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

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September 2020*

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. The interest rate differential between local and foreign currency borrowing induces this FX borrowing and trade credit intermediation at a quarterly frequency, generating an expansion in foreign currency borrowing and FX mismatch, gross trade credit and sales. Firms that were active in carry-trades have decreased investment and profits following a large depreciation event, compared to other firms. However, their extension of trade credit remains stable, insulating their counterparties from the shock.

JEL-Codes: E44, G15

Keywords: Emerging market corporate debt, currency mismatch, liability dollarization, currency crisis, systemic risk

*We thank Borağan Aruoba, Hyun Song Shin, Şebnem Kalemli-Özcan, Pablo Slutzky, Colin Ward, William Mullins, Ina Simonovska, Kinda Hachem, and Stefan Avdjiev for helpful comments, as well as seminar and conference participants at the BIS, IMF, and CBC-IMF-IMFER emerging markets conference. We are also thankful to Victoria Nuguer for an excellent discussion. All errors are our own. The views expressed here are those of the authors and not necessarily those of the Bank for International Settlements.
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1 Introduction

Non-financial firms are an important provider of financial resources to the economy, including the provision of trade credit to customers and suppliers. Throughout the paper, we use the term "trade credit" to generally refer to inter-firm credit (typically accounts payable/receivable). This can be trade credit extended (trade credit assets: accounts receivable) or trade credit borrowed (trade credit liabilities: accounts payable).[1] Trade credit is therefore, a direct measure of inter firm linkages and value chains. In addition, large firms in emerging markets have access to low cost foreign currency (FX) credit, which results in FX exposure in their liability positions. Those liabilities are balanced by assets, including trade credit, potentially denominated in both FX and peso.[2] Interest rate differentials across currencies (carry trade incentives) can foster balance sheet mismatches for firms with access FX credit. However, relatively little is known about how FX credit interacts with trade credit and if risks from FX mismatch propagate to other firms via their trade credit linkages. Regulation and prudential supervision tend to focus primarily on banks and other financial institutions.[3]

This paper uses a unique firm-level dataset from Mexico with detailed financial and real data to study financial intermediation by non-financial firms at a quarterly frequency and its real implications following a currency depreciation. We document that the main short-term destination of the proceeds from borrowing is the extension of trade credit to

[1] This is different from the term "trade finance", which refers to bank-based finance used to facilitate cross-border trade.

[2] 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 even 28% of of the external funds used for investment for firms in 13 emerging markets. Further, the data by Chui, Kuruc, and Turner (2016) show that FX debt accounts for 31% of debt on average across these countries.

[3] Recent regulatory efforts (e.g. Basel III) have started to account for firm FX risk, though this typically is done through regulation on banks.

customers and suppliers, including trade credit denominated in pesos. A key driver of firm-level carry trade behavior is the gap between FX and local currency interest rate. With cheaper dollar funding, firms borrow more in FX, extend more trade credit (which carries a high effective interest rate[4] (Klapper et al., 2012)), accumulate short term peso assets, and increase sales. Trade credit is resilient to shocks to the firm, acting more as a buffer than a catalyst in the event of an exchange rate shock.

Mexico is an ideal laboratory to study these relationships because of the high use of trade credit and prevalence of foreign currency borrowing. Moreover, our unique dataset provides a number of advantages over the existing literature and datasets studying carry trade behavior of non-financial corporates, which rely on annual data with only partial information on FX liabilities or assets. First, we build a panel database at a *quarterly* frequency. This enables us to examine higher frequency activities with short term maturities that are missed by studies relying on annual data. Because investment takes time to materialize, having quarterly data also allows us to improve our identification. In fact, our measured outcomes are more likely to reflect current price and selling conditions rather than increased productive capacity due to concurrent investment. Second, our dataset includes detailed information of the currency composition of both liabilities and assets. This level of detail allows us to directly examine if FX borrowing with carry trade leads to the accumulation of short term peso assets, a behavior only implied or indirectly observed in previous studies (e.g. Bruno and Shin (2017)). Further we capture all sources of FX borrowing (e.g. bonds, loans, etc.) and can distinguish between them, rather than using one borrowing source as a proxy for all FX debt. Third, the data also include a detailed

[4]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. (Klapper, Laeven, & Rajan, 2012) find the effective interest rate for trade credit is 54% on average and 31% for the median.

breakdown of short-term assets by instrument. This allows us to separately examine how firms adjust their cash holdings or other short term assets as compared to their extension of trade credit. And fourth, the dataset includes 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.

We document four novel empirical findings. First, we provide direct evidence on the extent of FX borrowing by non-financial corporations to finance short term peso assets, a type of carry trade that exposes their balance sheets to currency risk. This analysis reveals that nearly 50% of the short term assets accumulated from FX borrowing are peso denominated, while peso borrowing mostly funds peso assets.

Second, decomposing short term assets by instrument, we find that nearly 50% of the short-term assets accumulated from borrowing in either currency are accounts receivable. That is, non-financial firms lend the proceeds of their increased borrowing, in any currency, by extending more trade credit. The magnitude of the saving from FX liabilities into short term peso assets indicates that firms are intermediating some of their FX borrowing into peso trade credit. In fact, from the liability side, we directly see that accounts payable is partially denominated in FX currency and it reacts to cheap dollar funding. Thus, firms act as financial intermediaries, with a positive co-movement between financial assets and liabilities - funding peso assets with FX liabilities - but the main dimension along which they act as intermediaries is by extending trade credit to other firms. This is the first study showing that trade credit is a central element when considering FX borrowing or carry trades of non-financial firms.[5]

[5] Bruno and Shin (2018a, 2017) study the accumulation of cash and financial instruments from FX borrowing. While firms also accumulate cash and financial assets out of their peso and FX borrowing in our sample, accounts receivables is the main destination of these funds.

Third, we document that firms increase their short-term liabilities in FX and finance more short-term peso assets in response to carry trade incentives (wider interest rate differential between foreign and local currency borrowing, measured quarterly). These incentives also lead to an increase in trade credit extended and sales. Firms do not change the proportion of sales sold on credit. Rather, they appear to pass the cost savings from the cheaper FX borrowing on to their customers. With cheaper dollar borrowing, firms borrow more in FX, increase trade credit, and thus increase sales. Because we measure these outcomes quarterly, they are not determined by firms borrowing in FX and investing in increased productive capacity (increasing sales and trade credit) due to the lag between investment and production. This finding provides important evidence for how credit conditions can affect production and sales via trade credit linkages.

Fourth, we find that investment and employment fall after a large exchange rate shock for firms that built up FX exposure through carry trade, but their trade credit remains robust. Large depreciation episodes wreak havoc on firm balance sheets and the macroeconomy generally. We study the Mexican peso depreciation at the end of 2008 that featured a 33% unexpected decrease on the value of the Mexican peso. Prior to that shock, our sample features a high carry trade period over 2005-2008, with a relatively stable exchange rate and a large and increasing interest rate differential. Investment and employment fall after the depreciation for all firms, as does trade credit and sales, reflecting the general impact of the shock. Firms that accumulated 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.[6] Trade credit

[6]These effects are distinct from the traditional balance sheet channel, as we control directly for the level of FX exposure (short or in total) on the balance sheet. Indeed, carry trade activity may be a better indicator of vulnerability to currency risk than traditional mismatch measures. The direct balance sheet exposure does not appear to play a large role for the average firm, while carry trade activity has an important general

(borrowing or lending) for carry trade firms is not differentially affected by the depreciation shock. This 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 banking literature sees lending as a catalyst during currency crises, inter-firm lending behaves more like a buffer.

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, and firms with larger cash holdings are more likely to do so. These firms use the proceeds to disproportionately accumulate more cash, suggesting a carry trade motive. Recent work suggests that firms engaging in this behavior are negatively impacted by a depreciation (Bruno & Shin, 2018a).[7] Our database for Mexico allows us to complement these findings along two dimensions. First, because we can decompose assets by instrument and currency, we can relax the assumption that all cash holding is denominated in local currency and directly show that firms use carry trade proceeds to fund short-term assets in pesos. Moreover, non-cash peso assets have stronger co-movements with FX borrowing. Second, we show that trade credit is a central source and use of funding for firms. We directly show that firms finance trade credit out of their FX borrowing, and that both borrowing and lending in trade credit increases with relatively easier FX credit conditions.

impact. Note that the traditional balance sheet effect does still play a role among smaller, non-exporting firms in this sample (see Hardy (2018)).

[7] Evidence for carry-trade behavior by firms has also been shown by Acharya and Vij (2017) for India and Huang, Panizza, and Portes (2018) for China.

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 (Kalemli-Özcan, Kim, Shin, Sørensen, & Yeşiltaş, 2014). Bruno and Shin (2018b) 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. Our results also suggest 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] Such trade credit is especially important to firms without access to bank credit (Minetti, Murro, Rotondi, & Zhu, in press).

We further contribute to the literature on exchange rate related balance sheet shocks by showing that carry trade incentives can increase FX exposure for 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).[10] We show that firms take advantage of these interest rate differentials quarterly with short term borrowing, increasing their FX exposure when borrowing

[8]Trade credit may involve non-financial motives (Klapper et al., 2012) or be used to smooth customer prices (Finkelstein Shapiro et al., 2018).

