The Dominant Currency Financing Channel of External Adjustment *

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Abstract

We provide evidence of a new channel of how exchange rates affect trade. Using a novel identification strategy that exploits firms' foreign currency debt maturity structure in Colombia around a large depreciation, we show that firms experiencing a stronger debt revaluation of dominant currency debt due to a home currency depreciation compress imports relatively more while exports are unaffected. Dominant currency financing does not lead to an import compression for firms that export, hold foreign currency assets, or are active in the foreign exchange derivatives markets, as they are all hedged against a revaluation of their debt. These findings can be rationalized through the prism of a model with costly state verification and foreign currency borrowing. Dominant currency pricing mutes the effects of dominant currency financing on imports relative to producer currency pricing.

JEL Codes: F31, F32, F41, G15, G21, G32

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1 Introduction

The effect of exchange rate movements on trade has been one of the most discussed topics in international economics. In traditional models, a depreciation of the home currency causes firms' exports to expand and imports to shrink due to changes in relative prices (Mundell, 1963; Fleming, 1962; Obstfeld and Rogoff, 1995). Standard models, however, do not take into account that a depreciation of the domestic currency reduces the net worth of firms with debt denominated in foreign currency, thus affecting trade through a different channel.

If firms borrow in foreign currency, a depreciation of the domestic currency increases firms' debt burden and cost of financing, which potentially induces a compression of both exports and imports. Depending on the relative elasticity of exports and imports, the effect of foreign currency borrowing on the trade balance is ambiguous.

In this paper, we show that corporate foreign currency financing strongly amplifies the negative effect of a domestic exchange rate depreciation on imports. Firms with a larger balance sheet exposure to the depreciation reduce their imports significantly and persistently more compared to less exposed firms. In contrast, more exposed firms do not reduce their exports during or after the depreciation, as exporters are hedged through their foreign currency revenues.

There is substantial heterogeneity across firms in the effect of foreign currency borrowing on imports. First, firms that both import and export do not reduce their imports due to foreign currency borrowing during or after the depreciation. This result suggests that exports can provide a hedge during a depreciation period, especially if they are also priced in foreign currency (Gopinath and Itskhoki, 2021).[1] Second, imports of firms with foreign currency asset holdings are unaffected by the debt revaluation. Third, firms that use foreign exchange derivative contracts are hedged and do not contract their imports as a result of foreign currency borrowing during the depreciation period.

To shed light on the channel through which corporate foreign currency borrowing affects trade we construct a comprehensive dataset with firm-level data from Colombia, a country where trade is almost exclusively priced in US dollars. We merge highly disaggregated trade, loan, balance sheet and financial hedging data, and we use our unique dataset to study the trade response to a sharp and unexpected depreciation of the Colombian peso and its differ-

[1] A depreciation increases the marginal cost of the firm for importers, but hedging occurs when firms export in US Dollars.

ential effect on exports and imports depending on firms' financial heterogeneity in terms of foreign currency borrowing.[2] The Colombian peso depreciated between 2014 and 2015 mainly due to a large drop in oil prices. As this shock was an event exogenous to any individual firm, was not accompanied by the credit crunch that is often associated with currency crises, and increased financing costs differently across firms, it provides an ideal laboratory to study how differences in foreign currency debt affect non-commodity firms' imports and exports in response to a depreciation when trade and debt are denominated in the same (dominant) currency.

Using a novel identification strategy that exploits firms' maturity composition of dominant currency debt we study the effects of US dollar borrowing on external adjustment. The detailed loan-level data allows us to compute the increase in debt repayments due to the interaction between exchange rate movements and the maturity structure. Firms that happened to have foreign currency debt maturing at the height of the depreciation faced a large increase in their debt repayments. In contrast, for firms whose foreign currency debt matured predominantly just before the depreciation, their debt repayments remained almost unaffected. Since the maturity structure can be seen as exogenous to exchange rate movements, the effect of foreign currency financing on trade can likely be interpreted as causal.

We decompose firms' financial exposure to the exchange rate depreciation into a liquidity and a wealth shock. Foreign currency leverage exposes firms to the depreciation through a liquidity shock, and through an additional wealth shock by increasing the debt burden for liabilities that do not immediately mature. Qualitatively, the effects of the increase in the debt burden and the liquidity shocks are the same. Quantitatively, we estimate that a one standard deviation increase in a firm's foreign leverage ratio is associated with an additional decrease of 10.6% in imports after the depreciation. While a one standard deviation larger liquidity shock leads to a 4.7% larger decline in imports, a one standard deviation larger wealth shock is associated with a 5.9% larger decline in imports. As the wealth shock is computed as the sum of the liquidity shock and the debt revaluation not affecting debt repayments during the depreciation, the difference in the coefficient between the wealth and the liquidity shock can be interpreted as the effect of the debt revaluation. Hence, the liquidity shock explains 80% of the wealth shock while the debt revaluation only accounts for 20%.

We further analyze the underlying financial frictions under the microscope by utilizing a

[2]As foreign currency debt is also almost exclusively denominated in US dollars, we use the words dominant currency, foreign currency and US dollar interchangeably.

broad range of information from our loan-level data. Non-exporting firms that are more strongly affected by a debt revaluation through the depreciation face higher interest rates and are more likely to become delinquent on their loans after the depreciation, even after controlling for observed and unobserved time-varying characteristics of the lending bank. This is not the case for exporting firms.

To further ensure our results are indeed driven by the increase in the debt due to the depreciation and not more generally due to the macroeconomic environment, we perform a battery of robustness tests. We conduct a placebo test where we replace the foreign currency with domestic currency debt measures and we do not find that financial heterogeneity in terms of domestic debt affected the import performance in response to the depreciation. We also control for other firm characteristics that can affect firm-level trade flows such as age, size and profitability and our estimates of the negative effect of debt dollarization on imports are not affected. Our results are also not specific to the large depreciation that occurred in Colombia in 2014. We corroborate our main results by estimating panel regression of imports and exports on the interaction between foreign currency leverage and change in the exchange rate.

These empirical findings can be rationalized in a theoretical framework with Dominant Currency Financing (DCF) under Dominant Currency Pricing (DCP). We build a parsimonious model with foreign currency financing and financial frictions in the form of costly state verification. Borrowing in foreign currency increases the probability of default when the currency depreciates and creates a wedge between the risk-free and the firm-level interest rate. Higher borrowing costs induce a compression of imports. Exporters face a positive profitability shock which lowers their probability of default after a depreciation. This natural hedging mechanism shields exporters from higher interest rates and reduces import compression. Since DCP exporters face a higher profitability shock than producer currency pricing (PCP) exporters, exporting and financing in the same dominant currency is less contractionary for trade than foreign currency borrowing under PCP.

To quantify the magnitude of the effects, we conduct a simple back-of-the-envelope calculation and estimate the share of the total decline in imports attributed to foreign currency borrowing. Colombia's exports and imports dropped sharply around the depreciation of the Colombian peso. Imports dropped by 6 billion dollars and exports dropped by 4 billion dollars. We multiply the coefficient of our preferred specification with each firm's actual exposure and aggregate up. Our estimates imply that the dominant currency financing channel of external adjustment explains around 17%, or 1 billion of the drop in imports but does not explain the drop in exports.[3]

While this paper focuses on one specific country, it can be seen as a typical emerging market with trade priced predominantly in a dominant currency and several general implications can be drawn from our analysis. First, under producer currency pricing (PCP) where exports are priced in domestic currency and imports are priced and financed in foreign currency, exporters would not be hedged against a liquidity shock when the domestic currency depreciates. Second, the composition of non-exporting relative to exporting importers is crucial to understand the magnitude of the effect of dominant currency financing on external adjustment. In countries where the vast majority of firms are importers that do not export (e.g. countries with large wholesale or service sectors), the effect of dominant currency financing is likely to be larger than for countries with large manufacturing sectors that both import and export. Third, in countries where firms have substantial foreign currency asset holdings or where foreign currency derivative markets are well developed, the effect of foreign currency borrowing on imports during a depreciation is likely to be more muted.

Overall, these results imply that dominant currency financing has a contractionary impact on trade, but as the effect is only apparent for imports and not for exports, the effect on the trade balance is expansionary.

Related Literature

Our paper relates to the literature on the effect of exchange rate movements on the external adjustment. Recent work questions the conventional wisdom of both Producer Currency Pricing and Local Currency Pricing and shows that trade is mostly invoiced in a few vehicle currencies, and that the dollar plays a dominant role among them (Goldberg and Tille, 2008; Gopinath, 2015; Amiti et al., 2022). See Gopinath and Itskhoki (2021) for a review. As a result, after a domestic currency depreciation imports drop but exports remain relatively stable and the expenditure switching effect is milder than in the traditional Mundell-Fleming setting.[4]

[3]This number should be taken with caution as it ignores general equilibrium effects. However, we believe that this counterfactual exercise serves as a useful lower bound benchmark to understand the macroeconomic relevance of our channel as general equilibrium effects would likely strengthen the impact.

[4]The adjustment process of traded quantities depends on the currency in which prices are set. Under producer currency pricing (PCP), the law of one price holds and a nominal depreciation (all else equal) increases the domestic price of imports and reduces the price of exports in the destination markets. Hence, it leads to an improvement of the trade balance. However, there is evidence that the law of one price fails to hold (Obstfeld and Rogoff, 2000).

Gopinath et al. (2020) show that trade in Colombia is almost exclusively invoiced is US dollars and therefore can be seen as a perfect laboratory to study the effects Dominant Currency Pricing (DCP). Following Gopinath et al. (2020) we use Colombia as a laboratory to study Dominant Currency Financing (DCF) under Dominant Currency Pricing (DCP). Under DCF, firms do not only price their trade in the dominant currency but also finance their operations in that same currency (Adler et al., 2020).[5] We empirically show that when firms not only price imports and exports in US dollars but also borrow in foreign currency, the contractionary impact of exchange rate movements on imports is even stronger while exports are not affected. Adding DCF to DCP therefore amplifies the effect of the depreciation on the trade balance.

We also contribute to the large empirical literature on the effects of foreign currency borrowing. Several studies have found negative effects of foreign currency borrowing of firms on investment when the domestic currency depreciates (Aguiar, 2005; Kalemli-Ozcan et al., 2016; Hardy, 2018) or sales Alfaro et al. (2019). Desai et al. (2008) find that the effects of depreciations on sales and investment are heterogeneous across firms, and that the ability to overcome financial constraints (as affiliates of multinationals can) play a decisive role in their differential response. Other studies have not been able to confirm these results and find no effect on investment (Bleakley and Cowan, 2008).[6] Niepmann and Schmidt-Eisenlohr (2017a) show that firms with more foreign currency loans are more likely to default. Verner and Gyongyosi (2018) find negative consequences in response to household foreign currency borrowing after a depreciation.[7] Christiano et al. (2021) show that dollarization can help risk-sharing and is not associated with larger negative effects during banking crisis. While all of these papers study the real effects of foreign currency borrowing on several outcomes, they ignore their external adjustment effects.

Our paper is also closely related to the literature on the trade effects of financial shocks. Amiti and Weinstein (2011) and Niepmann and Schmidt-Eisenlohr (2017c) provide evidence in favor of contractionary export effects of trade finance shocks.[8] Paravisini et al. (2014) and

As an alternative Betts and Devereux (2000) and Devereux and Engel (2003) proposed that prices are instead sticky in the currency of the buyer (local currency pricing, LCP). Under LCP a nominal depreciation has no effect on the price of traded goods in the destination markets. Therefore, although it worsens the competitiveness, it has a muted effect on the trade balance. See Lane (2001) for a survey.

[5] Gopinath and Stein (2021) and Bahaj and Reis (2020) also study the complementarities between financing and invoicing in the same currency.

[6] See Galindo et al. (2003) for a survey. See Barajas et al. (2017), Restrepo et al. (2014) and Echeverry et al. (2003) for the case of Colombia.

[7] For the theoretical dimension see for example Céspedes et al. (2004), Krugman (1999) or Devereux et al. (2006).

[8] See Niepmann and Schmidt-Eisenlohr (2017b); Love et al. (2007); Schmidt-Eisenlohr (2013) for more details

Bruno and Shin (2019) show the that firms' exposed to bank credit shocks reduced their exports.[9] We differ from these papers in two dimensions. First, all papers focus solely on the export response of a tightening in financial constraints while we study imports and exports jointly. As pointed out by Blaum (2019), studying the response of imports and exports jointly is crucial to understand the external adjustment process of a country in response to currency movements. Second, none of these papers study shocks affecting firms directly through their borrowing in foreign currency. Our results on the muted effect on exports suggest that currency-related shocks that increase firms' debt through a domestic currency depreciation are very different from shocks that propagate through the banking system.

Our model is based on the Townsend costly state verification mechanism (Townsend, 1979) with several extensions. We allow firm's net worth to be dependent on exchange rate through foreign currency denominated liabilities. As Bernanke et al. (1999) we study general equilibrium implications of net worth shocks but in an open economy context. Akinci and Queralto (2018) and Kohn et al. (2020) also study the implications of foreign currency borrowing. Akinci and Queralto (2018) show that foreign currency borrowing induces imports to drop more but exports to drop less in response to a tightening of US monetary policy. Kohn et al. (2020) more explicitly model a large devaluation and confirm that financial frictions do not contribute largely to export dynamics. In contrast, our model highlights that exporting in dominant currency can partially offset the negative effects of the debt revaluation as it increases revenues when the currency depreciates. Moreover, we study the implications of foreign currency borrowing under two different pricing regimes: PCP and DCP.

The rest of the paper is structured as follows. In section 2 we present a simple model with financial frictions and dominant currency financing. In section 3 we describe the data and the construction of the variables. In section 4 we discuss the empirical specification. In section 5 we present the empirical results. In section 6 we conclude.

