is the year ahead expected exchange rate (from survey of professional forecasters, Banco de Mexico), and r and r^* are the the interest rates on 1 year treasury bills for Mexico and the U.S., respectively. All rates are period averages over each quarter.

Panel (a) of Figure 3 displays the evolution of the aggregated rates. The average interest rate

on FX loans is consistently lower than that of Peso loans.[24] For both rates, there is a spike around the global financial crisis, which was also associated with a large dollar appreciation, followed by a long and protracted decline. Panel (b) compares the interest rate differential between peso and FX loans with a measure of deviation from uncovered interest parity (UIP), defined as $dev_t \equiv \frac{s_t}{E[s_{t+1}]} * \frac{(1+i_t)}{(1+i_t^*)}$ with the interest rates i_t, i_t^* from 1 year T-bills and exchange rate s_t expectations from one-year ahead forecasts.[25] There is a strong correlation between these two series, though with an important delay between when the UIP measure changes –reflecting changes for sovereign rates–and when the realized rates for firms change. Thus, our constructed IRD measure is our preferred measure of carry trade opportunities for non-financial firms, as that more closely reflects the business environment faced by those firms.

Because both carry trades and trade credit are typically short-term activities, we focus on the short-term side of the firm's balance sheet.[26] Table 4 considers short-term FX and peso liabilities and assets as the dependent variables.[27] Column (1) shows that the net short-term FX position of these firms (ST FX liabilities - ST FX assets) rises with the carry trade, so firms tilt their FX exposure towards debt and away from assets on the short term side. Breaking this down, we see that firms are both increasing their FX liabilities (column (2)) and decreasing their FX assets (column (4)). Consistent with our narrative, we see in columns (3) and (4) that peso borrowing does not systematically respond to carry trades opportunities. Rather firms use their FX funds to accumulate short-term Peso assets when carry trade incentives are high (column (5)). Thus firms are building on-balance sheet currency mismatch at the short end as it becomes more attractive

[24] Hardy (2018) shows that this difference between FX and Peso loan pricing holds in a loan-level regression (for the same firms as in this paper) even after controlling for all firm specific factors (with firm-time fixed effects), all bank specific factors (with bank-time fixed effects) and any differences in banking relationship (with firm-bank fixed effects).

[25] Source: Banco de Mexico, FRED. Exchange rate expressed as Dollars per Peso. Forecast from survey of professional forecasters provided by the Banco de Mexico. We denote by i the rate on Mexican T-Bills, while i^* denotes the rate on US T-bills. All rates are period averages over each quarter.

[26] Most trade credit has a maturity of 90 days or less. Carry trades are dependent on the exchange rate remaining stable, which becomes less likely at longer horizons.

[27] For readability, we do not report the coefficients on the controls. Full tables are available upon request.

to do so. The effect is economically significant: a one standard deviation increase from the mean in ΔIRD_t (0.022) triggers an increase in the net short-term FX exposure of 1.4% of assets and in short-term peso assets of 1.1% of assets.

Table 4: Carry Trade and Short-Term Positions by Currency

	STL-STA	Short Term Liabilities		Short Term Assets	
	(1) FX	(2) FX	(3) Peso	(4) FX	(5) Peso
Δ IRD$_t$	0.649***	0.196*	0.179	-0.441**	0.498***
	(0.239)	(0.113)	(0.166)	(0.185)	(0.179)
Observations	2999	2999	2999	3001	3001
R^2	0.0495	0.00715	0.00795	0.0623	0.0198
Firms	133	133	133	134	134
FirmFE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in (short-term liabilities minus short-term assets), in columns (2)-(3) is the change in short-term liabilities, and in columns (4)-(5) is the change in short-term assets (both for the currency listed in the column heading). Short term is based on remaining maturity at one year or less. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table 5 decomposes the response of short-term liabilities to interest rate deviations by instrument to further document carry trade behavior at the firm level and its relationship with trade credit. Because of the shorter maturity of carry trade activities, we should expect FX bonds not to be a major vehicle to exploit carry-trade opportunities. This also highlights the value of examining

carry trade behavior at higher than annual frequencies. As expected, the response of short-term FX borrowing to carry trade incentives comes mainly from loans and trade credit. Moreover, this table provides direct evidence of a positive correlation between cheap dollar funding and inter-firm FX lending (acc. payable in FX). Thus, only foreign currency borrowing reacts to an increase in carry trade incentives, and the instruments used are the ones that can quickly react to such opportunities. We do not see a significant response for Peso borrowing in individual instruments. However, the magnitude of the Peso trade credit borrowing is similar to that of the FX trade credit borrowing. Because firms are accumulating Peso assets, and trade credit lending is a primary counterpart for those funds, this behavior may reflect part of the carry from FX debt to peso trade credit lending.

Table 5: Carry Trade and Short-term Liabilities by Instrument

	Loans		Bonds		Trade Credit	
	(1) FX	(2) Peso	(3) FX	(4) Peso	(5) FX	(6) Peso
Δ IRD$_t$	0.0988**	0.0574	-0.00593	0.0135	0.0846**	0.0929
	(0.0438)	(0.0538)	(0.00822)	(0.0246)	(0.0344)	(0.0778)
Observations	3222	3222	3222	3222	3222	3222
R^2	0.00716	0.00414	0.00164	0.000958	0.0142	0.00442
Firms	139	139	139	139	139	139
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the change in short-term loans, columns (3)-(4) is the change in short-term bonds, and columns (5)-(6) is the change in accounts payable. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

To examine the link to trade credit lending directly, Table 6 decomposes short-term assets by instrument. We first note that financial assets held by the firm increase with the carry trade incentives, in line with the usual narrative around carry trades by non-financial firms. Interestingly, cash holdings themselves do not follow the same pattern, decreasing with the interest rate differential, as those funds may be put to a higher yielding use in local currency assets. But most notably accounts receivables, as well as inventories, exhibit dynamics similar to the FX positions with higher carry trade incentives. Firms increase their short-term FX liabilities in response to carry trade opportunities, and these additional funds accompany increases in trade credit extended to other firms and the accumulation of inventories. The magnitude of the effect suggests a 2.5% increase in accounts receivable given a 1 standard deviation shock to the IRD variable. Thus, the composition of short-term assets drift away from cash holdings towards financial assets, possible denominated in the relatively higher Peso rate, and towards real economy activity as the accumulation of accounts receivables and inventories is consistent with scaling up sales. The results from Table 5, which show that only short-term peso assets respond to the carry trade, suggest that the increased trade credit (accounts receivable) must be almost predominantly denominated in Peso.

Given that trade credit is an important source of funding, a major instrument for short term asset holdings, and an important facilitator of sales, we link the correlation between the interest rate differential and the size of the firm's trade credit relationships as well as the firm's sales. In Table 7, column (1) shows that the firm's trade credit network, measured by the gross trade credit (accounts payable + accounts receivable), expands with an increase in the interest rate differential. Along with these fluctuations in trade credit, sales (columns (2)) also expands.[28] Column (3) examine the accounts receivable to sales ratio, a measure of the fraction of sales made on credit,

[28] An alternative explanation of these results is reverse causality where firms borrow in FX in order to invest and increase their productive capacity. Then, firms produce more, increase their sales, and consequently increase their trade credit on those sales. Because of the time lag between investment and output, our use of quarterly data addresses this concern. Measuring outcomes at a high frequency means that only faster moving factors like prices and selling conditions affect the measured outcomes, but not slower moving factors like investment.

Table 6: Carry Trade and Short Term Assets by Instrument

	(1) Financial Assets	(2) Cash	(3) Accounts Receivables	(4) Inventories
Δ IRD$_t$	0.232***	-0.378***	0.182**	0.315***
	(0.0790)	(0.0729)	(0.0787)	(0.0602)
Observations	3224	3202	3224	3224
R^2	0.0243	0.0918	0.0143	0.0288
Firms	139	139	139	139
FirmFE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in financial assets, column (2) is the change in cash holdings, and column (3) is the change in accounts receivables, and column (4) is the change in inventories. Dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

to see if firms adjust their invoicing patterns with credit conditions. This ratio does not show a statistically significant change with the interest rate differential. If firms do not change the share of sales made on credit, it may be that firms pass on the cost savings from cheaper FX credit to their prices, offering a lower implicit interest rate on the trade credit extended. These lower prices then lead to an increase in sales and consequently an increase in accounts receivable. The positive coefficient suggests that at least some firms do increase the share of sales made on credit, which can also serve to boost sales. In either case, cheaper dollar funding serves to grease the wheels of the economy, enabling firms to support longer value chains and larger amounts of trade credit and thus increase the overall output and sales in the economy.