[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.

in FX becomes more favorable. The increase in exposure is a stronger indicator of vulnerability to exchange rate shocks than is the level of exposure typically examined in this literature.

Summarizing, we use detailed firm-level financial data to document risky financial intermediation by non-financial firms and how FX credit conditions affect real activity. This has important policy implications, as most existing financial regulations focus on financial institutions and miss firm-level risk and inter-firm lending. Interestingly, inter-firm trade credit networks are resilient, acting more as a buffer than a catalyst for the transmission of a currency crisis.

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; and Section 6 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).[11] 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. We can examine the liabilities by currency and maturity (2005-2015), currency, maturity, and

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

instrument (2008-2015), and we have a breakdown of assets by currency (2005-2015), and currency and maturity (2012-2015). The instrument breakdown on the liability side includes bank credit, market credit (bonds), accounts payable (trade credit borrowed), 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, though not simultaneously split by currency. This detail in the balance sheet data is unique in the literature and makes it possible to 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. 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.

The dataset also includes data on interest rates at the loan level for 87% of our loan observations, which enables us to compute firm-level interest rates for 87% of firms in either currency, with 47% of firms with both peso and FX interest rates simultaneously, and therefore examine carry-trade opportunities faced by non-financial firms.[12] Finally, the dataset also includes standard balance sheet information, as well as data on employment, physical investment, and exports.

[12]While many firms borrow in both currencies, fewer borrow from banks simultaneously in both currencies.

Table 1: Currency Composition Data

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

Because our goal is to study currency risk it is important to distinguish between exporters (firms with a natural hedge for FX borrowing) and non exporting firms. Exporters are defined as having the median of the export share of sales greater than 15%. This captures firms that consistently have a meaningful amount of their revenues from foreign buyers, and thus potentially denominated in a foreign currency. 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.

Table 2 provides summary statistics for the balance sheet positions for firms in our data, with detail by currency, instrument, and maturity. For the average firm, FX liabilities stand at 15% of assets compared to peso liabilities which are closer to 38% of assets. Nearly half of the FX liabilities are short term. Panel (a) of Figure 1 shows the average share of FX liabilities by instrument for firms of different size.[13] Among firms that borrow in FX, a large portion of FX liabilities comes from loan debt (33%) and accounts payable/trade credit (32%), though bond debt (14%) can also be important for large firms. For all firms, bank credit and accounts payable (trade credit) form the majority of FX liabilities, a fact which highlights the importance of considering all forms of FX credit rather than FX bonds only. Because trade credit is typically short term, FX trade credit liabilities

[13]Size categories are based on the average of log assets over the sample. Number of firms in each size group is roughly equal.

are on average 46% of the short term FX liabilities. While firms do hold FX assets, on average those holdings are less than their FX liabilities.

Table 2: Summary Statistics

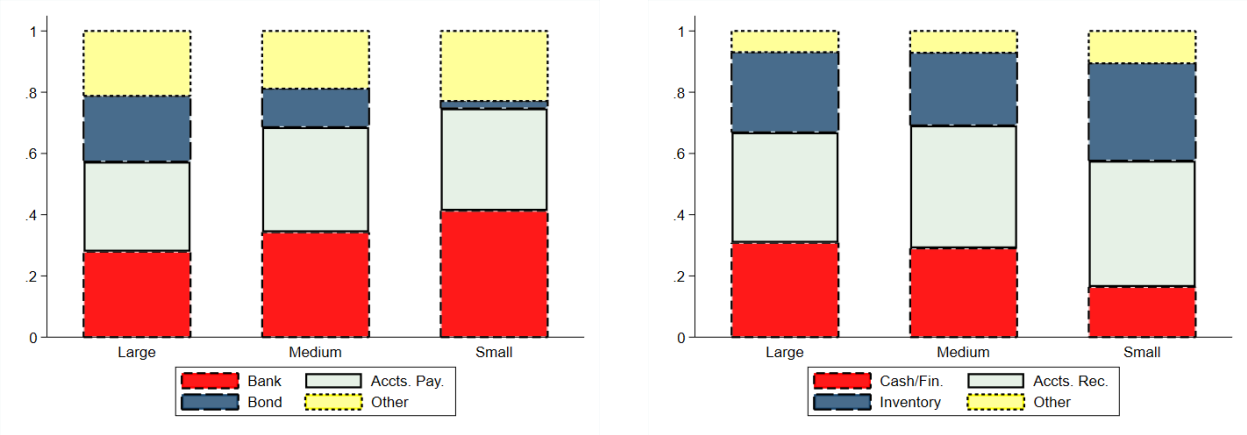
	N	Avg	p10	p50	p90	Std Dev
FXL/A	5028	15.37	0	8.14	42.09	18.46
Short	4528	7.54	0.02	3.97	18.78	11.98
PSL/A	5028	37.81	13.60	34.23	63.13	39.93
Short	4528	19.69	4.36	15.26	37.92	21.62
Bond/A	5126	9.90	0	0.01	26.77	19.93
FX	3472	2.73	0	0	11.48	6.86
Peso	3472	5.94	0	0	14.34	19.81
Loan/A	5126	13.31	0	10.31	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.

Among the short term assets held by firms, panel (b) of Figure 1 shows that accounts receivable is the largest category for all groups, and are nearly twice as large on average

than cash and financial asset holdings. Cash and financial assets make up a smaller portion of short term assets for smaller firms, which tend to hold more inventory. Thus, FX positions and trade credit (as an asset and as a liability) are important components in a firm's balance sheet.

Figure 1: 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).

3 FX Borrowing and Saving

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 cash is saved in short term assets, and how do these patterns vary by the currency of both the liability and the asset. We examine changes in bond, loan, and trade credit liabilities of the firm,[14] as well as changes in total FX and peso liabilities. Although FX bond issuance is an increasingly

[14]We also include residual "other" liabilities in the regression for completeness, though those tend to be small.

important source of firm FX funding, it is important to capture all FX liabilities, especially bank and trade credit, to get a full picture of the firm's FX exposures. We examine the relationship between firm liabilities and short term assets with the following regression:

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

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. Firm and time fixed effects are included to capture any common shocks to all firms and any level differences among firms. Standard errors are clustered at the firm level.[15] This approach is an expansion of those considered in Bruno and Shin (2018a) and Acharya and Vij (2017) in that it considers all types of funding by currency, instead of a subset (eg USD bonds), and examines all short term uses of those funds, including separately by currency and separately by instrument. It tracks the coevolution of both sides of the balance sheet together, including the sources and uses of funds by currency at quarterly frequency.

Table 3 takes a first look at the relationship between changes in borrowing by instrument and accumulation of short term assets. Column (1) shows that firms tend to accumulate short term assets at high rates out of both bond and loan borrowing, and especially their trade credit borrowing ($0.53, $0.41, and $0.71 out of each $1 borrowed, respectively). Columns (2) and (3) decompose short term assets by currency, to see what

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

instruments firms use to accumulate their short term FX assets. These show that the split between local and foreign currency short term assets is about even for any given instrument of borrowing. Notably, trade credit borrowing has the highest funding rate of the three instruments into short term assets, reflecting the pattern cited in the introduction of firm's using trade credit to finance working capital. Thus, there is valuable information in all sources of borrowing, including loans and trade credit, when studying the accumulation of short term FX and peso assets.

Columns (4) and (5) show two different short term asset instruments: cash and financial assets, and account receivables. The focus of the literature has been on the strong correlation between bond borrowing and increases in cash and financial assets depicted in column (4). The granularity of the data allows us to switch perspective to examine trade credit extended by the firm. In fact, as seen in column (5), all three sources of funding correlate positively with the extension of trade credit to other firms and customers (by accumulating accounts receivable). These correlations are stronger than they are for cash accumulation, indicating that a higher share of borrowing in any instrument supports the extension of trade credit to other firms than it does drive the accumulation of cash. This is an important and novel fact providing direct evidence for the literature on firm-to-firm shock propagation.