2 A Simple Model of Dominant Currency Financing

In this section we outline a parsimonious model with financial frictions and foreign currency borrowing. We will show how financial frictions affect firm-level cost of borrowing and hence

on trade finance shocks. Muûls (2015) shows that firms with credit ratings are more likely to be exporters and importers.

[9] Berman and Berthou (2009) and Berman and Berthou (2009) provide cross-country evidence.

optimal size and imports. A depreciation decreases firm's net worth and increases the wedge between the risk free and firm-level interest rate. Entry into exporting relaxes some of the frictions, reducing the interest rate and increases firm size and importing. At the end of the section we derive several predictions that will guide our empirical analysis.

2.1 Setup

Consider a simple one-period model.[10] A firm starts with a stock of net worth denoted by A, reflecting for example some assets, given by cash, minus some stock of debt. A firm may borrow B to finance its production from a bank that only observes firm-level productivity, but does not observe the firm's product appeal, or demand shock denoted by δ. It is costly for a bank to verify firm-level output, and the cost of verification is equal to γR where R is firm's revenue. The optimal contract will have a form of the debt contract: the bank will lend b units and require a repayment of $\bar{B}$ whenever the firm does not default, see Townsend (1979) for the proof. If the firm defaults, the bank receives $\left(1-\gamma\right)R$ and the firm will get 0.

Assume that revenues take the form:

$$R(\delta, M) = \rho(M/p^M, \varphi)\delta$$

where M is firm's import expenditures.[11] The revenue function is denoted by ρ and is assumed to have the following properties:

Assumption 1. *Revenue function is increasing in input:* $\rho_M > 0$

Assumption 2. *Revenue as a function of input is increasing at a decreasing rate:* $\rho_M > 0$, $\rho_M < 0$, $\frac{\partial \ln \rho}{\partial \ln M}$

Assumption 3. *Revenue function elasticity with respect to the input is less than* 1*:* $\frac{\partial \ln \rho}{\partial \ln M} < 1$

The assumptions listed above are fairly standard and hold for a vast class of revenue functions in settings with different production functions and market structures. Let the CDF and PDF of demand shocks be given by $F(\delta)$ and $f(\delta)$ with $\mathbb{E}[\delta] = 1$. Define the hazard rate as

$$h(x) = \frac{f(x)}{1-F(x)}$$

[10]See subsubsection C.1. 1 for a more detailed exposition

[11]To make model parsimonious, we only assume one input into production, although the model can be generalized to include labor, capital, and other inputs.

Assumption 4. *The CDF and PDF of the demand shocks are such that* $xh(x)$ *is increasing with a non-decreasing elasticity. The PDF* $f(x)$ *and its derivative is bounded for all* $\bar{\delta} > 0$, $f(0) = 0$ *and* $\lim_{\bar{\delta}\to 0} \bar{\delta} f'(\bar{\delta}) < \infty$

The previous assumption holds, for example, for the lognormal distribution .

At the beginning of the period a firm has net worth $A = a^d + a^f e$, where a^f and a^d are net domestic and foreign assets respectively and e is the nominal exchange rate (Colombian pesos per foreign currency). For firms that are net borrowers in foreign currency $a^f < 0$ and $\frac{\partial A}{\partial e} < 0$. It can borrow B and spends its resources on composite input $p^M M = A + B$ where p^M is the price of input.[12]

Then firm payoff is given by:

$$\pi^f = \mathbb{E}\left[\rho(M)\delta - \bar{B} | \delta \geq \bar{\delta}\right]\left(1 - F(\bar{\delta})\right)$$

where $\bar{\delta}$ is the cutoff for the demand shock that determines the probability of default given by $F\left(\bar{\delta}\right)$. If the realized value of the shock is below the cutoff, the firm defaults and the bank extracts all the revenues at some cost. This cutoff is implicitly defined by a condition that equates firm's revenues with fixed payment to the bank:

$$\bar{B} = \rho(M)\bar{\delta}$$

We can thus express firm payoff as:

$$\pi^f = \rho(M)\mathbb{E}\left[\delta | \delta \geq \bar{\delta}\right]\left(1 - F(\bar{\delta})\right) - \rho(M)\bar{\delta}\left(1 - F(\bar{\delta})\right)$$

Bank payoff is given by:

$$\pi^b = \left(1 - \gamma\right)\rho(M)\mathbb{E}\left[\delta | \delta < \bar{\delta}\right] F(\bar{\delta}) + \rho(M)\bar{\delta}\left(1 - F(\bar{\delta})\right)$$

[12] Even though our main focus is on the imported goods, at this point, for parsimonious reasons, we will assume that the price of inputs is not dependent on exchange rate. Relaxing this assumption will not qualitatively change our main results that focus on the heterogeneous effects across firms with various levels of foreign currency borrowing.

where the bank extracts $(1-\gamma)$ share of average revenues below the cutoff with probability $F(\bar{\delta})$, and the bank gets $\bar{B}$ with probability $\left(1-F(\bar{\delta})\right)$.

Define the following objects:

$$\Psi\left(\bar{\delta}\right) = \mathbb{E}\left[\delta|\delta < \bar{\delta}\right]]F(\delta) + \bar{\delta}(1-F(\bar{\delta}))$$
$$\zeta(\bar{\delta}) = \gamma\mathbb{E}\left[\delta|\delta < \bar{\delta}\right]F(\delta)$$

These objects have an intuitive interpretation. $\Psi(\bar{\delta})$ is the share of profits that goes to the bank inclusive of monitoring costs and $\zeta(\bar{\delta})$ is the share of revenues that goes to monitoring costs. Firm and bank profits can now be rewritten as:

$$\pi^f = \left(1-\Psi(\bar{\delta}))\right)\rho(M)$$
$$\pi^b = \left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\rho(M)$$

We make the following assumption on the market structure of the banking sector:

Assumption 5. *Banks borrow at a rate R to lend to the firms, are risk neutral, and operate under perfect competition.*

2.2 Solving the model

Assumption 5 implies that all banks will earn the same return R on their lending and earn zero profits, in other words $\pi^b = R(p^M M - A)$. Since banks are competing with each other, each bank will pick such lending B and repayment $\bar{B}$ that maximizes firm's profits. Note that conditional on the lending amount, picking the amount of repayment is analogous to picking the cutoff productivity $\bar{\delta}$. We can set the optimization problem of a bank as:

$$\max_{B,\bar{\delta}} \; \rho(M)\left(1-\Psi(\bar{\delta})\right)$$
$$s.t. \;\; \rho(M)\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right) = RB$$
$$p^M M = B + A$$

When solving this model, we are interested in how the amount of imported inputs, borrowing, and repayment depend on changes in exchange rate. Consider two firms that are identical in all respects but foreign currency leverage. Exchange rate affects those firms through the price of imported inputs p^M and net worth A. The former effect will be common across two firms, while the latter will depend on the extent of indebtedness in foreign currency. We will now derive several elasticities that will be useful in conveying the intuition of the main results in the model Let $\varepsilon_{x,y}$ denote the elasticity of x with respect to y. Denote the nominal interest rate by $1+i = \frac{\bar{B}}{B}$. Finally, let $r \equiv \frac{\frac{1}{p^M}\rho_M(M,\varphi)}{R}$ be the ratio of marginal revenues from a peso spent on imported inputs and a rate of return on a peso to the bank. We can show that in the optimum, the following comparative statics hold: [13]

$$\varepsilon_{1+i,\bar{\delta}} = 1 - \varepsilon_{\Psi-\zeta,\bar{\delta}} > 0, \tag{1}$$

$$\varepsilon_{M,\bar{\delta}} = \frac{\varepsilon_{r,\delta}}{\varepsilon_{\rho_M,M}} < 0, \tag{2}$$

$$\varepsilon_{\bar{\delta},A} = \frac{\varepsilon_{\rho,M}\frac{A}{p^M M}}{\varepsilon_{M,\delta}\left(\frac{p^M M}{p^M M - A} - \varepsilon_{\rho,M}\right) - \varepsilon_{\Psi-\zeta,\delta}} < 0. \tag{3}$$

Equation 1 is the elasticity of nominal interest rate with respect to the cutoff demand shock. The higher this cutoff is, the more likely the firm is to default, and the higher the interest rate will the bank charge to compensate for the higher default probability. The elasticity of imported inputs with respect to the demand shock cutoff is given by Equation 2.

Higher cutoff implies higher interest rates and thus costlier borrowing for the firm, lower production and lower demand for imported inputs. Finally Equation 3 establishes that the elasticity of the demand shock with respect to net worth is negative. Firms with more own resources are less likely to default since they need to borrow less to produce the same amount as firms with smaller net worth. The last equation is key to understanding the differential effects of an exchange rate depreciation for firms with different foreign currency leverage: the firms with higher foreign currency borrowing will experience a sharper reduction in net worth.

Define the ratio of foreign currency borrowing to equity as $f = -\frac{ea^f}{A}$. The variable f is posi-

[13] The proofs are provided in subsubsection C.1. 3

tive for firms who are net borrowers in foreign currency ($a^f < 0$). It can be shown that:

$$\varepsilon_{1+i,e} = -f\varepsilon_{1+i,\bar{\delta}}\varepsilon_{\bar{\delta},A} > 0, \quad if \quad f > 0, \tag{4}$$

$$\varepsilon_{M,e} = -f\varepsilon_{M,\bar{\delta}}\varepsilon_{\bar{\delta},A} < 0, \quad if \quad f > 0 \tag{5}$$

Nominal interest rate increases with the depreciation of exchange rate, and the effect is higher for firms with greater indebtedness in foreign currency. As a result those firms imports contracts relatively more.

We thus get the following implications from the model that can be tested empirically:[14]

Hypothesis 1. *A depreciation decreases imports more for firms that borrow more in foreign currency*

Hypothesis 2. *A depreciation increases interest rates more for firms that borrow more in foreign currency*

So far, we only focused on the firms that sell domestically. In subsubsection C.2. 4 we extend the model to allow for exporting. Consider two firms, that have the same probability of default before a depreciation, but one of them is an exporter. The exporting firm will face a positive revenue shock due to the depreciation, making it less likely to default. In the limiting case when the probability of default approaches zero, the balance sheet channel will have no effect of firm's behavior and thus the reaction of interest rates and imports will be muted.[15] In this case, the exporter faces a lower interest rate than a non-exporting firm. Consequently, we will have the following testable implications for the exporting firms:[16]

Hypothesis 3. *A depreciation does **not** decrease imports more for **exporting** firms that borrow more in foreign currency*

Hypothesis 4. *A depreciation does **not** increase interest rates more for **exporting** firms that borrow more in foreign currency*

Colombian firms invoice most of their exports in dollars.[17] This behavior can be rationalized by a high import share in production, strategic complementarities Amiti et al. (2014, 2019), or

[14] The proofs are provided in the subsubsection C.1. 3

[15] Generalizing the result for the cases in which exporting firms are less likely to default than non-exporters but the likelihood is strictly larger than zero is work in progress.

[16] The proofs are provided in the subsubsection C.2. 4

[17] See Gopinath (2015).

capacity constraints (Gopinath et al., 2010; Amiti et al., 2022) increasing firms profits relative to PCP. In our model, this would translate to a relatively lower probability of default. DCP firms will thus be even more likely to approach the limit of no default at $\bar{\delta} \to 0$. Dominant currency pricing hence mutes the effects of the dominant currency financing.

3 Data

3.1 Sources

We compiled data from several sources. For our main specification we merge detailed information on loans, trade flows and operational variables from balance sheets. Our combined dataset covers firms accounting for over 90% of trade value.[18]

Commercial loans granted by Colombian banks and other financial institutions to firms come from the credit registry from *Superintendecia Financiera*, the agency in charge of supervising the financial sector.[19] Every quarter Colombian banks report the amount outstanding and maturity date for each loan they issue to firms and the effective interest rates. Importantly, the amounts are allocated between loans in foreign and domestic currencies. Using firm tax ID, we construct the amount of outstanding loans in foreign and domestic currencies for each firm and quarter. These data are available between 2005 and 2017.

The trade data come from *DANE*, the Colombian statistical agency. This dataset covers the universe of foreign trade transactions and contains information on imports and exports at a very disaggregated level (by firm, country of origin/destination, product, and month of the year). Public data is available for 2008-2018. We construct total imports and exports by each firm and quarter. Balance sheet data comes from the Orbis global database.[20] Originally, the data come from Colombian chambers of commerce and has standard variables from the balance sheets and income statements of Colombian firms (e.g. assets, liabilities, sales). We have data for 2004-2018. We complement our main dataset data with information on firms' holdings of foreign assets and foreign exchange derivative contracts from Banco de la República, the Colombian central bank.

[18]We had access to confidential data while Casas worked at Banco de la República.

[19]By Colombian banks we mean banks operating in Colombia, regardless of nationality of ownership.

[20]The Orbis global database is provided by Bureau van Dijk, a Moody's Analytics company.

3.2 Measures of exposure and shocks

In this section we describe the measures of foreign currency exposure that we construct by merging the balance sheet and loans data. As foreign currency liabilities are the main driver of foreign currency mismatches on Colombian firms' balance sheets, we focus on foreign currency loans to construct our measures of exposure.

In subsection 4.1 we outline the framework for the regression analysis.