Because the change in the interest rate differential is a time series variable, one may be concerned that the increase in FX borrowing, trade credit (accounts receivable) extension, and sales with the carry trade is driven by other macroeconomic factors correlated with interest rates. We have shown our results are robust to including real macroeconomic growth at home and abroad, which can drive the real activity and supply chains (and thus trade credit and borrowing). We take two further alternative approaches to address this concern: incorporating year fixed effects on quarterly data, and using a sub sample with a firm-level measure of carry trade incentives that allows for quarterly-sector fixed effects.

The first approach is shown in Table C4. Including year fixed effects flexibly controls for all (observable and unobservable) yearly moving macroeconomic trends. This specification soaks up quite a bit of variation from our variable of interest, but the broad patterns remain though with less precision. The net short-term FX exposure increases, short-term FX liabilities increase, short term peso assets increase (significantly), accounts receivables increase (significantly), and sales expand (significantly).

Table 8 shows the results from the second approach that uses a firm-level measure based on a sub-sample of firms that simultaneously borrow in both currencies in a given quarter. This firm-level measure allows us to directly control for time varying factors with more stringent fixed ef-

Table 7: Carry Trade and Trade Credit

	(1) Accounts Rec. + Accounts Pay.	(2) Sales	(3) AR/Sales
Δ IRD$_t$	0.509***	0.470***	0.277
	(0.132)	(0.0797)	(0.205)
Observations	3224	3224	3122
R^2	0.0244	0.156	0.0145
Firms	139	139	137
FirmFE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in the sum of accounts receivable and accounts payable, column (2) is the changes in sales, and column (3) is the change in the ratio of accounts receivables to annualized sales. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

fects, ruling out unobservable factors correlated with aggregate carry-trade opportunities. Specifically, we include sector-quarter fixed effects, which control for time varying shocks to the sectors that these firms operate in. This demanding specification still yields most of our standard results, including an increase in FX liabilities (particularly FX loans), no impact on peso liabilities, an increase in peso assets, and an increase in sales.

Table 8: Firm-level Carry Trade Incentives

	(1) FX Liab.	(2) FX Loans	(3) Peso Liab.	(4) FX Assets	(5) Peso Assets	(6) Receivables	(7) Sales
Δ IRD$_{it}$	0.120**	0.169***	0.0347	0.222**	0.297***	0.0421	0.0753**
	(0.0597)	(0.0389)	(0.0968)	(0.0933)	(0.0872)	(0.0514)	(0.0333)
Observations	1042	1072	1042	1042	1042	1072	1072
R^2	0.0121	0.0463	0.0124	0.0260	0.0299	0.0366	0.182
Firms	70	71	70	70	70	71	71
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SectorTimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls							

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in short term FX liabilities, column (2) is the change in short term FX loans, column (3) is the change in short term peso liabilities, column (4) is the change in short term FX assets, column (5) is the change in short term Peso assets, columns (6) is the change in accounts receivable, and column (7) is the change in sales. Short term is by remaining maturity. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the difference between the firm's loan-weighted average interest rate on peso loans and that on FX loans outstanding for the firm in each quarter. Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level.R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Appendix C shows additional results and robustness analysis. Table C1 shows that measures of total FX liabilities and net FX position (as opposed to short term) also show responses to carry trade incentives. Tables C2 and C3 show differences for manufacturing and non-manufacturing firms. The sample of manufacturing firms shows a stronger response of peso assets and accounts receivables. While FX liabilities are not significant, the coefficient (0.169) is close to that in the full sample (0.196). Non-manufacturing firms show less of a connection to accounts receivable, suggesting that the link with carry trades may be tied to expanding supply chains (though non-manufacturing firms still appear to generate FX exposure under carry trade incentives).

Firms could be using financial derivatives to hedge these short-term positions. Table C5 examines the evidence for this. Columns (1) and (2) show firm-level changes in net and gross derivatives positions (at market value). The market value of gross derivatives positions do appear to expand with carry trades, but this might not reflect hedging of the exposure, as the net derivative positions do not move to offset. But market value of derivatives does not capture the notional amounts hedged and do not tell us what positions are being hedged. Column (3) and (4) take a different approach, where the dependent variable is a dummy for if the firm has any derivative value on its balance sheet, reflecting the use of derivatives in general. With either a linear probability model with fixed effects or a probit model without fixed effects, we see that firms are less likely to use derivatives as carry trades become more attractive. This suggests that firms are not hedging their FX risk from carry trade behavior. Hedging is costly, and while it lowers the risk from these positions, it also lowers the return (i.e. increases the borrowing costs) which attracted firms to the FX debt in the first place.[29] Moreover, if firms were successfully hedging their currency risk, the analysis in Section 5 should be less likely to find negative real effects arising from FX risk exposure during a currency depreciation.

Summarizing, firms react to carry trade incentives to increase their FX borrowing and accu-

[29]The limited use of derivative and the importance of currency risk is consistent with the literature (Guay & Kothari, 2003; Niepmann & Schmidt-Eisenlohr, 2022).

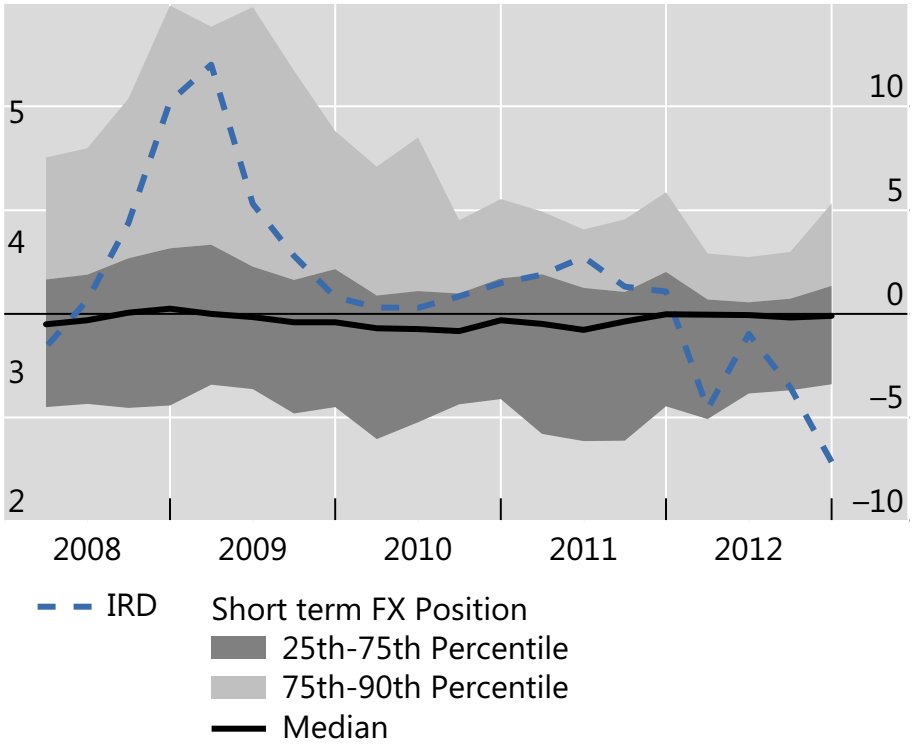
mulate Peso assets, including accounts receivables. This increase in available trade credit, and expansion of the firm's trade credit network generally, facilitates an increase in sales. In the process of these activities, firms increase on net their balance sheet exposure to currency risk. Section 5 studies the consequences of this exposure in the context of an unexpected currency deprecation for a firm's real activity and for its trade credit borrowing and lending.