Result 1: Firm-Level Currency Mismatch. We take advantage of the currency composition of both assets and liabilities to examine how currency of borrowing and currency of short term assets correlate. This is important because it allows us to directly examine if firms on average use their FX borrowing to accumulate short term peso assets, and thus understand better how currency mismatches arise on the balance sheet. Table 4 shows

Table 3: Corporate Saving by Instrument of Borrowing

	(1) Total	(2) FX	(3) Peso	(4) Cash and Financial	(5) Accounts Receivable
Cash Flow$_{it}$	0.419***	0.327***	0.337***	0.0672**	0.159***
	(0.0664)	(0.0721)	(0.0721)	(0.0320)	(0.0354)
Δ Bond$_{it}$	0.529***	0.293***	0.277***	0.117**	0.341***
	(0.0725)	(0.0867)	(0.0847)	(0.0555)	(0.102)
Δ Loan$_{it}$	0.413***	0.253***	0.239***	0.0920***	0.218***
	(0.0468)	(0.0832)	(0.0835)	(0.0244)	(0.0302)
Δ AccPay$_{it}$	0.713***	0.619***	0.642***	0.0958***	0.195***
	(0.0533)	(0.0562)	(0.0573)	(0.0261)	(0.0393)
Δ Other$_{it}$	0.410***	0.320***	0.326***	0.0546*	0.175***
	(0.0551)	(0.0601)	(0.0601)	(0.0282)	(0.0357)
Observations	4779	4225	4225	4756	4771
R^2	0.309	0.128	0.133	0.0391	0.155
Firms	183	161	161	183	183
FirmFE	Yes	Yes	Yes	Yes	Yes
TimeFE	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, and column (4) is change in cash and short term financial 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

these results. Column (1) shows that firms accumulate short term assets at a rate of a little under 50% on the dollar, regardless of the source of funds. Columns (2) and (3) decompose these assets by currency. Column (3) shows that peso borrowing are not associated with balance sheet mismatches as these peso liabilities are used to accumulate short term assets almost exclusively in peso. However, for every $1 increase in FX funding, firms increase their holdings of short term assets by about $0.43, $0.21 of which is in FX and $0.19 of which is in peso. Thus, we directly show that, on average, firms use FX liabilities to fund short term peso assets. Columns (4) and (5) show that this tendency is not exclusive to exporting firms, which have more foreign currency revenues and thus more activity in their FX positions, pointing to motives that go beyond exporting to save pesos out of dollar borrowing.[16] This provides direct evidence consistent with the implied relationship of FX borrowing accumulating to short term local currency assets shown in Bruno and Shin (2017) and Bruno and Shin (2018a). Importantly, we directly observe the currency instead of assuming all cash and liquid instruments are in domestic currency.

For robustness, Table B1 shows that these results hold both before and after the 2008 financial crisis.[17] Table B2 shows that these patterns are common to both manufacturing firms and retail firms (consisting of retail, wholesale, hotels, and restaurant firms).

Result 2: Firm-Level Financial Intermediation. What types of short term assets do firms accumulate with their peso and FX liabilities? Table 5 breaks down the short term assets on the LHS of the regression by instrument: cash and other financial assets, accounts receivable (i.e. trade credit extended), inventories, and other short term assets.

[16] We do not have comprehensive data on imports. However, exporting firms in Mexico tend to also be importers (Blaum (2017)).

[17] The results also hold in all periods if the crisis is broken out into its own period.

Table 4: Corporate Saving by Currency of Borrowing

	All Firms			Non-Exporters	
	(1) Total	(2) FX	(3) Peso	(4) FX	(5) Peso
Cash Flow$_{it}$	0.470***	0.0563*	0.408***	0.0112	0.521***
	(0.0538)	(0.0323)	(0.0563)	(0.0437)	(0.177)
Δ FX Liab$_{it}$	0.432***	0.210***	0.188***	0.219***	0.181**
	(0.0496)	(0.0331)	(0.0530)	(0.0532)	(0.0898)
Δ Peso Liab$_{it}$	0.488***	0.0361	0.416***	0.0206	0.417***
	(0.0443)	(0.0248)	(0.0465)	(0.0310)	(0.0620)
Observations	4683	4225	4225	2631	2631
R^2	0.296	0.0507	0.141	0.0567	0.145
Firms	179	161	161	102	102
FirmFE	Yes	Yes	Yes	Yes	Yes
TimeFE	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, columns (2) and (4) is change in short term FX assets, and columns (3) and (5) is change in short term peso assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Increases in both FX and peso liabilities are associated with the accumulation of all of these types of assets. However, nearly half of every new dollar (or peso) borrowed, that is allocated to short term instruments, goes towards accounts receivable (roughly \$0.22 out of \$0.45). As firms receive additional resources, they extend more credit to customers and suppliers. Firms also use the additional FX and peso resources to accumulate financial assets (\$0.08) and increase inventory (\$0.11). Because the firm accumulates short term assets in peso out of its FX borrowing at \$0.19 per dollar, anywhere from 56-100% of this mismatch must be in non-financial short term assets, primarily trade credit.[18]

These first two results highlight the value of using more granular financial data. While bond debt and cash holdings have been at the forefront of the discussion around non-financial firm carry trade behavior, firm borrowing and lending in trade credit plays a significant role in a firm's decision to increase their FX exposure on the balance sheet.

Again, the results are consistent both before and after the 2008 crisis, as shown in Table B3. The results are also consistent within manufacturing and retail firms (Table B4), which account for the majority of the sample.[19]

4 Carry Trades and FX Exposure

Having documented how firms expose themselves to currency risk when borrowing in FX and how those proceeds are allocated to provide credit to their relevant business partners, we turn our attention to the nature of foreign currency borrowing. In particular, we

[18] These results complement Huang et al. (2018), who find that risky firms in China, which appear to increase dollar bond issuance with a larger interest rate differential, do more inter-firm lending.

[19] Manufacturing firms appear also to use peso borrowing to finance accounts receivable alongside their FX borrowing, whereas retail firms only use their FX borrowing. Note again that the retail sector includes firms in retail, wholesale, restaurants, and hotels.

Table 5: Corporate Saving into Short Term Assets

	(1) Cash and Financial	(2) Accounts Receivable	(3) Inventories	(4) Other Short Term
Cash Flow$_{it}$	0.0914***	0.204***	0.123***	0.0463*
	(0.0233)	(0.0526)	(0.0367)	(0.0237)
Δ FX Liab$_{it}$	0.0826***	0.209***	0.104***	0.0218***
	(0.0175)	(0.0381)	(0.0249)	(0.00799)
Δ Peso Liab$_{it}$	0.0881***	0.240***	0.110***	0.0420***
	(0.0210)	(0.0595)	(0.0306)	(0.0153)
Observations	4660	4675	4683	2811
R^2	0.0372	0.141	0.0709	0.0264
Firms	179	179	179	175
FirmFE	Yes	Yes	Yes	Yes
TimeFE	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 cash and short term financial assets, column (2) is change in accounts receivable, column (3) is change in inventories, and column (4) is change in other short term assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

study how firm borrowing, lending, and other activity reacts to changes in carry trade incentives. To study this, we consider the following regressions:

$$\frac{\Delta Position_{it}}{TotalAssets_{it-1}} = \alpha_i + \sum_{k=0,1} (\delta_k IRD_{t-k} + \phi_k Vol_{t-k}) + X_{it-1}\beta + Z_t\Gamma + \epsilon_{it} \tag{2}$$

$$\frac{\Delta Position_{it}}{TotalAssets_{it-1}} = \alpha_i + \lambda \frac{\Delta IRD_t}{Vol_t} + X_{it-1}\beta + Z_t\Gamma + \epsilon_{it} \tag{3}$$

where *Position* is the relevant balance sheet position (e.g. short term FX liabilities, cash holdings, etc.), winsorized at 1%; 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 (includes one period lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio); and Z is a vector of macro time series controls, which may separately affect firm activity and be correlated with the time series variation from IRD (VIX, oil price growth, real GDP growth in the US, and real GDP growth in Mexico).[20] Our identification is improved by including these competing macro factors which may determine both FX borrowing and sales/trade credit outcomes. Our use of quarterly data also improves identification requiring reactions in the data to be at a higher frequency, so prices and business conditions have time to change but productive capacity of the firms does not.

To construct the IRD, we use data on loan level borrowing of these firms to build firm and aggregate level interest rates. We construct the IRD by computing a weighted

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

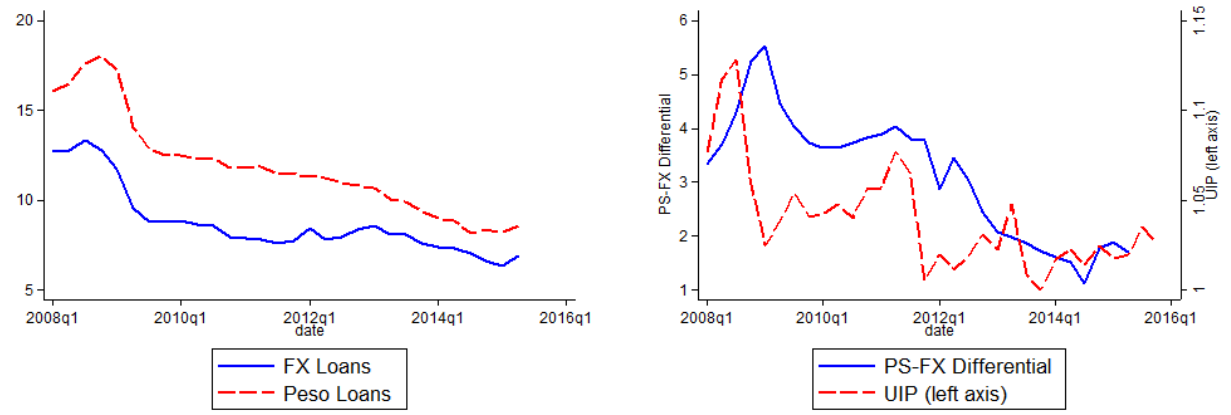
average of each interest rate, separately by currency, for each firm, with the weights determined by the remaining volume of the loan. This creates an effective interest rate for each firm in each currency. We have interest rate data for 87% of loan observations in our sample, which results in firm-level 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 interest rates in FX and peso for these firms. We also compute firm-specific interest rate differentials, but we can only do so 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. Results including the firm specific IRD can be found in the appendix. We use Equation 2 to illustrate that these positions respond quarter by quarter to the interest rate differential, but most results presented use Equation 3 to highlight how changes in in the IRD correlate with changes in balance sheet positions and firm activity. Our carry-trade measure normalizes the IRD by the depreciation rate volatility, capturing that higher volatility reduces the incentives provided by a widening interest rate gap.