We construct several measures of firm-level exposure to the exchange rate shock through their indebtedness in US dollars. First, we construct a measure of foreign currency leverage, which is given by total loans in foreign currency divided by firm-level assets:

$$FCL_{ft} = \frac{\sum_{i \in \Lambda^F_{ft}} L_i}{A_{ft}} \tag{6}$$

where Λ^F_{ft} is the set of firm's f loans with Colombian banks denominated in foreign currency in period t, L_i is the outstanding amount of the loans, and A_{ft} is the book value of assets of firm f at time t. This measure reflects the importance of foreign currency debt relative to total assets of the firm. However, it does not distinguish between the loans of different maturity. We observe firms having foreign currency loans with quite heterogeneous future maturity dates in the data. We can leverage this information to study whether firms with debt that is disproportionately due over shorter horizons were relatively more affected due to the liquidity shock that they face due to much higher than anticipated debt service payments in the near run in comparison to firms with longer debt maturity, who face a wealth shock.[21] In addition, firms having different maturity dates face different shocks due to the difference in the Peso exchange rate between those dates. To draw the distinction between the measures of liquidity vis-a-vis the wealth shock and to take into account depreciation of Colombian currency over time, we use information about the maturity date of each loan reported by Colombian banks and construct

[21]This identification strategy bears similarities with Duval et al. (2020) and Almeida et al. (2012) who exploit firms' debt maturity structure before the financial crisis. A similar approach has also been utilized by Giannetti and Saidi (2019).

the following following variables:

$$LS_{ft,t'} = \frac{\sum_{i\in\Lambda^F_{f,t}} 1_{T(i)\leq t'} L_i \Delta e_{t,T(i)}}{A_{ft}} \tag{7}$$

$$WS_{ft,t'} = \frac{\sum_{i\in\Lambda^F_{f,t}} 1_{T(i)>t'} L_i \Delta e_{t,t'} + \sum_{i\in\Lambda^F_{f,t}} 1_{T(i)\leq t'} L_i \Delta e_{t,T(i)}}{A_{ft}} \tag{8}$$

where $T(i)$ is the maturity day of loan i, $\Delta e_{t,T(i)}$ is the depreciation of Peso between t and $T(i)$, $1_{T(i)\leq t'}$ is an indicator that is equal to 1 if the loan is maturing before t' and zero otherwise, and $1_{T(i)>t'}$ is an indicator that is equal to 1 if the loan matures after t'. [22] The first measure, LS ('liquidity shock'), measures by how much the value of the debt repayments as of t increases due to depreciation between times t and t' given the actual depreciation as of their maturity date that falls between t and t'. The second measure, WS ('wealth shock'), adds the increase in debt that matures past t' using the exchange rate in t'. In our baseline empirical strategy we set t to 2014 Q1, as the depreciation started in 2014 Q3 (see Figure 1). This allows us to capture firms' debt that matures right before and right after the depreciation. t' is set to 2015 Q3, as it captured the height of the sudden depreciation. [23]

3.3 Descriptive statistics

Figure 1 plots imports, exports and the Colombian peso between 2008 and 2018. The Colombian peso officially switched to a floating status in 1999. Since then, it can be considered a commodity currency, as fluctuations in the peso are strongly correlated with fluctuations in commodity prices. Moreover, commodity price fluctuations are exogenous to the economy; while mining products (mainly oil, coal and nickel alloys) represent a large share of total exports, output is small relative to world markets. For example, in 2014 Colombia's oil production was 1.1% of world oil production but oil and oil products accounted for 52.8% of Colombian exports. Hence, the exchange rate depends heavily on oil prices but Colombia acts as a price taker in the oil world market.

In 2014, the price of oil plummeted. The spot price of WTI oil halved from over 100 dollars per barrel in July 2014, to 53.45 dollars by the end of the year and reached its lowest value,

[22] Payments need to be converted to pesos using the exchange rate of the payment date (Banco de la Republica, 2000) .

[23] Results are not sensitive to the choice of t and t'. Figure A2 shows the maturity distribution of loans.

less than 30 dollars, in January and February 2016. The peso/US dollar exchange rate increased from roughly 1850 at the end of July 2014 to 3435 by mid-February 2016. Importantly, the peso depreciation was not the result of a macroeconomic crisis. According to the World Bank's WDI, annual GDP growth in 2014-16 was 4.7%, 3% and 2.1%, lower than during the boom of commodity prices but well above the region's average, unemployment reached its 10-year minimum, and indicators of the financial system health such as the rate of capital to assets and the rate of liquid reserves to assets remained relatively unchanged.[24]

The depreciation of the exchange rate coincided with a drop in both exports and imports of Colombian firms. Between 2012 and 2014 imports and exports were remarkably stable. Colombian quarterly exports and imports equaled roughly 14 billion dollars, around 39% of GDP. With the depreciation, trade dropped. While imports dropped from 16 billion dollars to around 10 billion dollars between 2014 and 2018, exports dropped from 14 billion dollars to 6 billion dollars in 2016 but then recovering back to 10 billion in 2018.[25]

Table 1 shows summary statistics of firms in terms of their assets, exports and imports.[26] We split between non-exporters, exporters and all firms. There are 14,618 firms in our sample which do not export but import, and 7,232 export and import. The average size of a firm in our dataset is 12 million USD. Average firm-level exports before the depreciation are 127,000 USD but drop to 108,000 USD after the depreciation. Firm-level imports drop from 132,000 USD to 118,000 USD between before and after the depreciation.

The measures of exposure to depreciation due to indebtedness in dollars are computed as of the end of the first quarter of 2014, as described in subsection 3.2. Table 2 shows that foreign currency leverage is 4.4% for the average firm ranging between 0.2% to 11.6% between the 10th and 90th percentile. The average liquidity shock is close to zero as there are many firms that have liabilities that mature before the depreciation started. A firm at the 10th percentile of the liquidity shock distribution even faces a negative liquidity shock. A negative shock reflects a decrease in the debt repayments due to the small appreciation before the large depreciation. A firm at the 90th percentile of the liquidity shock sees an increase of their debt repayments purely due to the depreciation that is 0.6% of total assets.

The average wealth shock, which equals the liquidity shock plus the debt revaluation after

[24] See Figure A3 for the evolution of the oil price and the Peso. See Figure A4 for the evolution of the oil price and quarterly GDP growth.

[25] Notably, exports also decreased if measured in Colombian Pesos or in volumes (net kilograms).

[26] Since import regressions are the main focus of our empirical exercise, we only focus on firms that ever imported in our sample.

2015Q3, equals 0.8% of total assets. Even for the wealth shock we see some firms with negative values, which benefit from the exchange rate movements before the depreciation started. For the comparison purposes, all measures of foreign currency exposure entering the regressions were standardized to be mean-zero and have a unit standard deviation.

4 Empirical Strategy

4.1 Baseline specification

We use the unanticipated depreciation of the Colombian peso in 2014Q3 as a natural experiment to study the dominant currency financing channel of a foreign exchange rate depreciation on trade.[27] For our baseline specification we estimate the equation of the form:

$$\ln\left(1+Y_{ft}\right) = \beta \times FCE_f \times 1(t \geq t_0) + controls_{ft} + \epsilon_{ft}, \tag{9}$$

where Y is either the firm-level exports or imports of firm f at time t.[28] Our measure of foreign currency exposure, FCE_f, is either FCL_{ft} in $t = 2014Q1$, $LS_{ft,t'}$ with $t = 2014Q1$ and $t' = 2015Q3$, or $WS_{ft,t'}$ with $t = 2014Q1$ and $t' = 2015Q3$. $1(t \geq t_0)$ is a dummy that equals one in any quarter during or after the depreciation ($t \geq 2014Q3$).

Standard errors are double clustered at the firm and quarter level. The set of controls is given by firm and time fixed effects, and hence we interpret the β coefficient as a differential effect of the financial exposure to exchange rate shocks on imports or exports, with time fixed effects absorbing the level effect on imports (exports) of all firms. The firm fixed effects control for the time-invariant characteristics of the firm, for example, the average reliance on imported inputs, size, etc. It is worth mentioning that dominant currency financing is a choice for firms– that is, firms' foreign currency debt and its maturity structure can respond to their expectations

[27] Rodnyansky (2019) uses the depreciation of the Russian ruble due to the exogenous collapse in oil prices in 2014 to show that more productive exporters shrank relative to nonexporting firms in terms of domestic revenue, employment and profitability following the depreciation. **?** use the oil shock with Mexican data to study the dynamics of credit supply.

[28] Note that given the above logarithmic transformation of the dependent variable can introduce biases through the constant. We re-estimate all regressions with an inverse hyperbolic sine transformation of Y, and find qualitatively and quantitatively almost identical results. Except for small values of Y, this transformation approximately equals $\log(2Y)$, or $\log(2) + \log(Y)$, which can be interpreted in the same way as a standard logarithmic dependent variable. See Burbidge et al. (1988), or Chen (2013) for an application.

regarding exchange rate movements. Although these shocks are notoriously hard to predict, this potential endogeneity could bias our results. We address this concern by studying the specific case of an unanticipated, sudden depreciation that was unrelated to the economic situation in Colombia. Given the nature of this shock, we argue it is unlikely that firms' debt maturity profile that led to variations in the above-defined liquidity shock is systematically correlated with observed or unobserved characteristics that could bias our results.

4.2 Exogeneity of Liquidity Shock

Our main way of identifying a causal impact of how foreign currency borrowing affects trade is by the construction of the liquidity shock. We make use of the fact that firms' borrowing needs to be paid back at specific times during the depreciation period, and therefore are related to a more or less depreciated exchange rate. Figure A2 shows the distribution of maturity, with the weighted average original maturity at around 5 years.

As described in subsection 3.3 the Colombian peso did not only depreciate strongly but also exhibited large volatility which exposes firms to high frequency movement of the exchange rate due to their debt maturity structure. While other studies e.g. Almeida et al. (2012) or Duval et al. (2020), have made use of a similar identification strategy, our approach is strengthen due to two reasons. First, Almeida et al. (2012) and Duval et al. (2020) use the Global Financial Crisis as a shock for tightening credit conditions and argue that for firms that had debt maturing during the crisis tightened even more. However, the Global Financial Crisis has also been associated with other factors that may discourage firms from investing, e.g. an increase in uncertainty. In our case, as the exchange rate depreciation was driven by a drop in the oil price that was neither caused by the Colombian economy nor affected the Colombian firms through other factors other than the exchange rate, our effects can be likely attributed to the causal effect of the exchange rate. Second, we make use of a high frequency identification by using the date of the maturity instead of just the year or quarter, constructing an arguably more exogenous exposure to the exchange rate movements.

If our argument holds true, we would expect the liquidity shock to be uncorrelated with observed and unobserved characteristics that could drive the drop in stronger decline of imports for non-exporting firms that are faced with a larger liquidity shock. Table 3 shows the results from a cross-sectional regression of the liquidity shock on various firm-level variables. Column (1) shows that we do not find a statistical significant relationship between the average maturity of firms' loans before the depreciation and the liquidity shock in a linear regression. While by construction there is a non-linear relationship between the maturity of the firms' loans and the liquidity shock, we can rule out that firms that on average borrow shorter are also faced with a larger liquidity shock. The absence of a correlation can be explained by the high volatility in the exchange rate during the depreciation, and illustrated by the following example.

Imagine two firms that borrow at the maturity of 5 years. One firm borrows at the 16th of December 2009 while the other firm borrows at the 21th of December 2009. Both firms need to repay 1 million US Dollars on the day the loan matures. Firm 1, which borrowed on the 16th of December needs to pay back 2.413 billion pesos while the other firm that borrowed on the 21th of December needs to pay back 2.294 billion pesos (5% less).

This example shows that even the day of the week when a loan is scheduled to be paid back can explain a large fraction of the repayment in local currency. It also shows that a shorter maturity structure (Firm 1) is not necessarily correlated with a larger liquidity shock due to the large volatility in the exchange rate during the depreciation period, as we show in Table 3.

Therefore, as the day of the week when the loan has been issued can be seen as exogenous and we can control for the maturity of the loans, our regression coefficients can likely be interpreted as causal partial equilibrium effects.

4.3 Dynamic response

Equation 9 estimates the average effect of an additional unit of foreign currency exposure on firm-level imports after the depreciation. However, one might expect the effect to build up and/or decline over time. Hence, in our second set of empirical exercises, instead of interacting the measure of dominant currency financing with a post-depreciation dummy, we interact the measure with a dummy for each quarter:

$$\ln\left(1+Y_{ft}\right)=\sum_{t'}\beta_{t'}\times FCE_f\times 1(t=t')+controls_{ft}+\epsilon_{ft}, \tag{10}$$

where Y is either the firm-level exports or imports of firm f at time t. This helps us to pin down the timing of the response of exports and imports in response to the interaction between the depreciation and the firms' debt dollarization. In addition, we examine the trade activities of firms as a function of their debt dollarization just before the depreciation. This pre-trend analysis helps us to shed light on the question whether firms with more financial exposure to the exchange rate depreciation are fundamentally different from other firms. For example, if firms with more foreign currency debt before the depreciation already started reducing their imports, the interaction term in Equation 9 could just reflect a downward trend in the imports of these firms.

5 Results

5.1 Baseline Regression

Table 4 presents the results for Equation 9 for imports. Columns (1)-(3) use foreign currency leverage as the financial exposure to the exchange rate depreciation. When considering all 21,850 firms, we see a strong negative impact of the interaction between foreign currency leverage in 2014 Q1, just before the depreciation started, and the depreciation dummy. Hence, firms that had a larger share of foreign currency debt before the depreciation imported less after the depreciation than before. Quantitatively, a one standard deviation larger share of foreign currency debt[29] is associated with a 10% stronger decline in imports. However, this effect masks large heterogeneity across different firms. Around two thirds of all firms do solely import and do not export. We show the regression for only these firms in column (2). The regression coefficient roughly doubles. For non-exporters a one standard deviation larger share of foreign currency debt is associated with a 20% stronger decline in imports. For firms that import and export, the effect is only 1.8% and not statistically significant.[30]

Columns (4)-(9) repeat the same exercise but decomposes the increase in leverage due to the depreciation into a liquidity and a wealth shock. Columns (4)-(6) report the coefficients for the liquidity shock which captures the increase in debt repayments due to the movements in the exchange rate. The liquidity shock is defined such that the liquidity shock is positive when the firm sees an increase in their debt repayments due to the depreciation and negative if the debt repayments fall. The debt repayments can fall for the firm if it has very short-term maturity

[29] One standard deviation of foreign currency leverage is 3.2%

[30] The effect is extremely robust across sectors. Figure A5 displays the number of firms in the regression sample by sector. Figure A6 estimates the regression in column (1) separately for each broad sector and plots the coefficient, with all being negative. Figure A7 estimates a sector-specific (2-digit NAICS) code coefficient and plots the coefficient against the share of exporters in the sector. Consistent with the difference in the coefficient between column (2) and (3), sectors that have a larger share of exporters are more shielded from the negative import effect of foreign currency borrowing.

debt that matures before the depreciation happened.[31]

The effect of the liquidity shock on imports is around one half of the foreign currency leverage. In particular, a one standard deviation larger liquidity shock leads to a decline in imports relative to the pre-depreciation period by around 5%. As for foreign leverage, the effect is solely driven by non-exporters for which the response is around 7% and statistically signifanct. Exporters reduce their imports by 2.5% more if they face a one standard deviation larger liquidity shock but the coefficient is not statistically significant.