5 The Mexican Peso Depreciation

During periods of prolonged carry trade incentives, firms build FX exposure on their balance sheet by borrowing in FX and accumulating Peso assets. Figure 4 plots the distribution of short-term FX exposure – short-term FX liabilities minus short-term FX assets, normalized by total assets. This figure shows that as the gap between the average peso interest rate and average FX interest rate on loans widened, the entire distribution of FX exposure shifted upwards, especially at the higher percentiles. This means that firms increased their exposure to short-term currency risk when conditions were favorable for FX borrowing, building vulnerabilities with the carry trade behavior documented in the last section. Can this vulnerability affect real outcomes? We answer this question by examining the growth of firm-level investment, employment, and profits at the firm level. We use a large depreciation episode in late 2008 precipitated by the collapse of Lehman brothers in the U.S. as an exchange-rate shock experiment. This depreciation was very sudden and very large (33% depreciation of the peso from top to bottom). This depreciation was not driven by a crisis in Mexico, and so it provides a large shock while avoiding the identification problems of using a currency crisis (see Figure A2, panel (a)).

The building up of short-term FX exposure peaks in 2008q4. Thus, we define the relevant period of carry trades activity before the shock as 2005q1-2008q4. But the firm may have other characteristics that motivate it to borrow in FX, such as being a high growth firm or highly profitable firm (Salomao & Varela, 2018). There could also be other consequences from the carry trade,

Figure 4: Interest Rate Differential and short-term FX Exposure



short-term FX exposure is defined as short-term FX liabilities minus FX assets, normalized by total assets. IRD is the difference between the average interest rate on peso loans and the average intrest rate on FX loans (computed as a weighted average of interest rates on individual loans for each firm, and then a simple average across firms). Data is plotted in percent.

such as the build-up of inventories that may affect the ensuing outcomes. Thus, we want to distinguish between impacts to the firm driven by building up FX exposure via carry trade from other channels whereby the exchange rate shock could affect the firm. In particular, we propose the following empirical specification:

$$Y_{it} = \alpha_i + \alpha_t \ (\ or\ \beta_0 Shock_t) + \beta_1 \Delta STFXP_i \times Shock_t + X_i \times Shock_t \Gamma + \epsilon, \tag{3}$$

where Y_{it} is the firm outcome variables: $\Delta \log(PPE_{it})$, where PPE is property, plant, and equipment; $\Delta \log(Emp_{it})$ the logged value of total employment; profits (net income) over the past quar-

ter, normalized by last period's assets; accounts payable to assets; accounts receivable to assets; and sales to assets. The main independent variables is the change in short-term FX exposure, where $STFXP_i = \frac{STFXLiabilities - FXAssets}{Assets}$, and the change in this value is calculated between 2005q1 and 2008q4. This period was one of a high interest rate differential and stable exchange rate, and results from Tables C1 and C5 suggest that firms engaging in carry trades will build up their exposure over time, also reflected in Figure 4. This is our measure of FX exposure from engaging in carry trades. This measure reflects the additional FX exposure that a firm might accumulate due to responding to appealing carry trade opportunities, leading to FX exposure over and above what their typical FX exposure might have been.[30]

We estimate Equation (3) with a two year pre-shock period (2007-2008), a two year shock period (2009-2010) and a two year post-shock period (2011-2012).[31] Thus, *Shock* takes a value of 1 during 2009-2010 (the aftermath of the depreciation) and 0 otherwise. The interaction of the exposure measures with the shock thus provides a difference-in-difference experimental approach. Note that the time fixed effects α_t absorb the direct effect of the shock, when included.

The 2009-2010 period following the aftermath of the 2008 financial crisis included other important effects for Mexico along with the exchange rate movement. While Mexico's banking system was well capitalized and did not experience a banking crisis, growth in Mexico and exports from Mexico both fell in 2009 (see Figure A2, panel (b)). Both of these rebounded in 2010, offsetting the 2009 decline.

To ensure that our results are not driven by other channels associated with this period, we con-

[30] It may be useful to separate the buildup of FX exposure from the level of FX exposure for these firms. Firms endogenously select into the on-balance sheet FX exposure based on their characteristics, business models, and management preferences. Thus for some firms, the same level of FX exposure can carry different levels of risk (i.e. because one firm selected the exposure based on their partially unobserved fundamentals, like revenue correlation with the exchange rate, while they other responded to the carry trade). Our results are robust to directly including the end-2008 level of FX exposure interacted with the shock as a control. In our analysis, we focus on just the short-term FX exposure built up during the strong carry trade period.

[31] We stop the sample before 2013q1 to avoid a long, protracted depreciation period following the Taper Tantrum episode.

trol for the general impact with time fixed effects. To control for other possible channels whereby firms might be deferentially affected by this shock, we explicitly horse race other firm characteristics with our measures of FX exposure and carry trade. Primarily, we control for factors that may be associated with increasing FX borrowing, such as high growth and high profits before the shock. We also account for the inventory buildup that comes with the carry trade, as that may serve as a buffer for the shock. Further, we take averages over 2006-2008 of other firm characteristics (capturing different channels) through which the 2008 shock may impact firms: firm size (log assets), as larger firms have better access to external finance; cash to assets, capturing the firm's liquid assets that could help buffer the shock; liabilities to assets (leverage), reflecting if the firm is financially weak in other ways; bond credit to assets, which captures firms with better access to capital; share of sales to foreigners (exports and sales by foreign subsidiaries), to account for how exposed the firm is to foreign trade and revenues; and sales to assets, reflecting the scale of the firm's production which could be hit by the shock. When presenting the results we only report β_1 and coefficients on the interactions with asset growth, profitability, and inventories, abstracting from reporting the other interactions of firm level variables.[32]

Table 9 presents the results for investment, employment, and profits. Columns (1), (4), and (7) drop the time fixed effects, so we can observe the direct negative effect of the shock on real outcomes. Columns (1)-(3) show that engaging in carry trade activities that increased the short-term FX position of the firm resulted in a negative and significant impact on investment. This is robust to controlling for foixed effect and other firm characteristics described above. A change in short-term FX exposure of 0.11 (75th percentile) over this period results in a 0.4% decrease in investment growth. The average (quarterly) PPE growth for firms at the 75th percentile of carry-trade-built-FX exposure was 2% in the non-shock period and -0.4% during the shock period. Thus, our estimates suggest the carry trade related FX exposure accounted for roughly 17% of the overall investment decline for these firms. Employment and profits do not show a significant

[32]Full tables are available upon request.

impact in the full sample, though the negative impact for profits is seen clearly in the sample of non-manufacturing firms (Tables D3).

Given the importance of trade credit extension, and its relationship with carry-trade incentives shown in Section 4, it is possible that carry trade firms could propagate their currency risk by cutting lending to their related partners when they are caught exposed during a currency depreciation. Therefore, we examine how trade credit responds for carry trade firms following the depreciation. Table 10 shows that trade credit borrowing, lending, and sales all generally declined during this period (columns (1), (4), and (7)). However, firms who increased their balance sheet currency exposure do not appear to differently decrease any of these items. This suggests that inter-firm lending may be highly valuable to firms, leading them to cut investment or lose profits rather than sever those ties. This could reflect a desire to keep clients or suppliers afloat that may have lost access to credit, or a desire to maintain market share. It may also indicate that the implicit interest rate of trade credit makes it a profitable asset to hold and maintain, especially during a credit crunch when other sources of FX credit are less available, as was the case following the late 2008 depreciation. Thus, trade credit and sales remained surprisingly stable for these firms, relative to other firms with less FX exposure.

Appendix D provides additional analysis and robustness. In Table D1, we justify the difference-in-difference approach by testing whether outcomes were different in the pre-period across firms with different carry-trade linked FX buildup. This test is important, because firms who were increasing their FX exposure during the high carry trade period may have chosen to be more risky along other dimensions as well that would lead them to higher profits or perhaps rapid expansion. However, these firms do not appear to be different before of the shock (with the exception of employment, which is not found significant after the shock). Tables D2 and D3 examine results for the sample of manufacturing and non-manufacturing firms.[33] Manufacturing firms see a decline

[33] In these reduced samples, we do not include the full complement of firm characteristics interacted with the shock, as there is less variation to separately identify all of the different channels.

in investment from the carry trade, but otherwise hold trade credit constant compared to other manufacturing firms. Non-manufacturing firms see a negative carry trade impact on investment, profits, and sales, but see an increase in trade credit borrowed.