Panel (a) of Figure 2 displays the evolution of the aggregated rates. The average interest rate on FX loans is consistently lower than that of peso loans. 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 slow 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 year ahead forecasts.[21] There is a strong

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

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 measures are our preferred measure of carry trade opportunities for non-financial firms, as that more closely reflects the business environment faced by those firms.[22]

Figure 2: 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.

Result 3: Firm-Level Carry Trades. We focus again on the short term side of the firm's balance sheet, and examine the evolution of these positions, as well as sales, to changes in carry trade incentives, captured by the interest rate differential between FX and peso

[22]See also Salomao and Varela (2018), who develop a model whereby some firms respond to UIP deviations by taking on FX risk. They provide evidence from Hungarian firms and UIP deviations in Hungary.

borrowing.

Table 6 considers short term FX and peso liabilities as the dependent variable. Columns (1) and (2) show that short term peso borrowing does not systematically respond to carry trades opportunities. In columns (3) and (4), we see that when the interest rate differential is high (meaning FX loans are relatively cheaper than peso loans), firms increase their accumulation of short term FX liabilities. This occurs quarter by quarter, where the initial increase is reversed in the following quarter, as shown in column (3).[23] Note that firms do build up FX liabilities when the interest rate differential widens (column (4)). Columns (5)-(7) breakdown short term FX liabilities by instrument: loans, bonds, and accounts payable (trade credit). The response of short term FX borrowing to the carry trade comes mainly from loans and trade credit. Note that this provides direct evidence of a positive correlation between cheap dollar funding and inter-firm FX lending (acc. payable in FX). Loans and trade credit may be easier to obtain on a shorter notice, as firms try to take advantage of a favorable change in interest rates. Thus, only foreign currency borrowing reacts to an increase in carry trade incentives, and the instruments used are the ones that can react the quickest to such opportunities. This again signifies the importance of expanding the analysis of carry trade behavior beyond bond liabilities to especially consider trade credit and to examine it at higher frequencies. This evidence is novel, as previously no one in the literature had pointed to trade credit as a vehicle for this behavior.[24]

Next, we examine if this increase in FX borrowing with carry trade incentives increases overall FX exposure and how these firms accumulate short term assets by currency. Ta-

[23] Further lags are not significant. When the individual firm interest rate differential is included, it carries some explanatory power, but the magnitudes are small relative to the aggregate variable. See Table B5.

[24] These results thus complement those of Bruno and Shin (2017) and Bruno and Shin (2018a), which focus on longer term carry trade strategies involving bond issuance and cash holdings in annual data.

Table 6: Change in Short Term Liabilities

	Short Term Peso Liabilities		Short Term FX Liabilities				
	(1)	(2)	(3) All	(4) All	(5) Loan	(6) AccPay	(7) Bond
IRD_t	-0.0342		0.604***				
	(0.285)		(0.210)				
IRD_{t-1}	-0.165		-0.724***				
	(0.288)		(0.195)				
$XRvol_t$	0.00705*		0.00865***				
	(0.00363)		(0.00250)				
$XRvol_{t-1}$	-0.00391		-0.00501***				
	(0.00280)		(0.00191)				
Δ IRD_t		0.144		0.453***	0.160***	0.161***	0.00133
		(0.164)		(0.115)	(0.0420)	(0.0371)	(0.00796)
Observations	2999	2999	2999	2999	3222	3222	3222
R^2	0.0323	0.0290	0.0330	0.0167	0.0176	0.0110	0.00526
Firms	133	133	133	133	139	139	139
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	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 peso liabilities, and in columns (3)-(7) is the change in short term FX liabilities (for the instruments 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. XRvol is the standard deviation of the daily peso depreciation rate over the quarter. The change in IRD is normalized by XRvol. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

ble 7 uses the change in the short term FX positions as the dependent variable, which is defined as $\frac{(ShortFXLiab_{it} - FXAssets_{it}) - (ShortFXLiab_{it-1} - FXAssets_{it-1})}{TotalAssets_{it-1}}$. Results are similar if we use total FX liabilities in the measure for the change in total FX mismatch. Firms increase their short term and total FX exposure when the carry trade incentive increases. This is common to both exporters (column (1)), non-exporters (column (2)), and all firms together (column (3)). One could think that other factors drive this movement, such as domestic economic growth or foreign financial conditions. Column (4) shows that this result is robust to the inclusion of other time series variables which may influence FX borrowing incentives and the degree of FX mismatch firms may wish to take: Mexico's real GDP growth, US real GDP growth, the VIX, and oil price growth. Columns (5)-(8) illustrate that instead of accumulating short term FX assets as firms increase their FX borrowing, short term peso assets are accumulated, contributing to the increase in FX exposure. Thus, firms actively increase their FX mismatch by borrowing in FX and accumulating peso assets when carry trade incentives increase.

Are firms using derivatives to hedge these short term positions? Our data does not tell us about the exact derivative contracts firms have engaged in, but we can see the market values of derivatives, separately for those in an asset position and those in a liability position. In Table B6, we do see changes in net and gross derivatives positions for firms, with gross positions expanding with carry trade incentives.[25] To examine if firm's are truly hedging their added FX exposure, in Section 5 we test for negative effects in the event of a depreciation.

[25]However, these results are not robust to the inclusion of other macro controls, so these derivative values may be more reflective of hedging against other developments. This could be a reflection of less liquid derivative markets or deeper arbitrage deviations in the system (e.g. covered interest parity (CIP) deviations as documented by Du, Tepper, and Verdelhan (2018), Du, Im, and Schreger (in press), and Avdjiev, Du, Koch, and Shin (in press)).

Table 7: Change in Short Term FX Position

	Short Term FX Exposure				Short Term Assets			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exp.	Non-Exp.	All	All	FX	FX	Peso	Peso
Δ IRD$_t$	0.556*	0.311*	0.411***	0.337**	0.0378	-0.168	0.398**	0.407**
	(0.291)	(0.174)	(0.152)	(0.168)	(0.104)	(0.114)	(0.169)	(0.193)
Observations	1096	1903	2999	2999	3001	3001	3001	3001
R^2	0.0185	0.00832	0.0109	0.0141	0.00486	0.0204	0.0251	0.0291
Firms	47	86	133	133	134	134	134	134
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MacroControls	No	No	No	Yes	No	Yes	No	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(4) is the change in short term FX position (STFXL-FXA), and in columns (5)-(8) is the change in short term assets (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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Macro controls include the change in log(VIX), oil price growth, US real GDP growth, and Mexico real GDP growth. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8 decomposes short term assets by instrument. Here, we see that holdings of financial assets held by the firm does increase with the carry trade, 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. Accounts receivables, as well as inventories, do exhibit dynamics similar to the FX positions with the carry trade. 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 results from Table 7, which show that only short term peso assets respond to the carry trade, suggest that the increased trade credit (accounts receivable) must be almost entirely denominated in pesos.

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 study 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 9, columns (1)-(2) shows that the firm's trade credit network, measured by the gross trade credit (trade credit borrowed + accounts receivable), expands with an increase in the interest rate differential. Along with these fluctuations in trade credit, sales (columns (3)-(4)) similarly expands. Columns (5)-(6) examine the accounts receivable to sales ratio, a measure of the fraction of sales made on credit, to see if firms adjust their invoicing patterns with credit conditions. This ratio does not appear to change with the interest rate differential. Because, on average, 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.[26]

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. For instance, a growing Mexican economy can drive up both sales and trade credit, but also lead policy makers to increase interest rates to prevent overheating. External factors could also drive these results, by increasing demand for Mexican exports and increasing the supply of FX credit (e.g. via accommodative monetary policy). We control for such alternatives directly with our inclusion of Mexico's real GDP growth (for domestic factors), US real GDP growth, the VIX, and oil price growth (for external factors). We have shown our results are robust to the inclusion of these controls, and that they do not explain the correlation observed with the interest rate differential.

An alternative approach is to control for all slow moving macroeconomic trends with year fixed effects (on quarterly data). Table B7 presents those results. Here, we see the main result on FX borrowing holds in column (1). In column (2) the accumulation of short term assets in peso marginally loses significance when year fixed effects are included, but remains robust for exporters in column (3). A similar pattern is shown for accounts receivables in columns (4)-(5). Sales is robust in column (6).[27]

Another 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

[26]Looking at the results split by sector in Table B8, we see that most of the results are driven by the manufacturing sector (which makes up about half of the sample), but sales in the retail sector also move with the interest rate differential. Further results and commentary comparing exporters and non-exporters can be found in Appendix C.