Lastly, columns (7)-(9) show the average response of imports in the depreciation period as a function of a wealth shock, which combines the liquidity shock during the sharp depreciation with the shock to wealth that occurs due to debt revaluation for later periods. As above, firms that are financially more exposed to the depreciation of the exchange rate due to a wealth shock compress imports relatively more compared to other firms. This pattern is significantly stronger for firms which import and do not export, rather than firms that participate in both activities.[32]

In terms of economic significance, a one standard deviation larger exposure to the exchange rate depreciation through their debt dollarization is associated with a 12% larger compression of imports if measured by the wealth shock for non-exporters. The number shrinks to around 1% for exporters and is not statistically significant.

Table 5 repeats the same exercise as Table 4 but for exports. The number of observations significantly drops as many more firms import than export. In our sample only around 7,200 firms export. The results for exports differ starkly from the results shown in Table 4. While the coefficients are mostly negative, the estimates are much smaller and not statistically significant. Neither foreign leverage nor the wealth or liquidity shock indicates that firms with larger

[31]In Table 3 we test whether the liquidity shock is correlated with other pre-existing observable characteristics (in 2013) at the firm-level, such as their average maturity, their profitability, their age, and find that firms that have larger liquidity shocks are extremely balanced in terms of other characteristics, which suggest that unobservable characteristics are also unlikely to be correlated with the liquidity shock. When controlling for these observable characteristics interacted with the post dummy, as well as sector-time fixed effects, we find that our baseline coefficient remains extremely stable, suggesting no substantial bias in the estimated coefficient, see Table A1. In unreported results we also use a measure of revenue productivity as a control and the results remain unchanged. However, due to data constraints we are only able to estimate productivity for a relatively small sample of firms. We also find that the results are robust to controlling for firm size, which is a good proxy for strategic complementarities Amiti et al. (2014, 2019).

[32]We confirm that this result is robust to focusing exclusively on quantities. Table A2 shows that firms that have been exposed more contracted the number of units imported as well the kilograms imported more. Table A3 shows that exposed firms also reduce the unique number of products as well as the diversity of countries from which they import. We test formally for the statistical difference between non-exporters and exporters in Table A4. We cannot reject the hypothesis that the effect of being an exporter offsets the effect for non-exporters. This result is also robust when for other potential confounding factors that are correlated with exporter status are controlled for.

dominant currency financing face a larger drop in exports.[33]

This result is different from evidence in Paravisini et al. (2014) or Amiti and Weinstein (2011) who show that firms that face financial shocks reduce their exports. Why is the evidence different? Paravisini et al. (2014) and Amiti and Weinstein (2011) study shocks to banks that are unrelated to exchange rate movements to which firms are likely not hedged against. In contrast, in our case firms that have dollarized debt face a negative shock when the domestic currency depreciates, but this negative shock is offset by an increase in their export revenues as they are almost exclusively priced in dollars (Gopinath et al., 2020).

5.2 Dynamics Response

In this subsection we shed light on the dynamics of the response in imports and exports over time.

As in Table 4, we split the firms into importers that do not export and firms that import and export. Figure 2 shows the evolution of imports as a function of a one standard deviation larger financial exposure to the depreciation and the Peso/US Dollar exchange rate. The behavior of imports is not statistically different between 2012 Q3 and 2014 Q2. At the same time the peso/US dollar exchange rate was relatively stable at around 2000 pesos per dollar. The fact that imports did not behave differently as a function of dominant currency financing in the period before the depreciation serves as a useful placebo test. Once the peso starts to depreciate in 2014Q3, firms with a larger financial exposure to the exchange rate depreciation contract their imports significantly more. The effect of dominant currency financing on imports for non-exporters accumulates over time, which stresses the importance of studying the effect in a dynamic setting that allows firms to respond with a lag. Three years after the depreciation the effect reaches a coefficient of -0.4. This coefficient implies that firms with a one standard deviation larger financial exposure to the exchange rate depreciation contract imports by 40% more relative to before the depreciation period.

Figure 3 shows the evolution of imports for exporters in response to a one standard deviation larger dominant currency financing. The estimated coefficient is close to zero both before and after the depreciation period and is not statistically significant. This result suggests that firms that export and import were insulated from the dominant currency financing channel due to higher revenues in local currency since exports are priced in US Dollars.

[33]This result is robust when controlling for other factors, see Table A5.

Figure 4 plots the estimated coefficient for the interaction between financial exposure to the exchange rate depreciation and quarter dummies for the export response. As in the case of imports by exporters the line for exports is entirely flat. The logic is the same as for importers that export. While it may be the case that exports decline in response to a financial shock as exporters face difficulties to finance their working capital, this channel is not at work here as firms that export are hedged due to their higher domestic currency revenues given the appreciation of the US dollar in which their exports are priced.

Figure A1 jointly plots the coefficients of both exporters and non-exporters, highlighting the stark difference in their import responses during the depreciation episode.

5.3 Hedging

Firms that borrow in foreign currency can be hedged naturally through their export revenues in dollars, or through other sources, such as foreign exchange derivatives and through the accumulation of dollar assets.[34] When firms experience a debt revaluation in domestic currency due to a depreciation of the domestic exchange rate due to liabilities in foreign currency, the value of foreign currency assets appreciates at the same time in domestic currency terms. Hence, the assets held in foreign currency can serve as a hedge to dampen the negative effects of the increase in the debt burden. Firms that accumulated foreign currency assets before the sharp depreciation of the peso could have drawn down their foreign currency assets to either repay their revalued debt or pay for dollar-priced imports, dampening the negative effect of foreign currency borrowing on imports during and after the depreciation.

Similarly, firms can tap the derivatives markets to hedge their exposure to exchange rate fluctuation by engaging in a forward contract that locks in the exchange rate for the purchase or sale of a currency on a future date. For example, if a firm is expecting to repay debt in dollars at a certain date, it can lock in the current forward exchange rate for the repayment date to hedge against a dollar appreciation. On the agreed date, the counterparts exchange the amounts they had committed to. In case of an unexpected peso depreciation, the firm pays a smaller amount of pesos to obtain the pre-committed amount of dollars than it would in a spot transaction. The firm can then use the gains from the forward contract to repay the increased debt burden

[34] Froot et al. (1993) show that if external sources of funding are more costly to corporations than internally generated funds, there will typically be a benefit to hedging. Alfaro et al. (2020) develop a model that incorporates the joint decision of financing and hedging. Lyonnet et al. (2021) study the interaction between hedging and currency choice.

or pay the higher peso price for dollar-invoiced imports. For more details on the functioning of over-the-counter foreign exchange derivative markets, see Hau et al. (2021).[35]

Table 6 shows the percentage of firms that had accumulated foreign assets and the share of firms that have outstanding foreign exchange derivative positions in 2013. Around 13% of all firms are hedged either through dollar assets or are active in the derivative markets. Derivative markets are relatively infrequently used among Colombian non-financial corporations, with only 2.9% of all firms having a foreign exchange derivative contract outstanding in 2013.[36] 11.6% of all firms have outstanding assets in foreign currency. These statistics differ largely between exporters and non-exporters. While almost 30% of exporting firms hedge, only 5% of non-exporters do so. Both foreign exchange derivative markets and foreign assets are more likely to be used as hedging devices for exporters than for non-exporters.

We complement our baseline regression equation to test whether the usage of foreign exchange derivatives markets or the accumulation of assets in dollars cushions the negative impact of foreign currency borrowing.

We estimate the following equation:

$$\ln\left(1+Y_{ft}\right)=\beta\times FCE_f\times 1(t\geq t_0)+\gamma\times FCE_f\times Hedge_f\times 1(t\geq t_0)+controls_{ft}+\epsilon_{ft}, \quad (11)$$

where Y are firm-level imports of firm f at time t. FCE_f is the foreign currency exposure. $1(t\geq t_0)$ is a dummy that equals one in any quarter during or after the depreciation, $(t\geq 2014Q3)$. $Hedge_f$ is defined as a dummy that equals one if the firm (i) had FX derivative markets positions outstanding in 2013 (ii) held foreign currency assets in 2013 or (iii) either (i) or (ii). The set of controls is given by firm and time fixed effects as well as $Hedge_f\times 1(t\geq t_0)$.

We interpret the β coefficient as the effect of foreign currency borrowing on imports during and after the depreciation for firms that do not hedge $(Hedge_f=0)$. The coefficient on the triple interaction $(FCE_f\times Hedge_f\times 1(t\geq t_0))$, γ, reflects the differential effect of firms that do hedge $(Hedge_f=1)$. A negative coefficient for β shows that firms that do not hedge and have more foreign currency liabilities reduce their imports more relative to firms with fewer foreign

[35] Foreign-owned firms may also be hedged to some extent Kalemli-Ozcan et al. (2016). In unreported results, we control for foreign ownership, but our results remain unchanged.

[36] The vast majority of the foreign exchange rate derivative positions are net forward purchases of US dollars, implying firms hedging against a depreciation of the Colombian peso. Due to frequent misreporting issues of the sign of the forward position, we only define a dummy that takes the value one if the firm reports outstanding position in any direction.

currency liabilities. This confirms our baseline result shown in Table 4. The coefficient β is larger in absolute values than in the baseline result, which already suggests a cushioning effect of hedging on import compression due to debt revaluation.

A positive coefficient γ shows the effect is weaker (smaller import contraction) for firms that hedge. The sum of the two coefficients reflects the estimated effect of the post-depreciation import contraction due to foreign currency borrowing for hedging firms.

Table 7 shows the results for either type of hedging. The coefficient on the triple interaction between $FCE_f \times Hedge_f \times 1(t \geq t_0)$ is consistently positive across specifications and are close to the double interaction in absolute values. This result shows that once a firm hedges its foreign currency liabilities through either foreign exchange derivatives or foreign currency assets, the effect of dominant currency financing on imports during the depreciation period is absent. This result can be confirmed (in unreported tables) by re-estimating the regression for only firms that hedge. In these results, the double interaction between foreign currency borrowing and the post dummy is statistically insignificant.

In Table 7 the triple interaction is positive across all specifications, but the magnitude is largest for firms that do not export. As non-exporting firms are driving the negative impact of foreign currency borrowing on imports during the depreciation, the result suggests that non-exporting firms benefit most from hedging compared to firms that are already hedged through their export revenues in dollars. Indeed, columns (3), (6), and (9) show that the triple interaction is not statistically significant, and neither is the double interaction. Exporting firms, which do not hedge, either through foreign currency assets or foreign exchange derivatives, do not see a contraction of their imports due to foreign currency borrowing during the depreciation, as they are already naturally hedged through their dollar export revenues. The additional hedging has a non-significant positive effect on imports.

Next, we analyze whether both types of hedging, either through derivatives or through foreign currency assets can protect firms from the adverse effect of foreign currency borrowing on imports during a depreciation. Table 8 shows the results for firms that do borrow through foreign currency assets but not necessarily through the derivative markets. The dummy $Hedge$ is redefined as one if the firm has foreign currency assets outstanding before the depreciation (in 2013). The results closely resemble the results presented in Table 7. Firms that have assets in foreign currency but do not export do not contract their imports due to foreign currency borrowing during the depreciation period.

This is also true for firms that hedge their foreign currency exposure through the foreign exchange derivative markets (Table 9). We redefine the $Hedge$ dummy to one if the firm has outstanding foreign currency derivative positions outstanding before the depreciation (in 2013). For firms that have derivative positions outstanding the triple interaction offsets the effect of foreign currency borrowing, which is consistent with the idea that firms hedge the foreign currency borrowing with their outstanding derivative positions. Indeed, while the dummy variable does not indicate whether the firm speculates or hedges, or whether the firm bought or sold US dollars forward, in unreported results we show that the pattern is only existent for firms which are net purchasers of dollar forward positions.

5.4 Quantification

This section aims to quantify the effect of dominant currency financing on the trade adjustment. Our estimates allow us to calculate the counterfactual trade flows in the absence of foreign currency borrowing, ignoring general equilibrium effects.[37]

Using our estimates from Table 4 we calculate the response in imports and the trade balance due to foreign currency borrowing. The estimated effects can then be used to infer the counterfactual response of trade flows to exchange rate movements for other levels of foreign-currency financing. We show the results of our counterfactual exercise in Figure 5 and Figure 6. In the case of Colombia, foreign-currency financing was substantial for *many* importing firms, even though the *average* level of dependence on foreign currency loans is moderate. If all firms had no foreign-currency borrowing, the peak-to-trough import contraction is estimated to have been 17% percent smaller.