Table 9: Carry Trade Impacts

	Investment			Employment			Profits		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shock_t	-0.0151***			-0.00685**			-0.000641		
	(0.00318)			(0.00332)			(0.00100)		
Δ $\text{STFXP}_i \times \text{Shock}_t$	-0.0287**	-0.0389***	-0.0389***	0.0163	0.0151	0.00588	-0.00493	-0.00754	-0.00683
	(0.0114)	(0.0114)	(0.0137)	(0.0140)	(0.0148)	(0.0167)	(0.00596)	(0.00534)	(0.00565)
Δ $\text{Inventories}_i \times \text{Shock}_t$		0.000498	0.000500		0.000652	0.000782		-0.000260**	-0.000263**
		(0.000539)	(0.000446)		(0.000469)	(0.000486)		(0.000116)	(0.000112)
Δ $\text{Assets}_i \times \text{Shock}_t$		-0.0146**	-0.0212***		-0.00118	-0.00340		-0.00596***	-0.00544**
		(0.00700)	(0.00649)		(0.00541)	(0.00783)		(0.00207)	(0.00218)
$\text{Avg Profits}_i \times \text{Shock}_t$		0.000301	0.000720		0.000557	0.000313		-0.000171	-0.000111
		(0.000573)	(0.000591)		(0.000535)	(0.000661)		(0.000133)	(0.000173)
Observations	1995	1832	1832	1980	1817	1817	1903	1745	1745
R^2	0.0189	0.00819	0.0152	0.00190	0.00168	0.00325	0.00113	0.0102	0.0116
Firms	87	80	80	87	80	80	87	80	80
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(3) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in columns (4)-(6) is the log difference of employment, winsorized at 2%; and in columns (7)-(9) is net income (profits) divided by total assets, winsorized at 1%. STFXP is short term FX liabilities minus FX assets, normalized by total assets. Δ STFXP is the difference between the STFXP levels at 2008q4 and 2005q1. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Δ Inventories is the change in the Inventories to assets ratio over 2006q1-2008q4. Δ Assets is the growth in firm assets over 2006q1-2008q4 (expressed as a decimal). Avg Profits is the firm's average annualized profits over 2006q1-2008q4. Other controls include averages over 2006-2008 of the following variables, also interacted with the shock dummy: firm size (log assets), cash to assets, total liabilities to assets, bond credit to assets, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. R^2 is within-R^2. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Carry Trade Impacts: Trade Credit and Sales

	Accounts Payable			Accounts Receivable			Sales		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shock_t	-0.00252***			-0.00381***			-0.00394***		
	(0.000821)			(0.00116)			(0.00133)		
Δ $\text{STFXP}_i \times \text{Shock}_t$	-0.00182	-0.00320	-0.00366	0.00211	-0.00204	-0.00529	0.000655	-0.00527	-0.00436
	(0.00417)	(0.00406)	(0.00472)	(0.00355)	(0.00428)	(0.00481)	(0.00625)	(0.00604)	(0.00646)
Δ $\text{Inventories}_i \times \text{Shock}_t$		-0.000151	-0.000170		-0.0000508	-0.0000662		-0.000000348	0.0000725
		(0.000102)	(0.000106)		(0.000146)	(0.000144)		(0.000239)	(0.000199)
Δ $\text{Assets}_i \times \text{Shock}_t$		-0.00513***	-0.00551***		-0.00689***	-0.00602**		-0.00644***	-0.00863***
		(0.00181)	(0.00204)		(0.00210)	(0.00236)		(0.00194)	(0.00213)
$\text{Avg Profits}_i \times \text{Shock}_t$		0.000127	0.0000354		-0.00000786	-0.000272		-0.000297	0.0000804
		(0.000101)	(0.000144)		(0.000130)	(0.000181)		(0.000246)	(0.000268)
Observations	1976	1815	1815	1976	1815	1815	1975	1814	1814
R^2	0.00264	0.00401	0.00474	0.00316	0.00373	0.00529	0.000717	0.00118	0.00258
Firms	87	80	80	87	80	80	87	80	80
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(3) is the change in accounts payable, in columns (4)-(6) is the change in accounts receivable, and in columns (7)-(9) is the change in sales, all normalized by lagged assets and winsorized at 1%. STFXP is short term FX liabilities minus FX assets, normalized by total assets. STFXP is short term FX liabilities minus FX assets, normalized by total assets. Δ STFXP is the difference between the STFXP levels at 2008q4 and 2005q1. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Δ Inventories is the change in the Inventories to assets ratio over 2006q1-2008q4. Δ Assets is the growth in firm assets over 2006q1-2008q4 (expressed as a decimal). Avg Profits is the firm's average annualized profits over 2006q1-2008q4. Other controls include averages over 2006-2008 of the following variables, also interacted with the shock dummy: firm size (log assets), cash to assets, total liabilities to assets, bond credit to assets, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. R^2 is within-R^2. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 External Validity

Our unique dataset allows us to directly study the currency of assets and liabilities at the firm level and, therefore, track the currency exposure of firms. However, the reader might be concerned about the external validity of our analysis given that we only study public firms in Mexico. In this section we use firm-level data for 20 emerging markets to document the link between carry trade incentives and trade credit.

We use data from Capital IQ, which includes both quarterly balance sheet information and detail on the specific borrowing instruments for (typically listed) firms in several countries. We construct a sample of firms from 20 emerging markets where we have both their balance sheets and the currency composition of their debt.[34] This data can be used to study the link between FX borrowing and trade credit, but it does not contain the detail (i.e. currency composition of assets) to examine directly the accumulation of currency mismatch or its consequences.

Table 11 follows the same approach as Equation 1 and Table 2.[35] Note that for every dollar of FX liabilities 64 cents are accumulated in short-term assets. Consistent with Bruno and Shin (2017)'s result for FX bonds, firms accumulate 15 cents in cash, potentially denominated in local currency, providing indirect evidence of currency mismatch. More importantly, the main destination of every source of funds, including FX debt, is account receivables. This validates our second key result from Table 11.

Table 12 examines relationships following Equation 2 for results in Section 4. The carry trade incentive measure (IRD) is specified similarly as before, but for each country separately. The firm-

[34] See Appendix E for further details. Bruno and Shin (2020b) use the Mexican part of this data to study how the dollar affects Mexican exports. Financial studies have used the cross-country dimension of this data (Choi, Hackbarth, & Zechner, 2018; Colla, Ippolito, & Li, 2013; Grosse-Rueschkamp, Steffen, & Streitz, 2019) to study capital structure. This is the first study using the data to study the link between trade credit and carry trades.

[35] The only difference is that a residual "other" liabilities category is included, as liabilities are not directly reported by currency, but aggregated from individual positions and so may not exactly equal balance sheet liabilities depending on how the firm reports the detail.

Table 11: Corporate Saving by Instrument: Cross-Country Sample

	(1) Total	(2) Cash	(3) AR	(4) Inv	(5) Oth
Cash Flow$_{it}$	0.632***	0.152***	0.316***	0.0644***	0.0571***
	(0.0135)	(0.00761)	(0.00832)	(0.00579)	(0.00738)
Δ FX Debt$_{it}$	0.643***	0.150***	0.185***	0.157***	0.108***
	(0.0137)	(0.00670)	(0.00633)	(0.00529)	(0.00570)
Δ LC Debt$_{it}$	0.514***	0.0879***	0.179***	0.117***	0.0809***
	(0.0111)	(0.00360)	(0.00492)	(0.00360)	(0.00286)
Δ Other Liab$_{it}$	0.542***	0.0988***	0.192***	0.110***	0.0858***
	(0.0122)	(0.00396)	(0.00550)	(0.00375)	(0.00310)
Observations	159756	159756	159756	159756	159756
R^2	0.397	0.0405	0.173	0.112	0.0303
Firms	7607	7607	7607	7607	7607
FirmFE	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes

Sample, derived from Capital IQ, spans 2010q1-2019q4 for firms in 20 emerging markets (AR, BR, CL, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR, ZA). Firms reports the number of firms in each regression. Dependent variable in column (1) is change in short term assets, column (2) is change in cash and financial assets, column (3) is change in accounts receivable, column (4) is change in inventories, and column (5) is change in other short term assets. Cash flow is net income over the previous quarter; FX Debt is the change in FX debt liabilities over the previous quarter; LC Liab is change in local currency debt liabilities over the previous quarter; and Oth Liab is the change in other (residual) liabilities over the previous quarter. All variables are normalized by lagged assets and winsorized at 1%. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

level controls are the same as before, excluding the export share of sales which is not available from the Capital IQ data. The cross-country nature of the data allow for the inclusion of sector-time fixed effects to account for time varying macroeconomic factors, including shocks specific to specific industries.