[27]This specification is taxing on the data, but even then, the results for all firms are still significant at the 11% level. The change in FX position, not reported in the table, remains robust for all firms with the inclusion of year fixed effects. Accounts receivable is again significant for all firms if the macro controls are added in addition to the year fixed effects.

more, increase their sales, and consequently increase their trade credit on those sales. Our use of quarterly data addresses this concern because of the time lag between investment and output. 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.

Results in Tables 7-9 have focused on changes in carry trade incentives, as measured by changes in the interest rate differential normalized by the standard deviation of the peso depreciation rate. Table B9 illustrates that the build-up and unwinding pattern quarter-by-quarter, shown for FX borrowing in Table 6, is also present for the main results and is robust to the inclusion of macro controls. Note that, as shown in the main results, these positions are not fully unwound in the second quarter, but FX exposure is built up with increasing carry trade incentives. The behavior and activity documented in this section occurs at higher frequencies, and so it may be missed by analysis using annual data or focusing on longer maturity or less liquid instruments.

Table 8: Change in Short Term Assets

	Financial Assets		Cash		Accounts Receivable		Inventories	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ IRD$_t$	0.268***	0.132	-0.405***	-0.443***	0.167**	0.158*	0.277***	0.275***
	(0.0724)	(0.0802)	(0.0709)	(0.0727)	(0.0787)	(0.0811)	(0.0561)	(0.0665)
Observations	3224	3224	3202	3202	3224	3224	3224	3224
R^2	0.0241	0.0362	0.0911	0.103	0.0164	0.0193	0.0353	0.0421
Firms	139	139	139	139	139	139	139	139
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MacroControls	No	Yes	No	Yes	No	Yes	No	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 financial assets, (3)-(4) is change in cash holdings, (5)-(6) is change in accounts receivables, and (7)-(8) is change in inventories. 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Macro controls include the change in log(VIX), oil price growth, US real GDP growth, and Mexico real GDP growth. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Change in Trade Credit and Sales

	Gross Trade Credit		Sales		AR/Sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ IRD$_t$	0.444***	0.382***	0.405***	0.325***	0.255	0.192
	(0.120)	(0.136)	(0.0796)	(0.0885)	(0.187)	(0.214)
Observations	3224	3224	3224	3224	3122	3122
R^2	0.0251	0.0397	0.150	0.183	0.0147	0.0150
Firms	139	139	139	139	137	137
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes
MacroControls	No	Yes	No	Yes	No	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the change in gross trade credit (accounts payable + accounts receivable), (3)-(4) is the change in sales, and (5)-(6) is the change in the accounts receivable to sales ratio. Gross trade credit and sales are normalized by lagged assets, and all dependent variables 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Macro controls include the change in log(VIX), oil price growth, US real GDP growth, and Mexico real GDP growth. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Concluding the third result of the paper, firms react to carry trade incentives to increase their FX borrowing and accumulate 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.

5 Real Effects of the Carry Trades

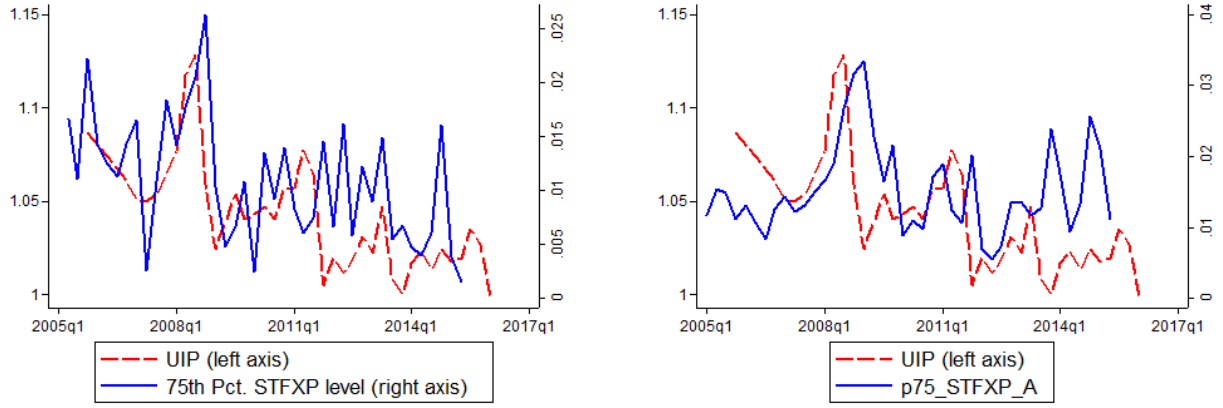
Evidence from the previous section indicates that in periods of prolonged carry trade incentive, firms build up FX exposure on their balance sheet. Figure 3 plots the 75th percentile for quarterly change and level of short term FX exposure, along with deviations from UIP. This figure shows that some firms are indeed increasing their short term FX exposure when the carry trade is high, building up potential vulnerabilities over time due to their carry trade behavior. But does this behavior affect real outcomes? We address this by examining the growth of firm-level investment and employment, and firm-level profits. 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 A1, panel (a)).

The building up of short term FX exposure peaks at 2008q4. Thus, the relevant period of carry trades activity before the shock is 2005q1-2008q4. We want to separate the effect of engaging in carry trade-type speculation from standard balance sheet effects. That is, we want to distinguish the level effect from the change effect in a firm's short term FX positions. Therefore, our regression takes the following form:

$$Y_{it} = \alpha_i + \alpha_t + \beta_0 \Delta STFXP_i \times Shock_t + \beta_1 STFXP_i \times Shock_t + X_i \times Shock_t \Gamma + \epsilon \quad (4)$$

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

Figure 3: UIP Deviations and Short Term FX Exposure



(a) 75th Percentile - Quarterly Change

(b) 75th Percentile - Level

Short term FX exposure is defined as Short term FX liabilities minus FX assets, normalized by total assets. 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.

the past quarter, normalized by last period's assets. Short term FX exposure is defined as $\frac{STFXLiabilities-FXAssets}{Assets}$.[28] $\Delta STFXP_i$ is the change in this value between 2005q1 and 2008q4. This period was one of a high interest rate differential and stable exchange rate, and results from Table 7 suggest that firms engaging in carry trades will build up their exposure over time, as seen in Figure 3. This is our measure of engaging in carry trades. Characteristics of the firm may determine the amount of FX exposure the firm might normally need. 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. $STFXP_i$ is the level value

[28]Note again that, based on our data from 2012q1-2015q2 where we can separate FX assets by maturity, over 90% of FX assets are short term assets. Thus, we make the simplifying assumption that all FX assets are short term in order to construct our short term exposure measure for the earlier period of our data.

at 2008q4 of the short term FX exposure, which serves to capture the traditional balance sheet effect and separate that from the effect for firms who increased their exposure. This allows us to compare two firms with same exposure, but differ in terms of one building up the exposure during the high carry trade incentive period and the other maintaining a relatively constant level. [29]

We run our regression 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).[30] 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.

We justify the difference-in-difference approach by testing whether outcomes (investment rates, etc.) were different in the pre-period for firms of differring increases in their FX exposures. We test this by replacing the shock with a placebo for the pre-period (2007-2008) in the Appendix, Tables B10-B11. We find no significant difference in outcomes for firms of different $STFXP$ changes during the pre-period for investment and profit outcomes. Employment is not significant when controls are included and only marginally significant when they are excluded. This 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 in profit, investment, or employment before of the shock.

The 2009-2010 period following the aftermath of the 2008 financial crisis included

[29] Results are robust to including a control for the overall level FX position instead of the short term level FX position.

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

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 A1, 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 control for the general impact with time fixed effects. This leaves variation across firms with how their outcomes differed following the shock. To control for other possible channels whereby firms might be differentially affected by this period, we explicitly horserace other firm characteristics with our measures of FX exposure and carry trade. Specifically, we take averages over 2006-2008 of firm size (log assets), cash to assets, liabilities to assets (leverage), bond credit to assets, share of sales to foreigners (exports and sales by foreign subsidiaries), and sales to assets.

The inclusion of these horseraced firm controls reduces omitted variable bias. For instance, it cold be that more risky firms with high leverage and borrowed more in FX during that period, but retracted real activity because of the general slowdown combined with their excessive debt. Or firms with more foreign currency revenues may have increased their FX borrowing before the shock, but saw a decline in real activity after the shock with the decline in exports during half of that period. We interact these firm characteristics with our shock dummy, and show that they do not explain the correlation of real outcomes with our carry trade measure.

Result 4: Real Effects of Firm-Level Carry Trades. Table 10 presents the results. First, columns (1) and (3) show that there was a general decline in investment and employment for these firms following the shock. We find that engaging in carry trade activities which

increase the short term FX position of the firm results in a negative and significant impact on the growth of physical capital (columns (1) and (2)). Employment appears to be not as affected, as seen in columns (3) and (4). Columns (5) and (6) show a negative impact on profits. A change in short term FX exposure of 0.11 over this period, the 75th percentile increase, results in about a 0.4% decrease in investment growth. The average (quarterly) PPE growth for firms with the 75th percentile carry trade 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 from these firms.

Table 11 splits the sample into exporters and non-exporters. The general patterns are maintained. Columns (1) and (2) show that both exporters and non-exporters with the "carry-trade" increase in FX exposure experienced a decline in their investment growth following the depreciation. The decline in profits was driven primarily by non-exporters. Thus, the repercussions of carry trade behavior, in the event of a depreciation, can affect all firms, and is particularly negative for non-exporting firms.