5.5 Lending

In this section we reestimate Equation 9, replacing exports and imports with the amount borrowed in domestic and foreign currency. This exercise allows us to test whether firms that faced larger financial constraints after the peso depreciation due to a higher dominant currency financing indeed had to delever. Table 10 shows that firms with larger corporate dollarization strongly contract their foreign currency borrowing. This result holds when we use either for-

[37]See Nakamura and Steinsson (2018) for a discussion of extrapolating aggregate effects from cross-sectional regressions.

eign currency leverage, the wealth shock or the liquidity shock as an independent variable. In contrast, local currency borrowing increases for firms with larger dominant currency financing as they seem to substitute foreign currency loans with domestic currency loans, consistent with evidence in Hardy (2018). Overall, an average firm with non-zero foreign currency borrowing, had roughly 20% of its debt denominated in foreign currency. As a result, this firm would see a 3% decline in total borrowing after the shock, taking into account foreign and domestic loans, and abstracting from the valuation effects of exchange rate movements. This is consistent with the results of Kalemli-Ozcan et al. (2020) who show that the firms that were more exposed to the negative effect of mismatches on their balance sheets (those operating in countries with higher foreign currency debt) delever more after currency depreciations than firms in less exposed countries.[38]

5.6 Financial Frictions under the Microscope

In this section we explore the richness of the loan-level dataset to shed light on the exact mechanism through which the revaluation of debt feeds into financial frictions and leads to a contraction in imports.

First we focus on the interest rates of the loans l that have been issued to firm f at day d by bank b. We regress the interest rate at which the loan is issued on the different measures of foreign currency exposure, as discussed above. The loan-level data allows us to control for bank-supply, by including bank-time(month) fixed effects. If firms that are financially more exposed to the depreciation borrow more from banks that are more negatively affected by the depreciation, the negative sign in our baseline results could be driven by a spurious correlation between banks' credit supply and firms' foreign currency exposure. The bank-time fixed effect allows us to compare firms with differential foreign currency exposure with each other that borrow from the same bank in the same month.

In particular, we estimate the following regression:

$$r_{lfd(t)b} = \alpha + \beta_1 FCE_f * Post_t + \alpha_{bt} + \alpha_f + \epsilon_{fd(t)b} \tag{12}$$

where r is the interest rate that is charged for loan l to firm f at issuance date $d(t)$ by bank b.

[38] Table A7 estimates a loan-level regression where we confirm that exposed firms substitute from foreign currency borrowing to local currency borrowing with overall borrowing remaining statistically not different from zero. This effect is not significantly different for exporters vs. non-exporters.

FCE are the different measures of foreign currency exposure. $Post$ is a dummy that equals 1 after the depreciation and 0 otherwise. α_{bt} are bank-month fixed effect and α_f are firm fixed effects. As before, standard errors are clustered at the firm level.

Table 11 shows the results. On average, firms that are more exposed to the depreciation financially face higher interest rates after the depreciation started compared to before, reflected in the positive coefficient. However, consistently with our results on imports, this result is entirely driven by firms that do not export. For exporters, the coefficient is statistically insignificant for all types of exposure measures and even negative for the simple foreign currency leverage measure as well as the wealth shock.

These results indicate that non-exporting firms that experience a larger appreciation of their debt values are charged higher interest rates, shedding light on the financial frictions that these firms face and providing evidence on a potential channel for why they contract imports.

The higher interest rates that are charged by banks are potentially due to higher probabilities of defaults of the non-exporting firms that face a debt revaluation. This is not the case for exporting firms, as they are hedged against the revaluation of their debt due to their appreciation of export revenues.

Next, we test whether the higher default risk of non-exporting firms with a larger appreciation of their debt due to the depreciation also feeds actually into delays in their payment of loans.

We create a balanced panel for each bank-firm-date combination and define a dummy that equals 1 if firm f is behind payment in their loans to bank b at time t and estimate the following linear probability model:

$$Delinquent_{fbt} = \alpha + \beta_1 FCE_f * Post_t + \alpha_{bt} + \alpha_f + \epsilon_{fbt} \tag{13}$$

where $Deliquent_{fbt}$ is equal to one if firm f is delinquent on a loan to bank b at time t and zero otherwise. FCE_f is either the foreign currency leverage just before the depreciation, the liquidity shock, or the wealth shock, as described above. α_{bt} are bank-time fixed effects and α_f are firm fixed effects. The bank-time fixed effects can again control for time-varying bank-specific factors that could lead to a spurious correlation between our foreign currency exposure measures and whether the firm is delinquent on their loans after the depreciation. For instance, certain banks may be better at screening and monitoring borrowers, which leads to lower nonperforming loans during the depreciation.[39] If the better screening and monitoring ability is correlated with the average foreign currency exposure of their borrowers, this could introduce a bias in the estimates. After absorbing for bank-time fixed effects, we control for this potential correlation between the error term and the treatment variable.

Table 12 shows the results. On average, firms with larger financial exposure to the exchange rate depreciation are more likely to fall behind their loan payments than their counterparts. This can be seen in Columns (1), (4), and (7). However, this effect is exclusively driven by non-exporting firms. For exporting firms the effect of larger debt appreciation due to foreign currency debt is not significantly affecting the probability of falling behind in debt payments.

These results confirm our baseline result and suggest that since exporters are hedged through higher US dollar revenues, they are still able to repay their loans.

5.7 Placebo

In this section we conduct a placebo exercise where we replace the *foreign* currency leverage with *domestic* currency leverage. This exercise helps us to rule out that our measures of financial exposure to the depreciation are not simply measures of financial vulnerabilities in general. If our measures captured financial constraints which are not related to foreign currency borrowing, our results would still be indicative of a financial channel of external adjustment but not a debt dollarization channel. Table 13 indeed shows that if we replace our measures of debt dollarization with domestic leverage, we do not find significant negative effects on neither imports nor exports. This evidence is strongly suggesting that foreign currency borrowing rather than domestic financial heterogeneity across firms is driving the import response.

5.8 Panel Regression

In this section we aim to generalize our results to a larger time window. While one advantage of the event-study approach is that the causal identification is more credible, our results may not be externally valid outside of large devaluation episodes. We use data between 2008 and 2018 to construct an annual panel dataset with log imports, log exports, foreign currency leverage and the Colombian peso/US dollar exchange rate. Although quarterly data is available, we move

[39] See for example Pierri and Timmer (2022), who show that banks that invest more in information technology are more resilient to financial shocks.

to an annual panel, as we have seen in Figure 2 that the dominant currency financing channel works with a lag to the exchange rate movement. We regress log imports and exports on the lagged foreign currency leverage and the movement in the peso/dollar exchange rate between $t-2$ and $t-1$ controlling for firm and year fixed effects.

Table 14 shows the results. The first row shows that firms that had higher foreign currency leverage in the previous year export and import more in the current year in the absence of exchange rate movements. However, once we see a depreciation of the peso relative to the US dollar, only non-exporters (column (2)) shrink their imports significantly in the following year. This is a confirmation of our baseline results shown in Table 4. As in the event-study approach, imports of firms that both export and import do not respond to the interaction between foreign currency leverage and the exchange rate. In contrast to the event-study approach, once we bundle non-exporters and exporters together we do not find a significant import response.

6 Conclusions

In this paper we analyze the dominant currency financing channel of external adjustment. We study whether firms with more foreign currency borrowing are affected differently in terms of their trade response compared to firms that borrow mainly in domestic currency. As foreign currency borrowing is an endogenous choice, we implement a novel identification strategy that helps us shed light on the causal impact of debt dollarization on external adjustment. We compute the increase in foreign currency debt payments that is solely due to the depreciation of the currency as firms have their debt maturing at different points in time.

Firms that have the majority of their debt maturing before the start of the depreciation are not affected by the depreciation through their balance sheet. In contrast, firms which have debt repayments scheduled at the height of the depreciation face a large increase in their debt repayment. This foreign currency liquidity shock strongly predicts a contraction in imports. However, this effect is solely present for firms that do not export. Exporters are naturally hedged against these negative balance sheet shocks through their revenues in foreign currency and therefore they not only do not shrink their imports in response to the shock, they also do not see their exports respond.

We conclude that foreign currency mismatches increases the potency of the external adjustment. This channel can be seen as an unintended side effect from borrowing in foreign currency from the perspective of external adjustment. However, the sharp decline in imports can have real effects on firms who are reliant on imported capital goods or intermediate inputs.

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Table 1: Descriptive statistics, firm characteristics

	Non-exporters		Exporters		All firms	
	mean	sd	mean	sd	mean	sd
Assets	8,810	154,309	19,655	208,475	12,400	174,183
Exports before 2014Q2	0	0	385	6,959	127	4,007
Exports after 2014Q2	0	0	326	4,584	108	2,646
Imports before 2014Q2	55	229	288	642	132	429
Imports after 2014Q2	48	219	260	615	118	410
Number of firms	14,618		7,232		21,850	

All variables reported in thousands of US dollars. Assets refer to total assets of firms as reported in Orbis database at the end of 2013. Trade data is taken from DANE and is calculated at the quarterly level. The sample is limited to firms that ever reported in our data. Exporters are defined as firms that ever exported in our data.

Table 2: Descriptive statistics, independent variables

	mean	Percentiles				
		10	25	50	75	90
Foreign leverage	4.4%	0.2%	0.4%	2.0%	6.3%	11.6%
Liquidity shock	0.1%	-0.2%	0.0%	0.0%	0.0%	0.6%
Wealth shock	0.8%	-0.1%	0.0%	0.2%	0.9%	2.6%

See subsection 3.2 for the definition of the variables.

Table 3: Balance Table

	(1)	(2)	(3)	(4)	(5)
	Size	Bank Credit Supply	Age	Profits	Maturity
LS	0.033*	-0.001	0.006	-0.002	0.007
	(0.017)	(0.001)	(0.009)	(0.007)	(0.010)
N	14,680	14,680	14,502	14,566	12,994

The table reports the estimated β coefficient from a cross-sectional firm-level regression of pre-depreciation (2013) firm level characteristics on the liquidity shock (LS). Size refers to log assets, Bank Credit Supply is the exposure of firms to a bank credit supply shock constructed in the spirit of Amiti and Weinstein (2018). Age is the log age of the firm, profits is EBITDA over total assets, and Maturity is the log of the average maturity of firms' loans. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 4: Imports

	ln (imports)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × FCL	-0.106***	-0.215***	-0.018						
	(0.025)	(0.047)	(0.023)						
Post × LS				-0.046**	-0.069*	-0.024			
				(0.020)	(0.034)	(0.021)			
Post × WS							-0.059***	-0.120***	-0.009
							(0.020)	(0.032)	(0.024)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	524,943	350,934	174,009	524,943	350,934	174,009	524,943	350,934	174,009

The table reports the estimated β coefficient from Equation 9 with $\ln\left(1 + imports\right)$ on the left-hand side at the quarterly level. Columns (1)-(3) report the estimated coefficient of the interaction of a *Post* with foreign currency leverage (FCL). In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS) respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 5: Exports

	ln (exports)		
	(1)	(2)	(3)
Post × FCL	-0.010		
	(0.025)		
Post × LS		-0.025	
		(0.023)	
Post × WS			-0.024
			(0.026)
Firm FE	Y	Y	Y
Time FE	Y	Y	Y
N	169,232	169,232	169,232

The table reports the estimated β coefficient from Equation 9 with $\ln(1 + exports)$ on the left-hand side at the quarterly level. Column (1) reports the estimated coefficient of the interaction of a *Post* with foreign currency leverage (FCL). In columns (2) and (3) *Post* is interacted with liquidity (LS) and wealth shocks (WS) respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively. The sample is limited to the firms that ever exported in our data.

Table 6: Descriptive statistics, hedging

	Non-exporters	Exporters	All firms
	Share of Firms (2013)		
Hedge Foreign Assets	4.0%	26.9%	11.6%
Hedge FX Derivatives	1.6%	5.6%	2.9%
Hedge (Foreign Assets or FX Derivatives)	5.1%	28.7%	12.9%
Number of firms	14,618	7,232	21,850

Hedge Foreign Assets is the share of firms that have outstanding foreign assets in 2013. Hedge FX Derivatives is the share of firms that have outstanding foreign exchange derivatives in 2013. Hedge (Foreign Assets or FX Derivatives) is the share of firms that have either outstanding foreign assets in 2013 or outstanding foreign exchange derivatives in 2013. The sample is limited to firms that ever reported in our data. Exporters are defined as firms that ever exported in our data.