Table 12: Carry Trade and Trade Credit: Cross-Country Sample

	(1)	(2)	(3)	(4)	(5)
	FX Loans	LC Loans	Acc. Rec.	Acc. Rec. + Acc. Pay.	Sales
Δ IRD$_{ct}$	0.0108**	-0.0128**	0.0145**	0.0369***	0.0175*
	(0.00461)	(0.00632)	(0.00694)	(0.0108)	(0.00987)
Observations	164829	164829	164829	164829	164829
R^2	0.0126	0.0697	0.0146	0.120	0.00377
Firms	7856	7856	7856	7856	7856
FirmFE	Yes	Yes	Yes	Yes	Yes
SectorTimeFE	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes

Sample, derived from Capital IQ, spans 2010q1-2019q4 for firms in 20 emerging markets (AR, BR, CL, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR, ZA). Firms reports the number of firms in each regression. Dependent variables, each normalized by lagged assets and expressed in percent, are as follows: in column (1), the change in FX loans, winsorized at 1%; in column (2), the change in local currency loans, winsorized at 1%; in column (3), the change in accounts receivable, winsorized at 1%; in column (4), the change in accounts receivable plus accounts payable, winsorized at 1%; and in column (5), the change in sales (proxied by total revenue), winsorized at 1%. IRD is the average interest rate on local currency loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms in each country. Change in IRD is normalized by the standard deviation of the daily local currency depreciation rate over the quarter, then winsorized at 1%. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio, total liabilities to assets ratio winsorized at 1%, bond credit to assets ratio winsorized at 1%, and (except in column (5)) sales (proxied by total revenues) to assets ratio winsorized at 1%. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12 reveals that this broader sample of firms shows similar responses to changing carry trade incentives. Specifically, when carry trade incentives increase, FX loan borrowing increase,

local currency loan borrowing decreases, and trade credit and sales expand.[36] Thus, carry trade incentives induce FX borrowing, which may help support an expansion of the trade credit network and stimulate sales. Our cross-country firm-level panel allows us to conclude that the link between carry trade incentives and trade credit seems to be a general feature across emerging markets.

7 Conclusion

We use a unique quarterly panel database of Mexican firms covering all sources of funding in every currency to document risky financial inter-mediation by non-financial firms. We use this unique data to document four main results. First, firms accumulate short-term peso assets out of their short-term FX borrowing, while peso borrowing is exclusively associated with peso assets. Second, non-financial firms act as financial intermediaries by extending trade credit out of both their peso and FX borrowing. Third, during periods of high interest rate differential, firms increase both their currency exposure and their trade credit participation. Thus, we show that the first and second results are driven by firms responding to carry trade opportunities. The expansion of the firm's trade credit network facilitates sales, providing a connection between FX credit conditions and real activity by supporting value chains. Fourth, in the event of a depreciation, accumulating short-term FX exposure leads to reductions in firm investment and profits. Interestingly, firms who increased their FX exposure, and then were hit by the depreciation shock, appear to be willing to cut physical investment or even draw down financial assets before cutting the trade credit that they provide to their customers and others.

Our results highlight the growing concerns over the financial activities of non-financial firms and the role they may play as financial intermediaries. Firms respond to carry trade opportunities increasing their FX exposure, and facilitating the extension of credit to other firms. We document this link between trade credit and carry trades at the firm level for 20 emerging countries. This

[36] Comparing with Tables 4, 6, and 7 we see similar patterns.

link connects foreign currency credit conditions to real outcomes like sales via trade credit linkages. The fact that Mexican firms hit by the exchange rate shock did not comparatively decrease their trade credit suggests that trade credit networks act as a buffer to shocks, so policy makers should view firm financial intermediation activity differently from that of banks. Nevertheless, there is a limit to the shock absorption capacity, so a larger shock could result in the failure of large, trade credit providing firms and thus a collapse of trade credit networks and supply chains. Future research could explore these issues in a model where general equilibrium effects could be taken into account. Understanding the financial behavior of non-financial firms is increasingly important for financial stability and may point in new directions to understand the nature of currency mismatch, FX borrowing, and financial intermediation in emerging markets.

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Appendix

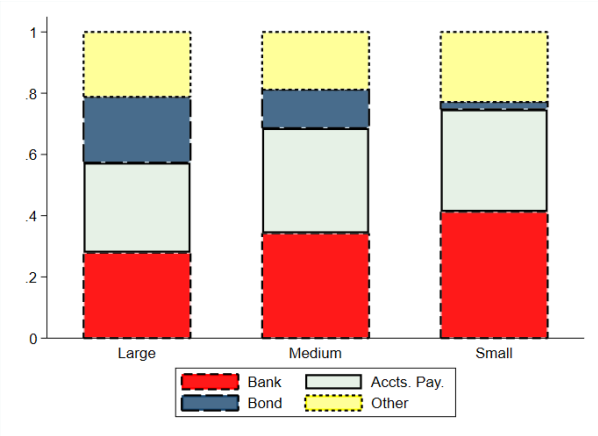
A Additional Data Description

Table A1: Summary Statistics

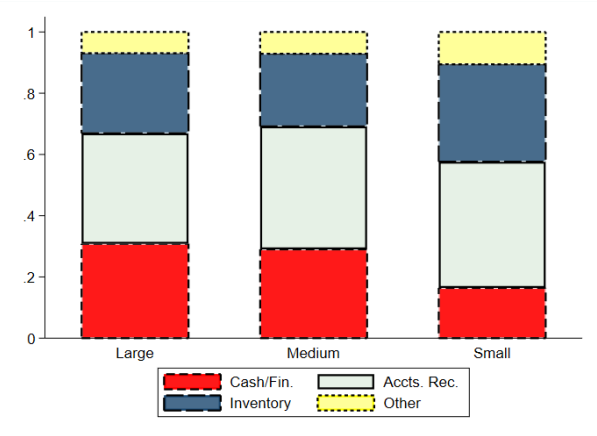
	N	Avg	p10	p50	p90	Std Dev
FXL/A	5028	15.37	0	8.14	42.09	18.46
Short	4528	7.54	0.02	3.97	18.78	11.98
PSL/A	5028	37.81	13.60	34.23	63.13	39.93
Short	4528	19.69	4.36	15.26	37.92	21.62
Bond/A	5126	9.90	0	0.01	26.77	19.93
FX	3472	2.73	0	0	11.48	6.86
Peso	3472	5.94	0	0	14.34	19.81
Loan/A	5126	13.31	0	10.31	30.83	13.79
FX	3472	5.23	0	0.42	18.13	8.78
Peso	3472	7.05	0	3.03	20.45	9.52
AcctsPay/A	5126	9.30	0.83	7.14	19.47	8.84
FX	3472	2.41	0	0.40	7.04	4.38
Peso	3472	4.99	0.02	2.91	11.73	7.59
FXA/A	4562	9.13	0.06	4.69	23.02	12.78
STPSA/A	4562	30.81	7.32	25.78	68.15	25.79
Cash&Fin/A	5114	7.98	0.83	5.50	18.58	8.61
AcctsRec/A	5122	16.21	3.07	12.62	33.47	14.33
Inventories/A	5126	13.75	0.20	8.54	33.13	16.71
log(Assets)	5157	16.12	13.63	16.34	18.32	1.787
Net Income/A	4782	0.79	-1.45	1.04	3.43	8.78

All variables expressed in percent, except log assets. FX denotes foreign currency; PS denotes local currency (pesos); L indicated liabilities; A indicates assets; ST indicates short term. AcctsPay is accounts payable (trade credit liabilities), while AcctsRec is accounts receivable (trade credit assets). Data is quarterly, 2005q1-2015q2.