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 to a depreciation. Therefore, we finish this section by studying how trade credit responds for carry trade firms following the depreciation. Table 12 shows that trade credit borrowing, lending, and sales all generally declined during this period. However, firms experiencing a balance sheet shock do not appear to be affected along any of these dimensions. 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 FX credit, or a de-

sire to maintain market share. It may also indicate that the implicit interest rate priced into FX denominated invoices makes trade credit 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.

It is also valuable to note that these carry trade responding firms saw decreased profits, though no change in sales as compared to firms without the exposure. Thus, the negative comparative impact to these firms from their increased FX exposure does not come from a decline in revenues, but from an increase in costs from the balance sheet shock.

Table B12 adds an interaction with a dummy variable with value 1 if the firm's level of trade credit extended over 2005-2008 was in the 75th percentile. These high accounts receivable firms show interesting behavior. Firms with larger carry trade exposure, and high accounts receivable, decrease their cash and financial holdings following the depreciation (column (1)), suggesting that they are drawing down those resources to cover their near term FX obligations. However, these firms simultaneously increase, in relative terms, their trade credit extended to other firms. Columns (3) and (4) reveal that these firms increase their short term FX assets, but not their short term peso assets. Thus, it appears that when firms which extend large amounts of trade credit get caught exposed to an increased currency mismatch, they draw down their liquid financial assets in order to maintain or increase their trade credit extended, likely denominated in FX. This reinforces that trade credit relationships are likely very valuable to these firms.

Table 10: Carry Trade Impacts

	Investment		Employment		Profits	
	(1)	(2)	(3)	(4)	(5)	(6)
Shock_t	-0.0143***		-0.00696**		-0.000312	
	(0.00323)		(0.00337)		(0.000974)	
$\text{STFXP Change}_i \times \text{Shock}_t$	-0.0448**	-0.0358**	0.0184	0.00893	-0.0114**	-0.0124*
	(0.0183)	(0.0142)	(0.0199)	(0.0201)	(0.00545)	(0.00641)
$\text{STFXP Level}_i \times \text{Shock}_t$	0.0308	0.0240	-0.00405	0.00828	0.0124**	0.0106*
	(0.0221)	(0.0185)	(0.0175)	(0.0210)	(0.00560)	(0.00581)
Observations	1995	1995	1980	1980	1903	1903
R^2	0.0201	0.00841	0.00191	0.00140	0.00326	0.00475
Firms	87	87	87	87	87	87
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	No	Yes	No	Yes	No	Yes
FirmControls	No	Yes	No	Yes	No	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in columns (3)-(4) is the log difference of total employment, winsorized at 2%; in columns (5)-(6) is net income (profits) divided by total assets, winsorized at 1%. STFXP level is short term FX liabilities minus FX assets, normalized by total assets, at 2008q4. STFXP change 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. Firm Controls include averages over 2006-2008 of the following variables, 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. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Carry Trade Impacts: Differences by Export Status

	Investment		Employment		Profits	
	(1) Non-Exporter	(2) Exporter	(3) Non-Exporter	(4) Exporter	(5) Non-Exporter	(6) Exporter
STFXP Change$_i$ × Shock$_t$	-0.0320**	-0.0682***	0.0124	-0.00673	-0.0240***	-0.00350
	(0.0154)	(0.0249)	(0.0266)	(0.0255)	(0.00695)	(0.00760)
STFXP Level$_i$ × Shock$_t$	-0.0406	0.0525**	-0.000280	0.0201	0.00628	0.00280
	(0.0339)	(0.0217)	(0.0374)	(0.0243)	(0.0102)	(0.00686)
Observations	1216	779	1208	772	1150	753
R^2	0.0114	0.0122	0.00138	0.0122	0.0169	0.0221
Firms	53	34	53	34	53	34
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Exporters are defined as having the median share of sales to foreigners above 15%. Dependent variable in columns (1)-(2) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in columns (3)-(4) is the log difference of total employment, winsorized at 2%; in columns (5)-(6) is net income (profits) divided by total assets, winsorized at 1%. STFXP level is short term FX liabilities minus FX assets, normalized by total assets, at 2008q4. STFXP change 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. Firm Controls include averages over 2006-2008 of the following variables, 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. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Carry Trade Impacts: Trade Credit and Sales

	Accounts Payable		Accounts Receivable		Sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Shock_t	-0.00268***		-0.00390***		-0.00382***	
	(0.000844)		(0.00119)		(0.00140)	
$\text{STFXP Change}_i \times \text{Shock}_t$	0.00120	0.00166	0.00382	0.00172	-0.00163	-0.00439
	(0.00490)	(0.00418)	(0.00457)	(0.00545)	(0.00789)	(0.00752)
$\text{STFXP Level}_i \times \text{Shock}_t$	-0.00574	-0.00771	-0.00326	-0.00470	0.00434	0.00655
	(0.00570)	(0.00538)	(0.00471)	(0.00555)	(0.00879)	(0.00716)
Observations	1976	1976	1976	1976	1975	1975
R^2	0.00291	0.00193	0.00322	0.00267	0.000737	0.00137
Firms	87	87	87	87	87	87
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	No	Yes	No	Yes	No	Yes
FirmControls	No	Yes	No	Yes	No	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the change in trade credit borrowed (accounts payable), in (3)-(4) is the change in trade credit extended (accounts receivable), and (5)-(6) is the change in sales. All dependent variables are normalized by lagged assets and winsorized at 1%. STFXP level is short term FX liabilities minus FX assets, normalized by total assets, at 2008q4. STFXP change 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. Firm Controls include averages over 2006-2008 of the following variables, 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. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Conclusion

We use a unique panel database of Mexican firms to study the borrowing and saving behavior of non-financial corporations, accounting for different instruments and currencies. We document risky financial intermediation by non-financial firms. Our database has four main advantages with respect to the empirical literature. First, we have quarterly frequency data that can be used to understand short-run behavior. Second, we have all sources of funding, in both FX and local currency, while most of the literature focuses exclusively on bonds. Third, we have information on the currency composition of FX assets, which allows us to directly examine if and how firms accumulate a currency mismatch with carry trade opportunities. Fourth, we additionally have a detailed instrument decomposition of short term assets which allows us to go beyond the behavior of cash and directly study inter-firm lending and its relation to firm FX positions. We show that all of these advantages are critical to study carry trade and inter-firm lending.

Four core results constitute the main message of our paper. First, firms accumulate short term peso assets out of their short term FX borrowing, while peso borrowing is exclusively associated with peso assets. We provide unique, direct evidence of the degree to which firms build currency risk when borrowing in foreign currency. Second, non-financial firms act as financial intermediaries by extending trade credit out of both their peso and FX borrowing, even at a higher rate than they accumulate cash and financial assets out of that borrowing. This new evidence points towards trade credit as an important transmission channel for FX credit conditions. Combined with the first result, this establishes direct evidence of firms borrowing in FX and accumulating short term local currency assets, primarily in the form of trade credit.

Third, during periods of high interest rate differential, firms increase both their cur-

rency exposure and their trade credit participation. Thus, we show that the first and second results can be driven by firms responding to carry trade opportunities. The expansion of the firm's trade credit network facilitates increased sales, providing a connection between FX credit conditions and real activity via facilitating larger production chains. This evidence is novel, pointing to a new vehicle (trade credit) by which firms react to carry trade opportunities. We show that firms increase their borrowing in short term FX and accumulate short term peso assets with higher carry trade incentives, increasing their overall FX exposure. Over a period of widening interest rate differentials, short term FX exposure can build up for firms which react to carry trade incentives.

Fourth, in the event of a depreciation, accumulating short term FX exposure leads to a negative shock to real firm investment and profits. This effect is separate from, and stronger than, the traditional balance sheet effect from the level of FX exposure on the balance sheet. Thus, we show new evidence that this carry trade activity can generate risk for real firm outcomes. 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. Thus, in contrast to the banking literature, our findings suggest that the value of inter-firm relationships provides a good buffer for reducing the propagation and amplification of firm balance sheet shocks in the event of a currency crisis.