Table 7: Hedging and Imports

	ln(imports)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × FCL	-0.150***	-0.270***	0.002						
	(0.045)	(0.062)	(0.046)						
Post × FCL × Hedge	0.140**	0.246***	0.000						
	(0.051)	(0.079)	(0.054)						
Post × LS				-0.071**	-0.085**	-0.049			
				(0.030)	(0.039)	(0.037)			
Post × LS × Hedge				0.086**	0.105	0.059			
				(0.040)	(0.071)	(0.046)			
Post × WS							-0.084***	-0.131***	-0.020
							(0.029)	(0.036)	(0.042)
Post × WS × Hedge							0.107***	0.140*	0.044
							(0.038)	(0.071)	(0.049)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	524,943	350,934	174,009	524,943	350,934	174,009	524,943	350,934	174,009

The table reports the estimated β and γ from Equation 11 with $\ln(1 + imports)$ on the left-hand side at the quarterly level. Columns (1)-(3) report the estimated coefficient of the interaction of *Post* with foreign currency leverage (FCL) and the interaction of *Post*×FCL×Hedge. In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS) and the hedging dummy respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Hedge* is a dummy that equals one if the firm has either foreign currency assets outstanding or has foreign currency derivative positions outstanding in 2013 and zero if not. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 8: Foreign Currency Assets Hedging and Imports

	ln(imports)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × FCL	-0.142***	-0.236***	-0.029						
	(0.039)	(0.055)	(0.040)						
Post × FCL × Hedge	0.126**	0.147*	0.045						
	(0.047)	(0.078)	(0.050)						
Post × LS				-0.064**	-0.082**	-0.039			
				(0.027)	(0.038)	(0.033)			
Post × LS × Hedge				0.077*	0.118*	0.042			
				(0.038)	(0.068)	(0.044)			
Post × WS							-0.080***	-0.125***	-0.026
							(0.026)	(0.035)	(0.036)
Post × WS × Hedge							0.104***	0.110	0.057
							(0.036)	(0.072)	(0.046)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	524,943	350,934	174,009	524,943	350,934	174,009	524,943	350,934	174,009

The table reports the estimated β and γ from Equation 11 with $\ln(1 + imports)$ on the left-hand side at the quarterly level. Columns (1)-(3) report the estimated coefficient of the interaction of *Post* with foreign currency leverage (FCL) and the interaction of *Post*×FCL×Hedge. In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS) and the hedging dummy respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Hedge* is a dummy that equals one if the firm has foreign currency assets outstanding in 2013 and zero if not. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 9: Foreign Exchange Derivative Markets Hedging and Imports

	ln(imports)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × FCL	-0.124***	-0.251***	-0.003						
	(0.033)	(0.054)	(0.028)						
Post × FCL × Hedge	0.127*	0.388***	-0.060						
	(0.062)	(0.114)	(0.058)						
Post × LS				-0.050**	-0.074*	-0.023			
				(0.023)	(0.036)	(0.024)			
Post × LS × Hedge				0.039	0.081	-0.005			
				(0.050)	(0.115)	(0.051)			
Post × WS							-0.066***	-0.134***	-0.003
							(0.023)	(0.034)	(0.028)
Post × WS × Hedge							0.088*	0.226**	-0.020
							(0.048)	(0.103)	(0.049)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	524,943	350,934	174,009	524,943	350,934	174,009	524,943	350,934	174,009

The table reports the estimated β and γ from Equation 11 with $\ln(1 + imports)$ on the left-hand side at the quarterly level. Columns (1)-(3) report the estimated coefficient of the interaction of *Post* with foreign currency leverage (FCL) and the interaction of *Post*×FCL×Hedge. In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS) and the hedging dummy respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Hedge* is a dummy that equals one if the firm has foreign currency derivative positions outstanding in 2013 and zero if not. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 10: Borrowing

	ln (FC borrowing)			ln (LC borrowing)		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × FCL	-0.587***			0.104***		
	(0.117)			(0.026)		
Post × LS		-0.207***			0.029	
		(0.059)			(0.017)	
Post × WS			-0.391***			0.068***
			(0.097)			(0.020)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
N	524,943	524,943	524,943	524,943	524,943	524,943

The table reports the estimated β coefficient from Equation 9 with $\ln\left(1+borrowing\right)$ on the left-hand side at the quarterly level. Columns (1)-(3) report the results for borrowing in foreign currency and columns (4)-(6) use borrowing in local currency on the left-hand side. Columns (1) and (4) report the estimated coefficient of the interaction of a *Post* with foreign currency leverage (FCL). In columns (2), (5) and (3), (6) *Post* is interacted with liquidity (LS) and wealth shocks (WS) respectively. FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively. The sample is limited to the firms that ever imported in our data. Exporters are firms that ever exported in our data.

Table 11: Interest Rate

	Interest Rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FCL × Post	0.040	0.134***	0.001						
	(0.028)	(0.049)	(0.036)						
LS × Post				0.052*	0.074*	0.043			
				(0.029)	(0.041)	(0.039)			
WS × Post							0.031	0.090*	-0.006
							(0.032)	(0.052)	(0.040)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank × Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	364,928	220,732	143,774	364,928	220,732	143,774	365,286	220,732	143,774

The table reports the estimated β from Equation 12 with r the interest rate charged by bank b at day d to firm f on the left-hand side. Columns (1)-(3) report the estimated coefficient of the interaction of *Post* with foreign currency leverage (FCL). In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS). FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 12: Delinquency

	Delinquent								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × FCL	0.002***	0.006***	0.001						
	(0.001)	(0.002)	(0.001)						
Post × LS				0.001*	0.003**	0.000			
				(0.001)	(0.001)	(0.001)			
Post × WS							0.001**	0.004***	0.001
							(0.001)	(0.001)	(0.001)
Sample	All	Non-X	X	All	Non-X	X	All	Non-X	X
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank × Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	3,635,780	2,165,253	1,470,378	3,635,780	2,165,253	1,470,378	3,635,780	2,165,253	1,470,378

The table reports the estimated β from Equation 13 with $Delinquent$ as a dummy variable on the left-hand side at the quarterly level that is equal to 1 if the firm is delinquent on a loan at quarter t to bank b. Columns (1)-(3) report the estimated coefficient of the interaction of *Post* with foreign currency leverage (FCL). In columns (4)-(6) and (7)-(9) *Post* is interacted with liquidity (LS) and wealth shocks (WS). FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The sample is limited to the firms that ever imported. Columns (1), (4), (7) report the results for all importers, columns (2), (5), (8) report the results for non-exporters, and columns (3), (6), and (9) report the results estimated on the sample of exporters. Exporters are firms that ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table 13: Placebo Domestic Leverage

	ln(imports)			ln(exports)
	(1)	(2)	(3)	(4)
Post × Domestic Leverage	-0.006	-0.007	-0.001	0.001
	(0.004)	(0.005)	(0.007)	(0.003)
Sample	All	Non-X	X	All
Firm FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
N	523,719	350,094	173,625	168,848

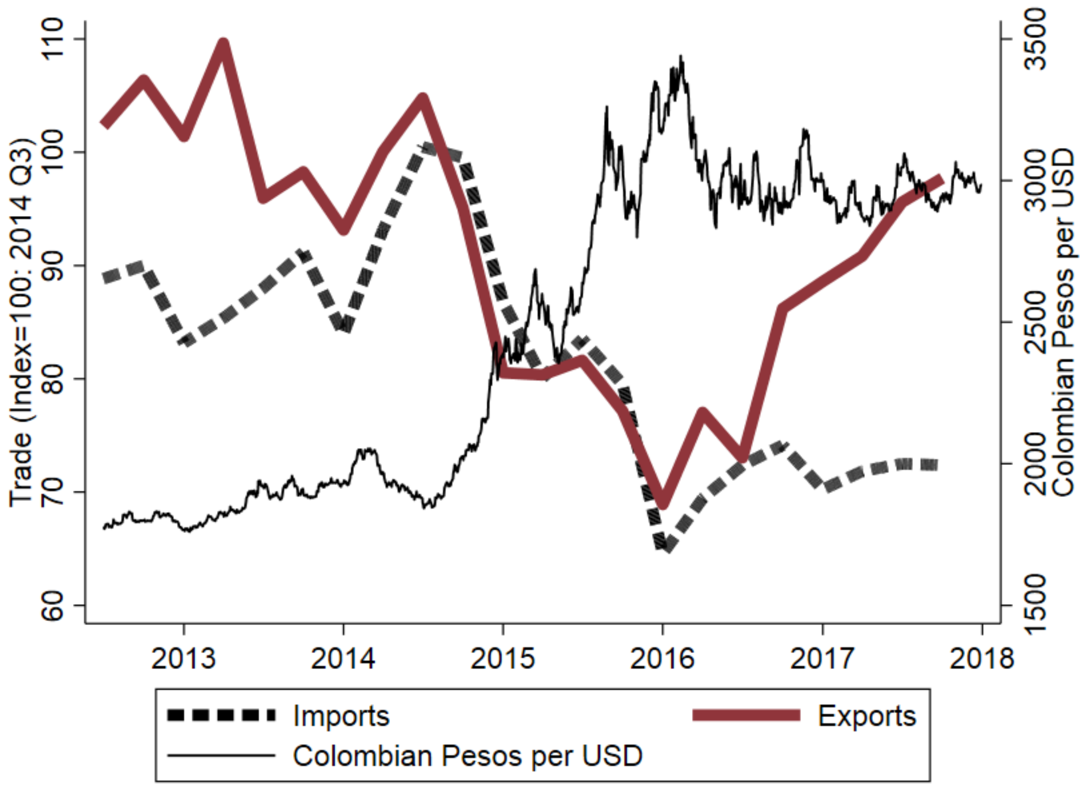
The table reports the estimated β coefficient from Equation 9 with $\ln(1 + imports)$ on the left-hand side in columns (1)-(3) report and $\ln(1 + exports)$ in column (4) at the quarterly level. Column (1) reports the estimated coefficient of the interaction of a *Post* with domestic currency leverage (DCL). DCL was normalized to have zero mean and a standard deviation of 1. Column (1) reports the results for all firms, column (2) focuses on non-exporters, while the sample in columns (3) and (4) is limited to only exporters. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively. The sample is limited to the firms that ever imported in our data. Exporters are firms that ever exported in our data.

Table 14: Panel regression

	ln(imports)			ln(exports)
	(1)	(2)	(3)	(4)
$FCL_{i,t-1}$	5.008***	6.715***	3.586***	2.098***
	(0.386)	(0.651)	(0.443)	(0.329)
$FCL_{i,t-1} \times \Delta ER_{t-1}$	-0.737	-5.044**	-0.465	-1.840
	(1.254)	(2.225)	(1.458)	(1.312)
Sample	All	Non-Exporters	Exporters	All
Firm FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
N	230,340	148,590	81,750	230,340

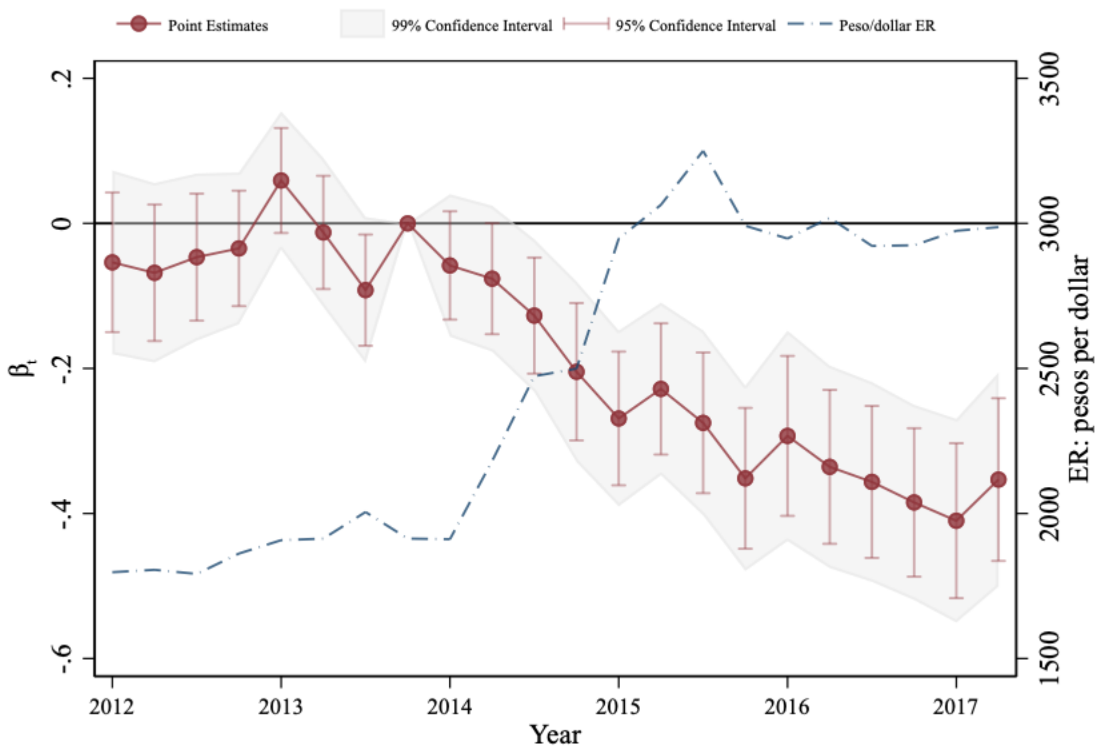
The table reports the estimated β coefficient from panel regression discussed in subsection 5.8 with $\ln(1+imports)$ on the left-hand side in columns (1)-(3) report and $\ln(1+exports)$ in column (4) at the annual level. See subsection 3.2 for the definition of FCL, which was normalized to have zero mean and a standard deviation of 1. Column (1) reports the results for all firms, column (2) focuses on non-exporters, while the sample in columns (3) and (4) is limited to only exporters. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively. The sample is limited to the firms that ever imported in our data. Exporters are firms that ever exported in our data.

Figure 1: Imports, exports and the exchange rate in Colombia



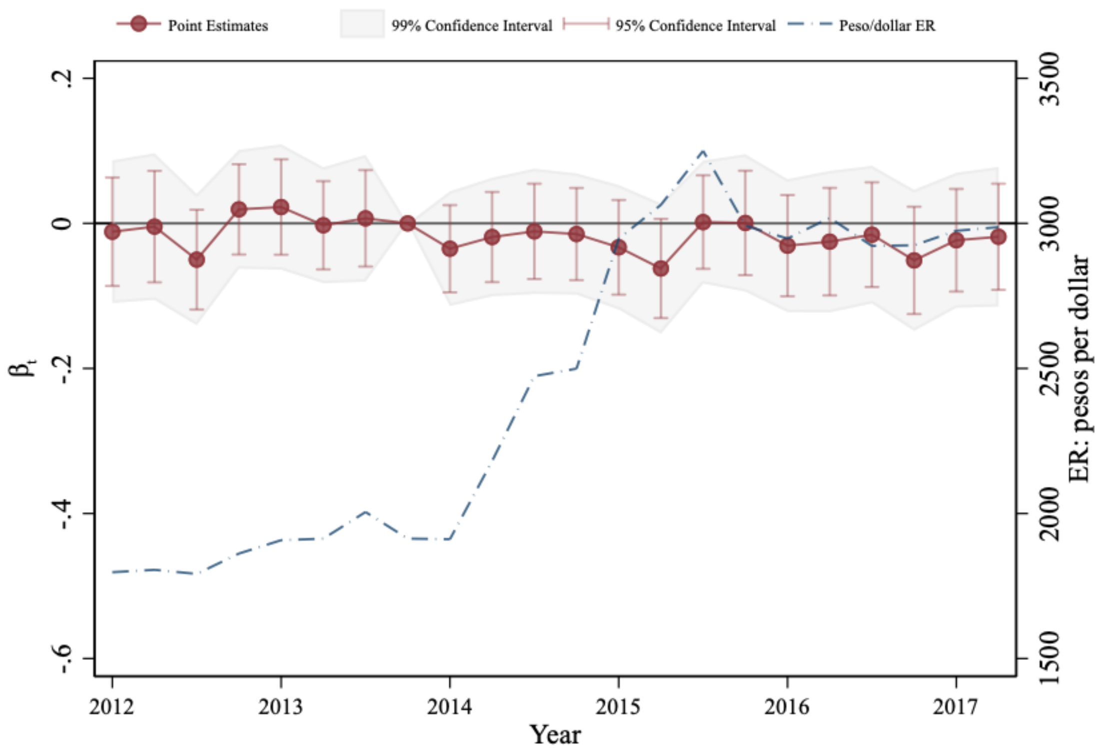
The thick red line represents aggregate exports and the dashed black line represents aggregate imports in Colombia in million dollars. Trade variables are plotted on the left vertical axis and indexed before the depreciation. The thin black line represents exchange rate (Colombian Pesos per US dollar, right axis).