Figure A1: Balance Sheet Positions, share of total



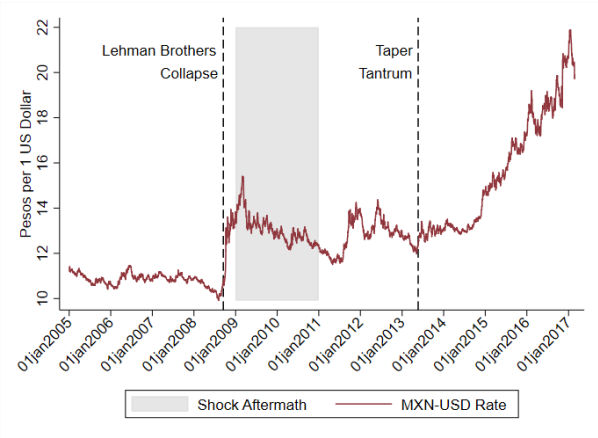
(a) Average FX Liabilities



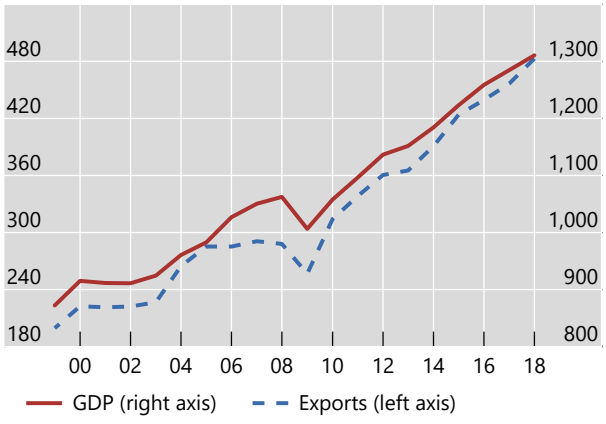
(b) Average Short Term Assets

Source: Author's calculations, averages over 2008q1-2015q2. Firm size groups based on assets: small (avg. assets<33rd pctile), medium (33rd pctile < avg. assets < 66th pctile) and large (avg. assets>66th pctile).

Figure A2: Mexico's Macroeconomic Context



(a) USD-MXN Exchange Rate



(b) Mexico GDP and Exports

Exchange rate data is daily, from FRED. GDP and exports are from World Bank World Development Indicators, expressed in (constant 2010) billions US dollars.

B Currency Mismatch: Additional Results

This section presents additional results relating to Tables 2 and 3 in the main text. Table B1 shows the key relationships (FX borrowing accumulating short-term peso assets, accounts receivable being a key destination among short-term assets) are similar pre-2008 and post-2008. Table B2 shows these key relationships are also similar across exporters and non-exporters. Table B3 shows that manufacturing firms are more prone to accumulating short-term peso assets funded by FX liabilities. Table B4 splits the FX and peso liabilities by instrument, showing that manufacturing firms generate their FX mismatch from their FX loans and FX trade credit borrowing.

Table B1: Corporate Saving by Currency: Pre- vs Post-Crisis

	2005q1-2008q3				2008q4-2015q2			
	(1) Total	(2) FX	(3) Peso	(4) AR	(5) Total	(6) FX	(7) Peso	(8) AR
Cash Flow$_{it}$	0.363***	0.316***	0.0471	0.192***	0.600***	0.118	0.481***	0.110**
	(0.0961)	(0.119)	(0.166)	(0.0606)	(0.160)	(0.0771)	(0.176)	(0.0494)
Δ FX Liab$_{it}$	0.356***	0.224***	0.132***	0.199***	0.397***	0.223***	0.174**	0.116***
	(0.0563)	(0.0441)	(0.0443)	(0.0253)	(0.0748)	(0.0585)	(0.0740)	(0.0284)
Δ Peso Liab$_{it}$	0.507***	-0.0259	0.533***	0.226***	0.422***	0.0590**	0.363***	0.121***
	(0.0487)	(0.0464)	(0.0641)	(0.0374)	(0.0688)	(0.0281)	(0.0593)	(0.0332)
Observations	1034	1034	1034	1034	2850	2850	2850	2850
R^2	0.460	0.111	0.283	0.269	0.190	0.0557	0.104	0.0356
Firms	117	117	117	117	137	137	137	137
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1) and (5) is change in short term assets, columns (2) and (6) is change in short term FX assets, columns (3) and (7) is change in short term peso assets, and columns (4) and (8) is change in accounts receivables. Cash flow is net income over the previous quarter; FX Liab is the change in FX liabilities over the previous quarter; Peso Liab is change in peso liabilities over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table B2: Corporate Saving by Currency: Exporters vs Non-Exporters

	Exporters				Non-Exporters			
	(1) Total	(2) FX	(3) Peso	(4) AR	(5) Total	(6) FX	(7) Peso	(8) AR
Cash Flow$_{it}$	0.546***	0.452***	0.0942	0.156***	0.503***	0.0380	0.465**	0.108*
	(0.147)	(0.131)	(0.159)	(0.0540)	(0.185)	(0.0446)	(0.201)	(0.0555)
Δ FX Liab$_{it}$	0.391***	0.191***	0.200***	0.164***	0.376***	0.230***	0.146*	0.145***
	(0.0432)	(0.0344)	(0.0430)	(0.0246)	(0.0836)	(0.0518)	(0.0863)	(0.0304)
Δ Peso Liab$_{it}$	0.470***	0.0339	0.436***	0.183***	0.421***	0.0320	0.389***	0.133***
	(0.0576)	(0.0430)	(0.0623)	(0.0304)	(0.0679)	(0.0279)	(0.0622)	(0.0375)
Observations	1464	1464	1464	1464	2425	2425	2425	2425
R^2	0.416	0.0795	0.155	0.200	0.184	0.0756	0.123	0.0456
Firms	56	56	56	56	96	96	96	96
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1) and (5) is change in short term assets, columns (2) and (6) is change in short term FX assets, columns (3) and (7) is change in short term peso assets, and columns (4) and (8) is change in accounts receivables. Cash flow is net income over the previous quarter; FX Liab is the change in FX liabilities over the previous quarter; Peso Liab is change in peso liabilities over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B3: Corporate Saving by Currency: Manufacturing vs Non-Manufacturing

	Manufacturing				Non-Manufacturing			
	(1) Total	(2) FX	(3) Peso	(4) AR	(5) Total	(6) FX	(7) Peso	(8) AR
Cash Flow$_{it}$	0.632***	0.351***	0.280***	0.164**	0.453**	0.0874	0.366	0.117**
	(0.117)	(0.119)	(0.0813)	(0.0638)	(0.199)	(0.0803)	(0.249)	(0.0496)
Δ FX Liab$_{it}$	0.426***	0.186***	0.240***	0.186***	0.318***	0.275***	0.0426	0.113***
	(0.0511)	(0.0281)	(0.0474)	(0.0296)	(0.0874)	(0.0745)	(0.101)	(0.0329)
Δ Peso Liab$_{it}$	0.482***	0.0662*	0.416***	0.196***	0.404***	0.000358	0.404***	0.109***
	(0.0692)	(0.0345)	(0.0639)	(0.0440)	(0.0691)	(0.0384)	(0.0743)	(0.0322)
Observations	1955	1955	1955	1955	1934	1934	1934	1934
R^2	0.302	0.0661	0.150	0.0933	0.179	0.0858	0.119	0.0460
Firms	74	74	74	74	78	78	78	78
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1) and (5) is change in short term assets, columns (2) and (6) is change in short term FX assets, columns (3) and (7) is change in short term peso assets, and columns (4) and (8) is change in accounts receivables. Cash flow is net income over the previous quarter; FX Liab is the change in FX liabilities over the previous quarter; Peso Liab is change in peso liabilities over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B4: Corporate Saving by Currency and Instrument: Manufacturing vs Non-Manufacturing