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 in a way which increases their FX exposure, and may facilitate the extension of credit to other firms. This connects foreign currency credit conditions to real outcomes like sales via trade credit linkages. The fact that firms hit by the exchange rate shock did

not comparatively decrease their trade credit suggests that trade credit networks serve as a buffer to shocks, so policy makers should view firm financial intermediation activity differently from that of banks. On the other hand, 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. Thus, the policy prescription is not clear. 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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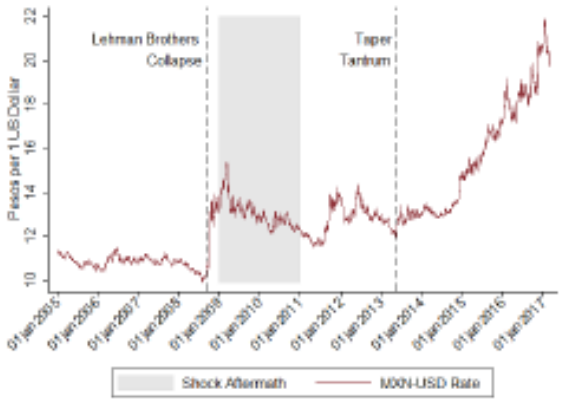
Appendix

A Figures

Figure A1: 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 Other Results

Table B1: Corporate Saving by Currency of Borrowing: Pre- and Post- Crisis

	2005q2-2008q3			2008q4-2015q2		
	(1) Total	(2) FX	(3) Peso	(4) Total	(5) FX	(6) Peso
Cash Flow$_{it}$	0.408***	0.0114	0.479***	0.593***	0.0989	0.466***
	(0.0698)	(0.0586)	(0.0819)	(0.155)	(0.0746)	(0.177)
Δ FX Liab$_{it}$	0.394***	0.209***	0.196***	0.456***	0.213***	0.174**
	(0.0593)	(0.0429)	(0.0523)	(0.0699)	(0.0583)	(0.0738)
Δ Peso Liab$_{it}$	0.438***	-0.00775	0.507***	0.499***	0.0558**	0.362***
	(0.0602)	(0.0545)	(0.0729)	(0.0586)	(0.0276)	(0.0592)
Observations	1540	1372	1372	3141	2850	2850
R^2	0.414	0.125	0.319	0.318	0.098	0.143
Firms	141	129	129	152	137	137
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	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 (4) is change in short term assets, columns (2) and (5) is change in short term FX assets, and columns (3) and (6) is change in short term peso assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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 of Borrowing: by Sector

	Manufacturing			Retail		
	(1) Total	(2) FX	(3) Peso	(4) Total	(5) FX	(6) Peso
Cash Flow$_{it}$	0.450***	0.0657	0.441***	0.289	0.427**	-0.119
	(0.0736)	(0.0489)	(0.0680)	(0.171)	(0.182)	(0.322)
Δ FX Liab$_{it}$	0.440***	0.177***	0.267***	0.690***	0.219**	0.478***
	(0.0461)	(0.0279)	(0.0513)	(0.129)	(0.0900)	(0.105)
Δ Peso Liab$_{it}$	0.470***	0.0531	0.446***	0.447***	0.0745	0.379**
	(0.0620)	(0.0440)	(0.0667)	(0.136)	(0.0616)	(0.143)
Observations	2286	2138	2138	696	636	636
R^2	0.318	0.092	0.224	0.213	0.415	0.177
Firms	84	80	80	29	26	26
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	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 (4) is change in short term assets, columns (2) and (5) is change in short term FX assets, and columns (3) and (6) is change in short term peso assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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. Retail includes firms in retail, wholesale, restaurants, and hotels. Errors are clustered at the firm level. * p < 0.10, ** p < 0.05, *** p < 0.01

Table B3: Corporate Saving into Short Term Assets: Pre- and Post- Crisis

	2005q2-2008q3				2008q4-2015q2			
	(1) Cash and Financial	(2) Accounts Receivable	(3) Inventories	(4) Other Short Term	(5) Cash and Financial	(6) Accounts Receivable	(7) Inventories	(8) Other Short Term
Cash Flow$_{it}$	0.0991***	0.163***	0.0894***	0.0632*	0.130	0.166***	0.322**	-0.0387
	(0.0236)	(0.0467)	(0.0250)	(0.0377)	(0.0967)	(0.0463)	(0.147)	(0.0355)
Δ FX Liab$_{it}$	0.0832***	0.202***	0.0825***	0.0261**	0.0833***	0.218***	0.107***	0.0235*
	(0.0279)	(0.0254)	(0.0269)	(0.0117)	(0.0232)	(0.0632)	(0.0327)	(0.0140)
Δ Peso Liab$_{it}$	0.103***	0.187***	0.103***	0.0541*	0.0823***	0.260***	0.0997**	0.0402**
	(0.0251)	(0.0438)	(0.0258)	(0.0279)	(0.0253)	(0.0786)	(0.0385)	(0.0196)
Observations	1539	1532	1540	1204	3119	3141	3141	1606
R^2	0.0465	0.150	0.0634	0.0463	0.0349	0.141	0.0903	0.0252
Firms	141	141	141	139	152	152	152	135
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 cash and short term financial assets, in columns (2) and (6) is change in accounts receivable, in columns (3) and (7) is change in inventories, and in columns (4) and (8) is change in other short term assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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 into Short Term Assets: by Sector

	Manufacturing				Retail			
	(1) Cash and Financial	(2) Accounts Receivable	(3) Inventories	(4) Other Short Term	(5) Cash and Financial	(6) Accounts Receivable	(7) Inventories	(8) Other Short Term
Cash Flow$_{it}$	0.103***	0.168***	0.138***	0.0573	0.191***	0.195	-0.0399	-0.0438
	(0.0377)	(0.0503)	(0.0355)	(0.0441)	(0.0596)	(0.140)	(0.0464)	(0.0311)
Δ FX Liab$_{it}$	0.0725***	0.198***	0.151***	0.0223	0.195**	0.181***	0.189***	0.0625
	(0.0238)	(0.0294)	(0.0257)	(0.0141)	(0.0774)	(0.0595)	(0.0656)	(0.0597)
Δ Peso Liab$_{it}$	0.0957***	0.190***	0.155***	0.0474	0.0769***	0.0940	0.124	0.125***
	(0.0319)	(0.0467)	(0.0361)	(0.0343)	(0.0262)	(0.0631)	(0.0754)	(0.0307)
Observations	2275	2284	2286	1373	692	696	696	416
R^2	0.0287	0.0778	0.164	0.0323	0.0445	0.0771	0.159	0.211
Firms	84	84	84	83	29	29	29	28
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 cash and short term financial assets, in columns (2) and (6) is change in accounts receivable, in columns (3) and (7) is change in inventories, and in columns (4) and (8) is change in other short term assets. Cash flow is net income over the previous quarter; FX Liab is the exchange rate adjusted 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. Retail includes firms in retail, wholesale, restaurants, and hotels. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B5: Firm Specific Interest Rate Differential

	Short Term FX Liab		Short Term FX Exposure		Accounts Receivables		Sales	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Firm IRD$_{it}$	0.0784**	0.0500	0.0620	0.0549	0.0271	0.0141	0.0546*	0.0477
	(0.0361)	(0.0315)	(0.0442)	(0.0409)	(0.0300)	(0.0292)	(0.0289)	(0.0291)
Δ IRD$_t$		0.702***		0.174		0.320***		0.169
		(0.204)		(0.238)		(0.109)		(0.103)
Observations	1100	1100	1100	1100	1123	1123	1123	1123
R^2	0.0244	0.0401	0.0194	0.0200	0.0375	0.0435	0.179	0.180
Firms	70	70	70	70	71	71	71	71
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	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 FX liabilities, (3)-(4) is the change in short term FX position (STFXL-FXA), (5)-(6) is the change in accounts receivables, and (7)-(8) 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%. Firm IRD is the firm specific difference between interest rates on their peso borrowing and on their FX borrowing in the same quarter. IRD is the average interest rate (across firms) on peso loans minus the average interest rate (across firms) 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. Changes in IRD and Firm IRD are normalized by the standard deviation of the daily peso depreciation rate over the quarter. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B6: Change in Derivatives

	Non-Exporters				Exporters			
	(1) Net	(2) Net	(3) Gross	(4) Gross	(5) Net	(6) Net	(7) Gross	(8) Gross
Δ IRD$_t$	0.0407**	0.00721	0.0458***	0.0162	-0.0886**	-0.0311	0.135***	0.0432
	(0.0162)	(0.0106)	(0.0163)	(0.0191)	(0.0353)	(0.0212)	(0.0346)	(0.0302)
Observations	2111	2111	2111	2111	1111	1111	1111	1111
R^2	0.0137	0.0347	0.0135	0.0269	0.0354	0.0672	0.0392	0.106
Firms	91	91	91	91	48	48	48	48
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MacroControls	No	Yes	No	Yes	No	Yes	No	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Exporters are defined as having the median share of sales to foreigners above 15%. Dependent variable in columns (1)-(2) and (5)-(6) is the change in the market value of the net derivatives position (derivative assets – derivative liabilities), and in columns (3)-(4) and (7)-(8) is the change in the market value of the gross derivatives position (derivative assets + derivative liabilities). 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Macro controls include the change in log(VIX), oil price growth, US real GDP growth, and Mexico real GDP growth. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B7: Results with Year Fixed Effects

	STFXL	Short Term Peso Assets		Accounts Receivable		Sales
	(1) All	(2) All	(3) Exp.	(4) All	(5) Exp.	(6) All
Δ IRD$_t$	0.278**	0.352	0.980***	0.152	0.366**	0.254***
	(0.132)	(0.225)	(0.334)	(0.0946)	(0.145)	(0.0849)
Observations	2999	3001	1096	3224	1112	3224
R^2	0.00918	0.0232	0.0180	0.0156	0.0341	0.150
Firms	133	134	47	139	48	139
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
YearFE	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Exporters are defined as having the median share of sales to foreigners above 15%. Dependent variable in column (1) is the change in short term FX liabilities, (2)-(3) the change in short term peso assets, (4)-(5) the change in accounts receivables, and (6) 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B8: Results by Sector