Figure 2: Estimated Impact of Imports by Non-Exporters as a function of larger dominant currency financing



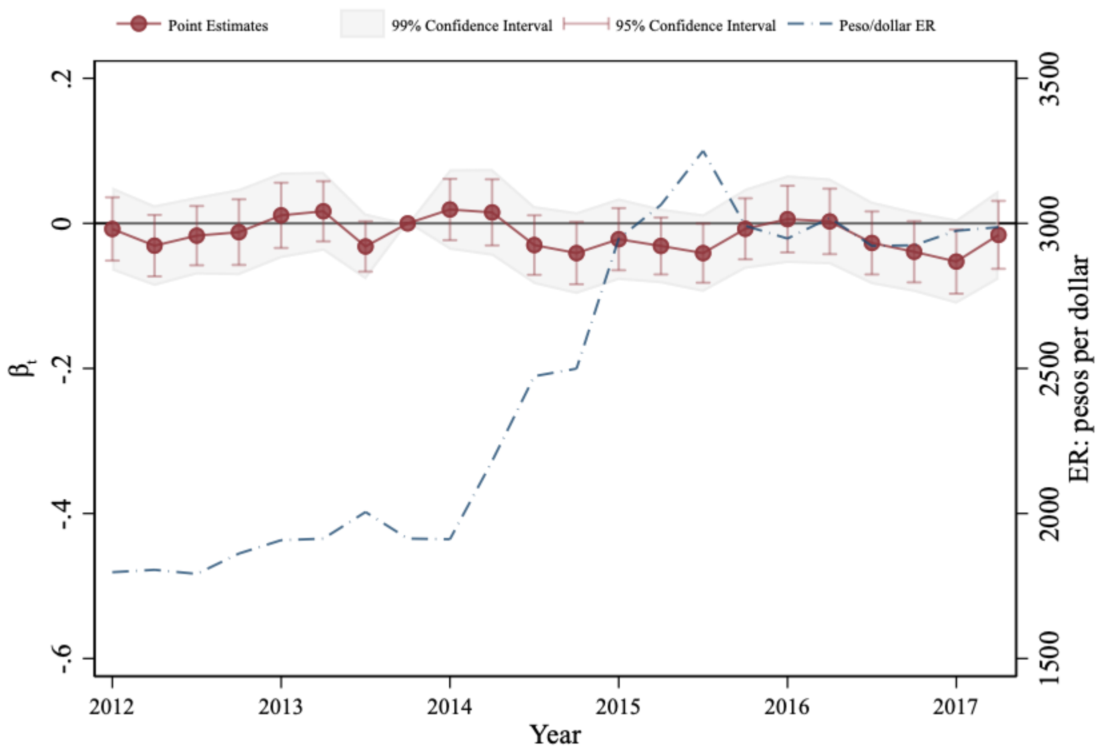
The figure plots point estimates (red dots), 95% (vertical bars) and 99% (grey shade) confidence bands of the effect of foreign currency leverage on imports (left vertical axis). See Equation 10 for specification. The thin blue dotted line represents average Colombian Peso/US dollar exchange rate (right axis). Standard errors are clustered at the firm and quarter levels. The sample is limited to firms that imported at least once and never exported in our data.

Figure 3: Estimated Impact of Imports by Exporters as a function of larger dominant currency financing



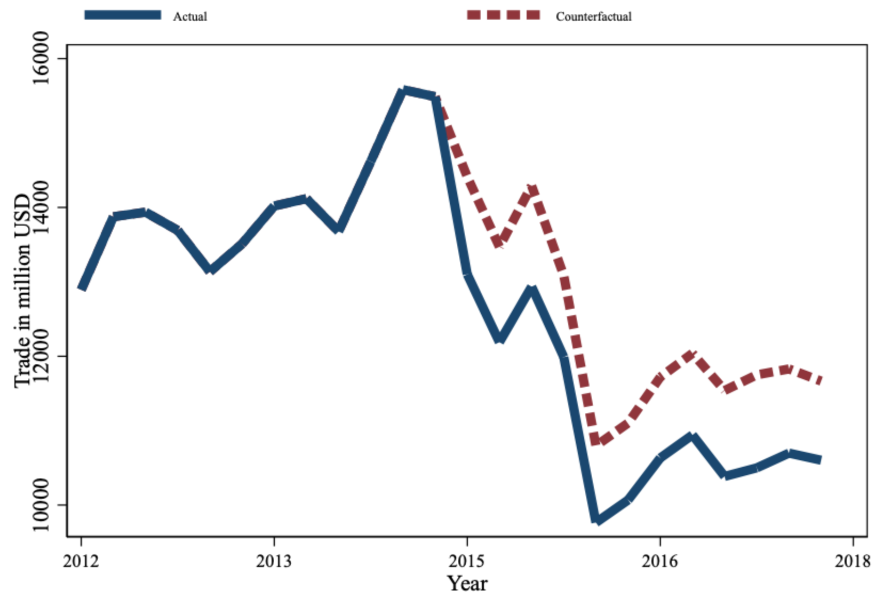
The figure plots point estimates (red dots), 95% (vertical bars) and 99% (grey shade) confidence bands of the effect of foreign currency leverage on imports (left vertical axis). See Equation 10 for specification. The thin blue dotted line represents average Colombian Peso/US dollar exchange rate (right axis). Standard errors are clustered at the firm and quarter levels. The sample is limited to firms that imported and exported at least once in our data.

Figure 4: Estimated Impact of Exports as a function of larger dominant currency financing



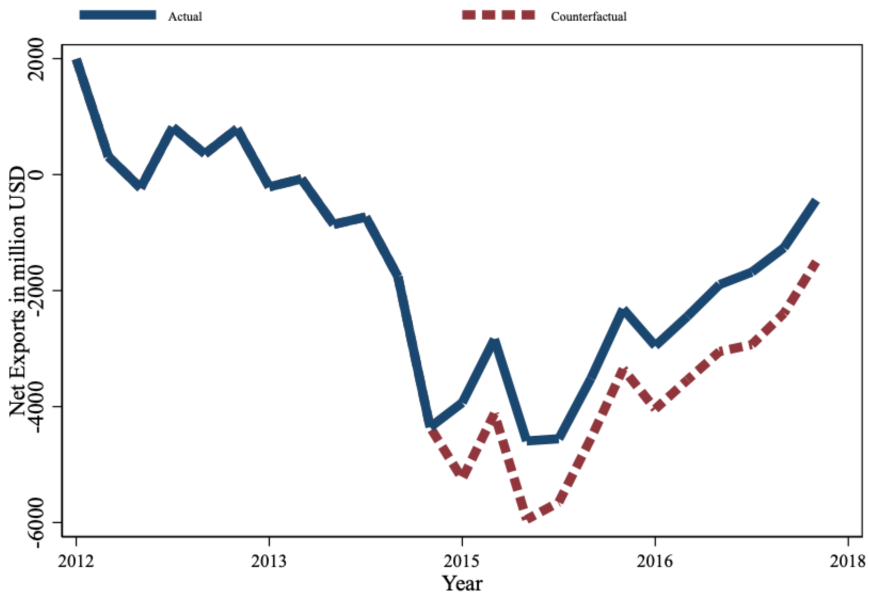
The figure plots point estimates (red dots), 95% (vertical bars) and 99% (grey shade) confidence bands of the effect of foreign currency leverage on exports (left vertical axis). See Equation 10 for specification. The thin blue dotted line represents average Colombian Peso/US dollar exchange rate (right axis). Standard errors are clustered at the firm and quarter levels. The sample is limited to firms that imported and exported at least once in our data.

Figure 5: Counterfactual Imports without Foreign Currency Debt



The figure plots the actual (thick blue line) and counterfactual (dashed red line) imports to Colombia. The counterfactual imports are computed assuming firms in 2014Q2 had zero foreign currency leverage. See subsection 5.4 for the details of the counterfactual exercise.

Figure 6: Counterfactual Net Exports without Foreign Currency Debt



The figure plots the actual (thick blue line) and counterfactual (dashed red line) Colombia's net exports. The counterfactual net exports are computed assuming firms in 2014Q2 had zero foreign currency leverage. See subsection 5.4 for the details of the counterfactual exercise.

Appendix

A Tables

Table A1: Baseline with Controls

	ln(imports)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × LS	-0.068*	-0.071**	-0.069**	-0.069**	-0.069**	-0.069**	-0.070**
	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Size × Post			-0.044**	-0.045**	-0.016	-0.011	-0.014
			(0.016)	(0.016)	(0.022)	(0.022)	(0.022)
Bank Credit Supply × Post				-0.212	-0.269	-0.270	-0.290
				(0.242)	(0.237)	(0.237)	(0.237)
Age × Post					-0.138	-0.141	-0.131
					(0.083)	(0.083)	(0.083)
Profits × Post						0.109**	0.109**
						(0.042)	(0.041)
Maturity × Post							0.080***
							(0.025)
Sample	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X
Sector-Time FE	N	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y
N	350,934	305,518	305,518	305,518	305,518	305,518	305,518

The table reports the estimated β coefficients from panel regression discussed in subsection 4.1 complemented with pre-depreciation (2013) firm level characteristics controls interacted with the Post dummy and with sector-time fixed effects. Size refers to log assets, Bank Credit Supply is the exposure of firms to a bank credit supply shock constructed in the spirit of Amiti and Weinstein (2018). Age is the log age of the firm, profits is EBITDA over total assets, and Maturity is the log of the average maturity of firms' loans. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table A2: Imports: Quantities

	Units			Kilograms		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × FCL	-0.338***			-0.317***		
	(0.073)			(0.074)		
Post × LS		-0.099*			-0.105**	
		(0.050)			(0.049)	
Post × WS			-0.154***			-0.161***
			(0.044)			(0.043)
Sample	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
N	350,934	350,934	350,934	350,934	350,934	350,934

The table reports the estimated β coefficient from panel regression discussed in subsection 5.8 where in columns (1)-(3) the left hand side takes the log of the number units imported and columns (4)-(6) takes the log kilograms imported by firm-quarter. See subsection 3.2 for the definition of FCL, which was normalized to have zero mean and a standard deviation of 1. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table A3: Imports: Extensive Margin

	#Countries			#Products		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × FCL	-0.038***			-0.075***		
	(0.009)			(0.017)		
Post × LS		-0.009			-0.026*	
		(0.006)			(0.013)	
Post × WS			-0.018***			-0.041***
			(0.006)			(0.011)
Sample	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
N	350,934	350,934	350,934	350,934	350,934	350,934

The table reports the estimated β coefficient from panel regression discussed in subsection 5.8 where in columns (1)-(3) the left hand side takes the log of the unique number of import country destinations and columns (4)-(6) it takes the log number of unique products by firm-quarter. See subsection 3.2 for the definition of FCL, which was normalized to have zero mean and a standard deviation of 1. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table A4: Robustness: Exporter

	ln(imports)					
	(1)	(2)	(3)	(4)	(5)	(6)
Post × FCL	-0.189***	-0.187***	-0.186***	-0.189***	-0.188***	-0.193***
	(0.043)	(0.044)	(0.045)	(0.043)	(0.043)	(0.043)
Post × FCL × exporter	0.176***	0.151***	0.151***	0.151***	0.150***	0.151***
	(0.049)	(0.049)	(0.050)	(0.050)	(0.050)	(0.050)
Sample	No controls	Size	Bank Credit Supply	Age	Profits	Maturity
$p : \beta_1 + \beta_2 = 0$	0.574	0.289	0.289	0.247	0.244	0.202
N	461,746	461,746	461,746	461,746	461,746	461,746

The table reports the estimated β coefficients from panel regression discussed in subsection 4.1 complemented with a triple interaction with an exporter dummy instead of splitting the sample. Columns (2)-(6) introduce sequentially additional triple interactions of pre-depreciation (2013) firm level characteristics with $Post$ and FCL on top of the ones included in the previous columns. Size refers to log assets, Bank Credit Supply is the exposure of firms to a bank credit supply shock constructed in the spirit of Amiti and Weinstein (2018). Age is the log age of the firm, profits is EBITDA over total assets, and Maturity is the log of the average maturity of firms' loans. $p : \beta_1 + \beta_2 = 0$ displays the p value from a t-test whether the sum of $Post \times FCL$ and $Post \times FCL \times exporter$ are equal to zero. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table A5: Robustness: Exports

	ln(exports)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × FCL	-0.010	-0.020	-0.009	-0.009	-0.005	-0.005	-0.003
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Size × Post			-0.055**	-0.055**	0.019	0.020	0.019
			(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
Bank Credit Supply × Post				0.031	-0.048	-0.046	-0.056
				(0.342)	(0.338)	(0.338)	(0.339)
Age × Post					-0.355***	-0.355***	-0.349***
					(0.073)	(0.074)	(0.072)
Profits × Post						0.008	0.007
						(0.017)	(0.017)
Maturity × Post							0.051
							(0.036)
Sample	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X	Non-X
Sector-Time FE	N	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y
N	169,232	151,764	151,764	151,764	151,764	151,764	151,764