	Manufacturing				Non-Manufacturing			
	(1) Total	(2) FX	(3) Peso	(4) AR	(5) Total	(6) FX	(7) Peso	(8) AR
Cash Flow$_{it}$	0.588***	0.301**	0.287***	0.120*	0.596**	0.0683	0.527**	0.122*
	(0.153)	(0.144)	(0.0795)	(0.0687)	(0.229)	(0.0578)	(0.243)	(0.0639)
Δ FX Loan$_{it}$	0.326***	0.0960***	0.230***	0.148***	0.348***	0.997**	-0.649	0.0584
	(0.0628)	(0.0289)	(0.0590)	(0.0283)	(0.0846)	(0.410)	(0.453)	(0.0611)
Δ FX Bond$_{it}$	0.105*	0.0438	0.0610	0.0478*	-0.0481	0.0458	-0.0939**	-0.00395
	(0.0527)	(0.0353)	(0.0465)	(0.0260)	(0.0387)	(0.0419)	(0.0442)	(0.0170)
Δ FX Trade$_{it}$	0.365**	0.136*	0.229*	0.0898	0.355***	0.348	0.00720	0.189***
	(0.169)	(0.0799)	(0.122)	(0.0542)	(0.104)	(0.264)	(0.248)	(0.0524)
ΔPeso Loan$_{it}$	0.398***	0.0779*	0.320***	0.219***	0.405***	0.125**	0.280**	0.0637
	(0.101)	(0.0422)	(0.0927)	(0.0650)	(0.104)	(0.0605)	(0.114)	(0.0427)
Δ Peso Bond$_{it}$	0.299***	0.0598	0.239**	0.0541	0.0667	0.0564**	0.0103	-0.0513
	(0.0943)	(0.0453)	(0.0906)	(0.0540)	(0.101)	(0.0235)	(0.0963)	(0.0682)
Δ Peso Trade$_{it}$	0.686***	0.0373	0.649***	0.225***	0.457***	0.0451	0.412***	0.0922*
	(0.119)	(0.0377)	(0.113)	(0.0356)	(0.135)	(0.0279)	(0.130)	(0.0475)
Δ Other$_{it}$	0.361**	0.0941	0.267**	0.0957	0.292***	0.00413	0.288***	0.0637
	(0.147)	(0.0593)	(0.114)	(0.0838)	(0.0981)	(0.0302)	(0.0981)	(0.0497)
Observations	1500	1500	1500	1500	1549	1549	1549	1549
R^2	0.219	0.0398	0.123	0.0508	0.137	0.140	0.106	0.0243
Firms	69	69	69	69	70	70	70	70
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2005q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1) and (5) is change in short term assets, columns (2) and (6) is change in short term FX assets, columns (3) and (7) is change in short term peso assets, and columns (4) and (8) is change in accounts receivables. Cash flow is net income over the previous quarter; other independent variables are change in the indicated liability in the indicated currency over the previous quarter. All variables are normalized by lagged assets. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C Carry Trade Incentives: Additional Results

This section presents additional results relating to Tables 4-7 in the main text. Table C1 shows the impact on total FX liabilities and net FX position is similar to the short-term impact shown in the main text. Tables C2 and C3 show that manufacturing firms tend to drive the overall response documented in the main text. Table C4 shows that many of the key results persist even after absorbing year fixed effects. Table C5 shows that the short-term FX exposure indeed increases, but it is not clear that derivatives usage expands to hedge the increased FX risk. In fact, firms are less likely to change their derivative holding during periods of high carry trade incentives.

Table C1: Carry Trade and Total FX Liabilities

	Net FX Position	All Liab.	Loans	Bonds
	(1)	(2)	(3)	(4)
Δ IRD$_t$	0.536**	0.122	0.163***	0.0369
	(0.247)	(0.113)	(0.0542)	(0.0751)
Observations	3001	3154	3222	3222
R^2	0.0387	0.0119	0.0121	0.00104
Firms	134	135	139	139
FirmFE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in net FX position (FX liabilities - FX Assets), in column (2) is the change in total FX liabilites, in column (3) is the change in total FX loans, in column (4) is the change in total FX bonds. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table C2: Carry Trade and Short-Term Positions: Manufacturing Firms

	Liabilities		Assets			Sales
	(1) FX	(2) Peso	(3) FX	(4) Peso	(5) AR	(6)
Δ IRD$_t$	0.169	0.0766	-0.163	0.688***	0.303**	0.498***
	(0.190)	(0.253)	(0.224)	(0.223)	(0.117)	(0.0987)
Observations	1473	1473	1473	1473	1542	1542
R^2	0.00673	0.00763	0.0489	0.0206	0.0201	0.145
Firms	66	66	66	66	67	67
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the change in short term liabilities, and in columns (3)-(5) is the change in short term assets (for the currency listed in the column heading; for all accounts receivables in column (5)), and in column (6) is the change in sales. Short term is based on remaining maturity at one year or less. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table C3: Carry Trade and Short-Term Positions: Non-Manufacturing Firms

	Liabilities		Assets			Sales
	(1) FX	(2) Peso	(3) FX	(4) Peso	(5) AR	(6)
Δ IRD$_t$	0.212*	0.291	-0.660**	0.354	0.0834	0.396***
	(0.117)	(0.224)	(0.291)	(0.276)	(0.102)	(0.118)
Observations	1526	1526	1528	1528	1682	1682
R^2	0.0164	0.0120	0.0824	0.0268	0.0167	0.188
Firms	67	67	68	68	72	72
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the change in short term liabilities, and in columns (3)-(5) is the change in short term assets (for the currency listed in the column heading; for all accounts receivables in column (5)), and in column (6) is the change in sales. Short term is based on remaining maturity at one year or less. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table C4: Carry Trade and Short-Term Positions: Year Fixed Effects

	(1) Net FX Position	(2) Short-term FX Liab.	(3) Short-term Peso Assets	(4) Accounts Receivables	(5) Sales
Δ IRD$_t$	0.399	0.128	0.397*	0.165*	0.315***
	(0.310)	(0.135)	(0.225)	(0.0955)	(0.0874)
Observations	2999	2999	3001	3224	3224
R^2	0.0390	0.00506	0.0166	0.0119	0.159
Firms	133	133	134	139	139
FirmFE	Yes	Yes	Yes	Yes	Yes
YearFE	Yes	Yes	Yes	Yes	Yes
FirmControls					

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in short-term FX position, column (2) is the change in short term FX liabilities, in column (3) is the change in short-term peso assets, in column (4) is the change in accounts receviable, and column (5) is the change in sales. Short term is based on remaining maturity at one year or less. All dependent variables are normalized by lagged assets and winsorized at 1%. IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table C5: Carry Trade, FX Exposure, and Derivatives

	Net Derivatives	Gross Derivatives	Any Derivatives	
	(1)	(2)	(3) LPM	(4) Probit
Δ IRD$_t$	-0.00654	0.0617***	-3.389***	-10.69***
	(0.0147)	(0.0170)	(0.905)	(3.738)
Observations	3222	3222	3249	3253
R^2	0.00633	0.0251	0.0227	0.2001
Firms	139	139	140	140
FirmFE	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in market value of the firm's net derivatives position (derivatives in the asset position minus derivatives in the liability position), columns (2) is the change in the market value of gross derivatives (derivative assets plus derivative liabilities) - each normalized by lagged assets and winsorized at 1% - and columns (3)-(4) is a dummy variable equal to 1 if the firm has any derivatives (any non-zero amount on the balance sheet). Column (3) uses a linear probability model with fixed effects, column (4) uses a probit model (without fixed effects). IRD is the average interest rate on peso loans minus the average interest rate on FX loans in each quarter. Interest rates are loan weighted averages of all firm loans up to the firm level, and then a simple average across firms. Change in IRD is normalized by the standard deviation of the daily peso depreciation rate over the quarter. Controls include US real GDP growth, Mexico real GDP growth, and one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Errors are clustered at the firm level. R^2 is within-R^2, in column (4) it is a Pseudo R^2. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

D The Mexican Peso Depreciation: Additional Results

This section presents additional results relating to Tables 9 and 10 in the main text. Table D1 indicates that there were no significant differences in outcomes before the exchange rate shock according to the change in their short-term FX exposure (as a validity check on the difference-in-differences approach). Tables D2 and D3 show evidence that both manufacturing and non-manufacturing firms with carry-trade exposure may have comparatively decreased investment (and had lower profits in the case of non-manufacturers), but did not adjust the trade credit they extended to other firms.