	Manufacturing				Retail			
	(1) STFXL	(2) STFXP	(3) AR	(4) Sales	(5) STFXL	(6) STFXP	(7) AR	(8) Sales
Δ IRD$_t$	0.493**	0.669***	0.294**	0.410***	0.155	-0.134	-0.0369	0.514*
	(0.187)	(0.232)	(0.114)	(0.0963)	(0.129)	(0.160)	(0.160)	(0.248)
Observations	1473	1473	1542	1542	451	451	500	500
R^2	0.0271	0.0237	0.0204	0.117	0.0220	0.0266	0.0165	0.369
Firms	66	66	67	67	21	21	22	22
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. The retail sector includes firms in retail, wholesale, restaurants, or hotels. Dependent variable in columns (1) and (5) is the change in short term FX liabilities, (2) and (6) the change in short term FX position (STFXL – FXA), (3) and (7) the change in accounts receivable, and (4) and (8) 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B9: Results with Current and Lagged Interest Rate Differential

	(1) FX Acc. Pay.	(2) STFXP	(3) ST Peso Assets	(4) Acc. Rec.	(5) Sales
IRD_t	0.200***	0.659*	0.666*	0.333**	0.859***
	(0.0714)	(0.344)	(0.386)	(0.160)	(0.206)
IRD_{t-1}	-0.240***	-0.698*	-0.764*	-0.253	-0.678***
	(0.0784)	(0.357)	(0.411)	(0.163)	(0.156)
$XRvol_t$	0.00103	-0.00310	-0.00271	-0.00429	0.00950***
	(0.00109)	(0.00418)	(0.00466)	(0.00275)	(0.00251)
$XRvol_{t-1}$	-0.000266	0.00142	0.000385	-0.000236	-0.00177
	(0.00114)	(0.00430)	(0.00471)	(0.00230)	(0.00277)
Observations	3222	2999	3001	3224	3224
R^2	0.0294	0.0147	0.0294	0.0208	0.190
Firms	139	133	134	139	139
FirmFE	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes
MacroControls	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 FX trade credit borrowed (accounts payable), (2) the change in short term FX position (STFXL-FXA), (3) the change in short term peso assets, (4) the change in accounts receivables, and (5) 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. XRvol is the standard deviation of the daily peso depreciation rate over the quarter. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit to assets ratio winsorized at 1%, share of sales to foreigners (including exports and sales by foreign subsidiaries), and sales to assets ratio. Macro controls include the change in log(VIX), oil price growth, US real GDP growth, and Mexico real GDP growth. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B10: Carry Trade Impacts - Pre-period Placebo

	Investment		Employment		Profits	
	(1)	(2)	(3)	(4)	(5)	(6)
STFXP Change$_i$ $\times$ Pre$_t$	0.0219	0.0196	-0.0324*	-0.0309	-0.00435	-0.00417
	(0.0175)	(0.0188)	(0.0193)	(0.0205)	(0.00805)	(0.00813)
Observations	1995	1995	1980	1980	1903	1903
R^2	0.00111	0.00754	0.00168	0.00268	0.000471	0.00295
Firms	87	87	87	87	87	87
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	No	Yes	No	Yes	No	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in columns (1)-(2) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in columns (3)-(4) is the log difference of total employment, winsorized at 2%; in columns (5)-(6) is net income (profits) divided by total assets, winsorized at 1%. STFXP level 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. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Firm Controls include the value of STFXP at 2008q4 and averages over 2006-2008 of the following variables, all interacted with the shock dummy (equal to 1 for 2009-2010): 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. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B11: Carry Trade Impacts - Pre-period Placebo, Exporter vs Non-Exporter

	Investment		Employment		Profits	
	(1) Non-Exporter	(2) Exporter	(3) Non-Exporter	(4) Exporter	(5) Non-Exporter	(6) Exporter
STFXP Change$_i$ $\times$ Pre$_t$	0.0384	0.00988	-0.0133	-0.0370	0.00821	-0.0113
	(0.0313)	(0.0183)	(0.0269)	(0.0301)	(0.0101)	(0.00998)
Observations	1216	779	1208	772	1150	753
R^2	0.0125	0.00691	0.00144	0.0150	0.00802	0.0248
Firms	53	34	53	34	53	34
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Exporters are defined as having the median share of sales to foreigners above 15%. Dependent variable in columns (1)-(2) is the log difference of physical capital outstanding, measured as Property, Plant, and Equipment, winsorized at 2%; in columns (3)-(4) is the log difference of total employment, winsorized at 2%; in columns (5)-(6) is net income (profits) divided by total assets, winsorized at 1%. STFXP level 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. Shock is a dummy equal to 1 during 2009 and 2010, and 0 otherwise. Firm Controls include the value of STFXP at 2008q4 and averages over 2006-2008 of the following variables, all interacted with the shock dummy (equal to 1 for 2009-2010): 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. Errors are clustered at the firm level. * p < 0.10, ** p < 0.05, *** p < 0.01

Table B12: Carry Trade Impacts - Short Term Assets

	(1) Cash and Financial	(2) Accounts Receivable	(3) ST FX	(4) ST Peso
$\text{Shock}_t \times \text{High AR}_i$	0.00701***	-0.00783**	-0.00294	-0.000209
	(0.00240)	(0.00330)	(0.00256)	(0.00678)
$\text{STFXP Change}_i \times \text{Shock}_t$	0.00819	-0.00167	-0.00608	0.00946
	(0.00523)	(0.00455)	(0.0107)	(0.0157)
$\text{STFXP Change}_i \times \text{Shock}_t \times \text{High AR}_i$	-0.0385***	0.0461***	0.0517**	-0.0355
	(0.0115)	(0.0156)	(0.0244)	(0.0438)
$\text{STFXP Level}_i \times \text{Shock}_t$	0.0163***	-0.00311	0.0628***	-0.0839***
	(0.00569)	(0.00471)	(0.0161)	(0.0288)
$\text{STFXP Level}_i \times \text{Shock}_t \times \text{High AR}_i$	-0.00103	-0.0365**	-0.0519*	0.0592
	(0.0128)	(0.0155)	(0.0268)	(0.0635)
Observations	1961	1976	1934	1934
R^2	0.00684	0.00495	0.0208	0.0104
Firms	87	87	87	87
FirmFE	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes

Sample spans 2006q1-2012q4. Firms reports the number of firms in each regression. Dependent variable in column (1) is the change in holdings of cash and financial assets, (2) the change in accounts receivables, (3) the change in short term FX assets, and (4) ithe change in short term peso assets. All dependent variables are normalized by lagged assets and winsorized at 1%. STFXP level is short term FX liabilities minus FX assets, normalized by total assets, at 2008q4. STFXP change 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. High AR is a dummy for if the firm was in the 75th percentile for the 2005-2008 average of accounts receivable to assets. Firm Controls include averages over 2006-2008 of the following variables, 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. Errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C Exporters vs Non-Exporters

Exporters and non-exporters may have different levels of integration into networks of trade credit, which may affect the way in which they respond to carry trade opportunities. Table C13 shows that the increase in peso asset accumulation and accounts receivables is largely due to exporters, but both exporters and non-exporters increase their FX borrowing and their sales with changes in carry trade incentives. Exporters may also increase their accounts receivable to sales ratio, and thus may be extending more trade credit per sale. Examining these together suggests that both exporters and non-exporters use cheaper FX borrowing to help boost sales, but do so through different means. Exporters by increasing the share of sales made on credit and increasing the amount of trade credit they extend, non-exporters by reducing their borrowing costs by borrowing in cheaper FX, including in the form of trade credit, and passing those cost savings on to their customers.

Table C13: Results by Export Status

	Exporters					Non-Exporters				
	(1) STFXL	(2) STPSA	(3) AR	(4) Sales	(5) AR/Sales	(6) STFXL	(7) STPSA	(8) AR	(9) Sales	(10) AR/Sales
Δ IRD$_t$	0.438**	0.925***	0.451***	0.408***	0.425**	0.443***	0.113	0.0258	0.381***	0.138
	(0.193)	(0.272)	(0.128)	(0.125)	(0.188)	(0.140)	(0.206)	(0.0964)	(0.103)	(0.277)
Observations	1096	1096	1112	1112	1080	1903	1905	2112	2112	2042
R^2	0.0257	0.0237	0.0363	0.139	0.0233	0.0235	0.0347	0.0192	0.166	0.0167
Firms	47	47	48	48	48	86	87	91	91	89
FirmFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FirmControls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sample spans 2008q2-2015q2. Firms reports the number of firms in each regression. Exporters are defined as having the median share of sales to foreigners above 15%. Dependent variable in columns (1) and (6) is the change in short term FX liabilities, (2) and (7) the change in short term peso assets, (3) and (8) the change in accounts receivables, (4) and (9) the change in sales, and (5) and (10) the change in the accounts receivable to sales ratio. Short term is based on remaining maturity at one year or less. All dependent variables (except the accounts receivable to sales ratio) 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. Firm Controls include one quarter lags of firm size (log assets), cash to assets ratio winsorized at 1%, total liabilities to assets ratio winsorized at 2%, bond credit 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$