Table D1: Carry Trade Impacts: Pre-period Placebo

	(1) Inv.	(2) Emp.	(3) ROA	(4) AP	(5) AR	(6) Sales
Δ STFXP$_i$ $\times$ Pre$_t$	0.0219	-0.0324*	-0.00435	0.000921	-0.00536	-0.0124
	(0.0175)	(0.0193)	(0.00805)	(0.00418)	(0.00499)	(0.00926)
Observations	1995	1980	1903	1976	1976	1975
R^2	0.00111	0.00168	0.000471	0.0000126	0.000246	0.000343
Firms	87	87	87	87	87	87
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in column (1) is the log difference in property, plant, and equipement, winsorized at 2%; in column (2) is the log difference in employment, winsorized at 2%; in column (3) is the return on assets, winsorized at 1%; in column (4) is the change in accounts payable, in column (5) is the change in accounts receivable, and in column (6) is the change in sales, each in (4)-(6) normalized by lagged assets and winsorized at 1%. STFXP is short term FX liabilities minus FX assets, normalized by total assets. STFXP change is the difference between the STFXP levels at 2008q4 and 2005q1. Pre is a dummy equal to 1 during 2007 and 2008, and 0 otherwise. R^2 is within-R^2. Errors are clustered at the firm level. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table D2: Carry Trade Impacts: Manufacturing Firms

	(1) Inv.	(2) Emp.	(3) ROA	(4) AP	(5) AR	(6) Sales
Δ STFXP$_i$ $\times$ Shock$_t$	-0.0250*	0.0173	-0.00435	-0.00651	-0.00121	0.000229
	(0.0132)	(0.0143)	(0.00439)	(0.00444)	(0.00646)	(0.00893)
Δ Inventories$_i$ $\times$ Shock$_t$	-0.000314	-0.000836*	-0.000265	-0.000233	-0.000257	-0.000786**
	(0.000715)	(0.000469)	(0.000263)	(0.000200)	(0.000242)	(0.000306)
Δ Assets$_i$ $\times$ Shock$_t$	-0.0208***	0.00104	-0.00494	-0.00647**	-0.00560***	-0.00691***
	(0.00742)	(0.00457)	(0.00318)	(0.00258)	(0.00168)	(0.00236)
Avg Profits$_i$ $\times$ Shock$_t$	0.00108*	0.000107	-0.000258	0.000200	0.0000253	0.0000752
	(0.000620)	(0.000477)	(0.000177)	(0.000128)	(0.000154)	(0.000259)
Observations	998	991	963	994	994	994
R^2	0.0142	0.00165	0.00906	0.00797	0.00328	0.00223
Firms	44	44	44	44	44	44
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in column (1) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in column (2) is the log difference of employment, winsorized at 2%; in column (3) is net income (profits) divided by total assets, winsorized at 1%; in column (4) is the change in accounts payable normalized by lagged assets, winsorized at 1%; in column (5) is the change in accounts receivable normalized by lagged assets, winsorized at 1%; and in column (6) is the change in sales normalized by lagged assets, winsorized at 1%. STFXP is short term FX liabilities minus FX assets, normalized by total assets. Δ STFXP is the difference between the STFXP levels at 2008q4 and 2005q1. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Δ Inventories is the change in the Inventories to assets ratio over 2006q1-2008q4. Δ Assets is the growth in firm assets over 2006q1-2008q4 (expressed as a decimal). Avg Profits is the firm's average annualized profits over 2006q1-2008q4. R^2 is within-R^2. Errors are clustered at the firm level. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

Table D3: Carry Trade Impacts: Non-Manufacturing Firms

	(1) Inv.	(2) Emp.	(3) ROA	(4) AP	(5) AR	(6) Sales
Δ STFXP$_i$ $\times$ Shock$_t$	-0.0493**	0.0215	-0.0170**	0.00659*	-0.00314	-0.00827*
	(0.0198)	(0.0252)	(0.00760)	(0.00369)	(0.00759)	(0.00484)
Δ Inventories$_i$ $\times$ Shock$_t$	0.000612	0.00162**	-0.000232**	-0.000126	0.0000139	0.000187
	(0.000568)	(0.000653)	(0.0000911)	(0.000163)	(0.000207)	(0.000206)
Δ Assets$_i$ $\times$ Shock$_t$	-0.00757	-0.00236	-0.00687***	-0.00366**	-0.00824*	-0.00573**
	(0.00893)	(0.00925)	(0.00115)	(0.00167)	(0.00463)	(0.00280)
Avg Profits$_i$ $\times$ Shock$_t$	-0.000640	0.00204*	-0.0000275	0.0000543	0.000000555	-0.000697*
	(0.000978)	(0.00110)	(0.000201)	(0.000229)	(0.000276)	(0.000373)
Observations	834	826	782	821	821	820
R^2	0.00944	0.00869	0.0187	0.00275	0.00494	0.00268
Firms	36	36	36	36	36	36
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in column (1) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in column (2) is the log difference of employment, winsorized at 2%; in column (3) is net income (profits) divided by total assets, winsorized at 1%; in column (4) is the change in accounts payable normalized by lagged assets, winsorized at 1%; in column (5) is the change in accounts receivable normalized by lagged assets, winsorized at 1%; and in column (6) is the change in sales normalized by lagged assets, winsorized at 1%. STFXP is short term FX liabilities minus FX assets, normalized by total assets. Δ STFXP is the difference between the STFXP levels at 2008q4 and 2005q1. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Δ Inventories is the change in the Inventories to assets ratio over 2006q1-2008q4. Δ Assets is the growth in firm assets over 2006q1-2008q4 (expressed as a decimal). Avg Profits is the firm's average annualized profits over 2006q1-2008q4. R^2 is within-R^2. Errors are clustered at the firm level. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01

E External Validity: Data Description

The EMEs in our panel include Argentina, Brazil, Chile, Colombia, Czech Republic, Hong Kong, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Singapore, South Africa, South Korea, Thailand, and Turkey.

Our data source is Capital IQ. We utilize both firm-level balance sheet data as well as capital structure (debt-level) data at a quarterly frequency. Only firm-quarter observations are used that have capital structure data as well as data on assets, sales, accounts receivable and accounts tradable.

The capital structure data includes the different debt sources (e.g. individual loans and bonds) for each firm. Important for us, this includes the currency of the debt and the type of debt, allowing us to classify debt into foreign vs domestic currency, bank debt vs bond debt, etc. Debt where no currency is listed is assumed to be in foreign currency.[37] We drop observations specific to the maximum value of credit lines (i.e. we only consider the drawn portion of credit lines).

Table E4 presents summary statistics for this data.

[37] When a firm reports "foreign currency" or "multiple currencies", Capital IQ leaves the repayment currency blank.

Table E4: Summary Statistics: Cross-Country Sample

	N	Avg	p10	p50	p90	Std Dev
FXD/A	256234	7.24	0	0	22.54	126.37
LCD/A	256234	43.13	0	22.69	78.18	805.32
FX Loan/A	256234	5.26	0	0	16.25	104.62
LC Loan/A	256234	19.19	0	9.88	38.29	332.43
STA/A	256234	47.29	15.12	46.72	80.38	23.99
Cash/A	255605	8.73	0.63	5.25	20.89	10.49
AcctsRec/A	256234	16.08	1.45	12.41	35.53	14.60
AcctsPay/A	256234	12.74	1.03	7.34	24.91	159.51
Inventories/A	235069	14.40	0.53	10.64	33.47	14.44
Sales/A	256234	22.27	3.36	17.73	42.92	68.36

All variables expressed in percent. FX denotes foreign currency; LC denotes local currency; A indicates assets; ST denotes short-term. AcctsPay is accounts payable (trade credit liabilities), while AcctsRec is accounts receivable (trade credit assets). Sample, derived from Capital IQ, spans 2010q1-2019q4 for firms in 20 emerging markets (AR, BR, CL, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR, ZA).

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