The table reports the estimated β coefficients from panel regression discussed in subsection 4.1 complemented with pre-depreciation (2013) firm level characteristics controls interacted with the Post dummy. Size refers to log assets, Bank Credit Supply is the exposure of firms to a bank credit supply shock constructed in the spirit of Amiti and Weinstein (2018). Age is the log age of the firm, profits is EBITDA over total assets, and Maturity is the log of the average maturity of firms' loans. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

Table A6: Investment

	Δ Investment				
	(1)	(2)	(3)	(4)	(5)
FCL	-0.035	-0.101**	-0.062	-0.100*	-0.101**
	(0.027)	(0.045)	(0.041)	(0.057)	(0.043)
Exporter					0.068
					(0.050)
FCL × Exporter					0.102*
					(0.055)
Sample	All	Non-X	Non-Hedge	Non-X,Non-Hedge	All
N	16,924	10,621	14,225	9,956	16,924

The table reports the estimated β coefficients from a cross-sectional regression of the change in investment between pre-depreciation and 2014 on the foreign currency leverage of the firm before the depreciation. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

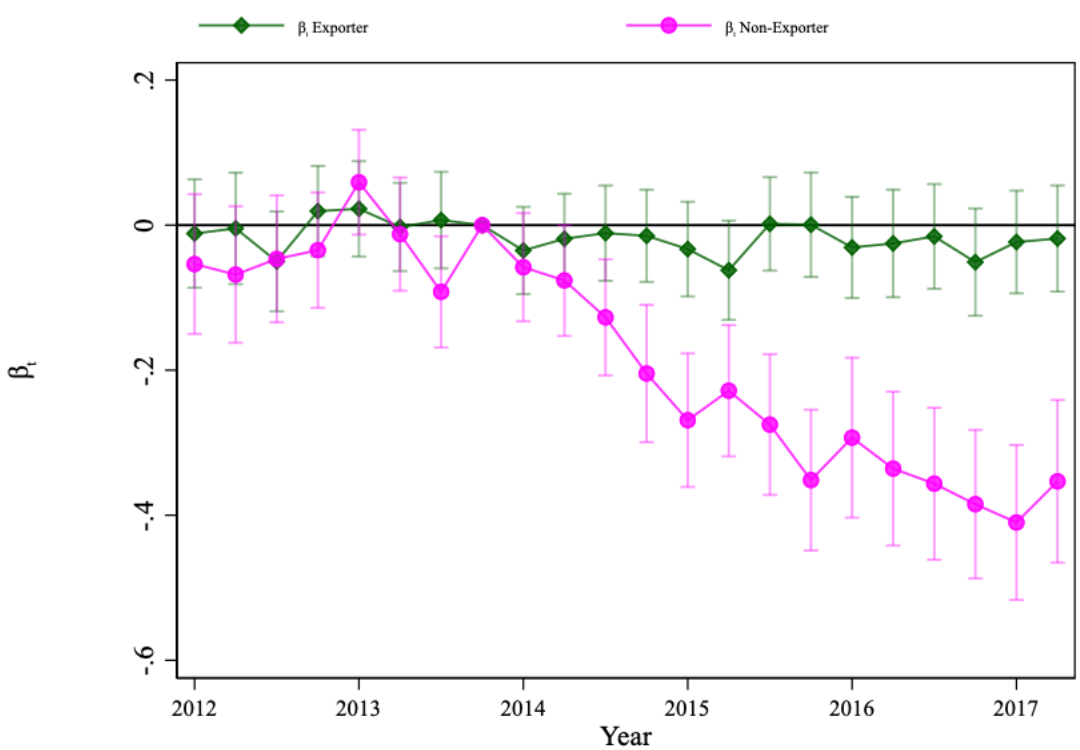
Table A7: New Borrowing

	Foreign Currency								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FCL × Post	-0.284***			0.234***			0.008		
	(0.059)			(0.050)			(0.014)		
FCL × Post × exporter	0.034			-0.048			0.021		
	(0.077)			(0.068)			(0.019)		
LS × Post		-0.100**			0.105***			0.003	
		(0.049)			(0.039)			(0.013)	
LS × Post × exporter		-0.013			-0.058			-0.013	
		(0.069)			(0.057)			(0.018)	
WS × Post			-0.092*			0.124***			0.012
			(0.050)			(0.039)			(0.017)
WS × Post × exporter			-0.032			-0.048			-0.001
			(0.069)			(0.054)			(0.021)
Sample	All	All	All	All	All	All	All	All	All
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank × Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	364,911	364,911	364,911	364,911	364,911	364,911	364,911	364,911	364,911

The table reports the estimated β from $Loan_{i,f,d(t),b} = \alpha + \beta_1 FCE_f * Post_t + \beta_2 FCE_f * Exporter_f * Post_t + \alpha_{b,t} + \alpha_i + \epsilon_{f,d(t),b}$ where Loan is the log of the loan volume of loan (i) to firm (f) at issuance date (d) by bank (b). Columns (1)-(3) report the results for loans in foreign currency, columns (4)-(6) report the results for loans in local currency, and columns (7)-(9) report the results for all loans. *Post* is interacted with liquidity (LS) and wealth shocks (WS). FCL, WS, and LS were normalized to have zero mean and a standard deviation of 1. *Post* is defined as a binary variable equal to 1 for the period after 2014Q2. The $Exporter$ dummy takes the value one if a firm ever exported in our data. See subsection 3.2 for the definition of the independent variables. Standard errors are clustered at the firm and quarter level. ***,**, and * indicate significance at 10%, 5%, and 1% levels respectively.

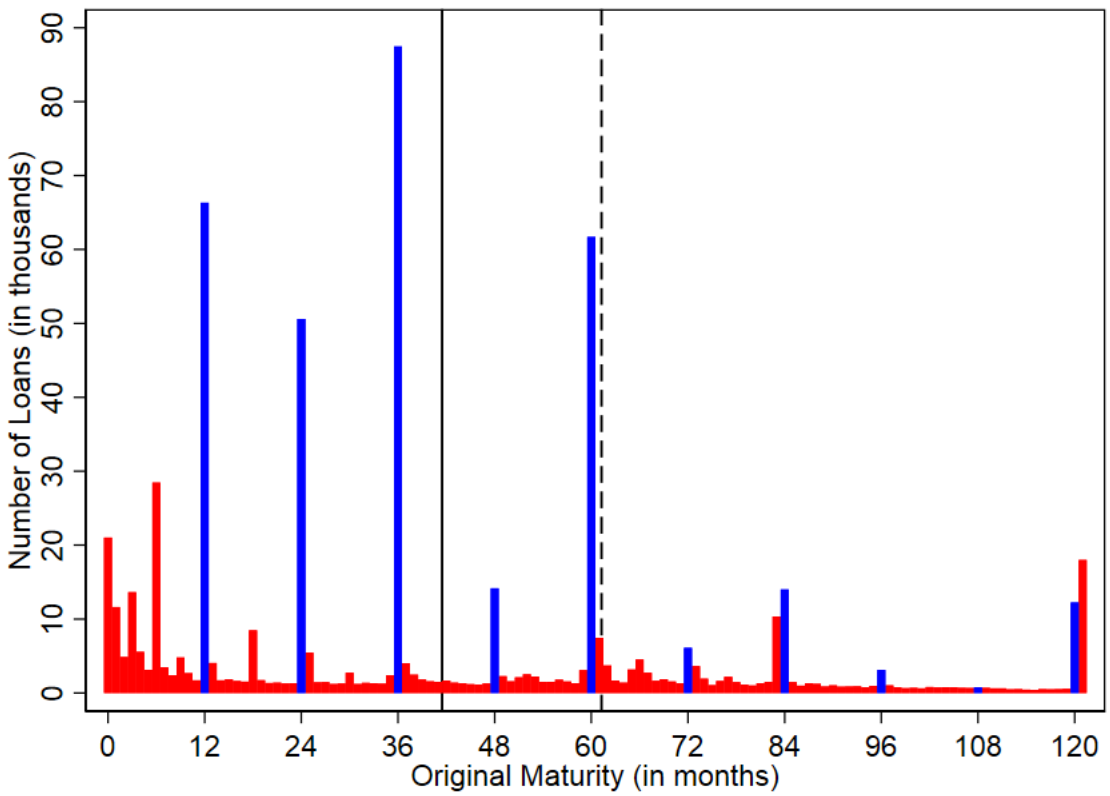
B Figures

Figure A1: Estimated Impact of Imports by Non-Exporters and Exporters as a function of larger dominant currency financing



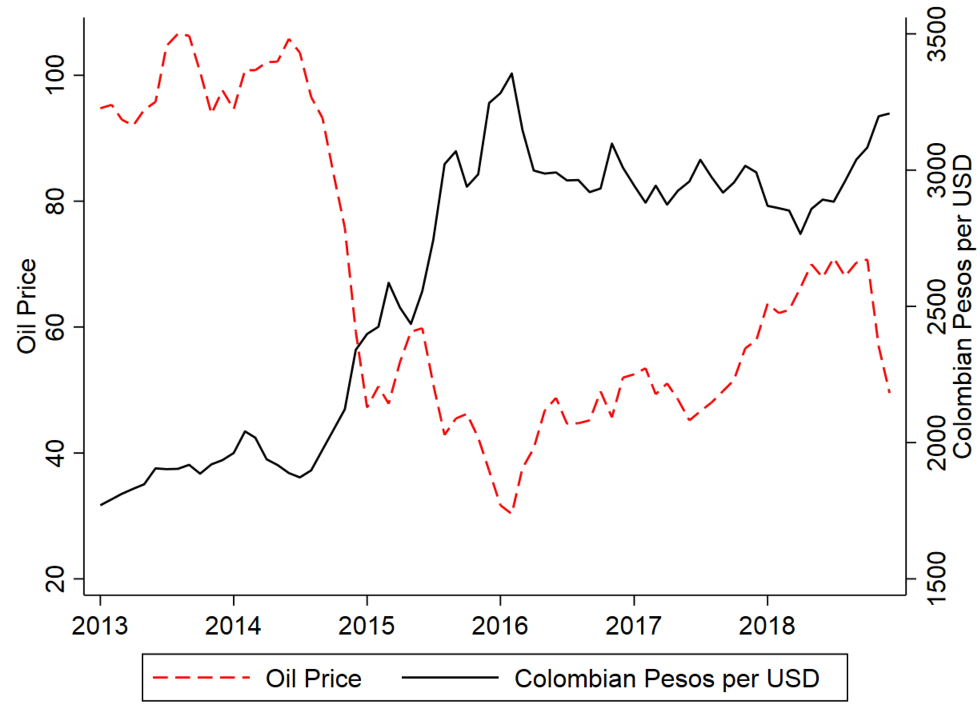
The figure plots point estimates for exporters (green dots) and non-exporters (pink dots) and their 95% (vertical bars) confidence bands of the effect of foreign currency leverage on imports for exporters and non-exporters. See Equation 10 The sample is limited to firms that imported.

Figure A2: Maturity Structure of Loans



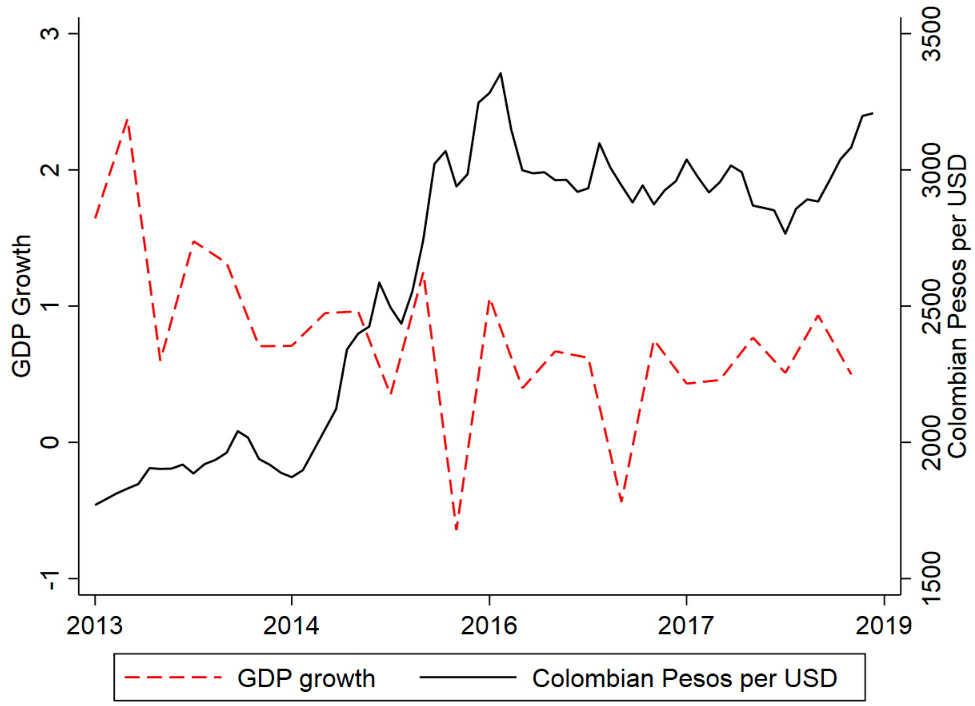
The figure plots the loan frequency by the original maturity in months. The red (blue) bars reflect loans have an original maturity of non-whole (whole) years. The black solid (dashed) line represents the average (weighted) maturity. The maturity is winsorized for longer than 120 months.

Figure A3: Oil Price and the Peso



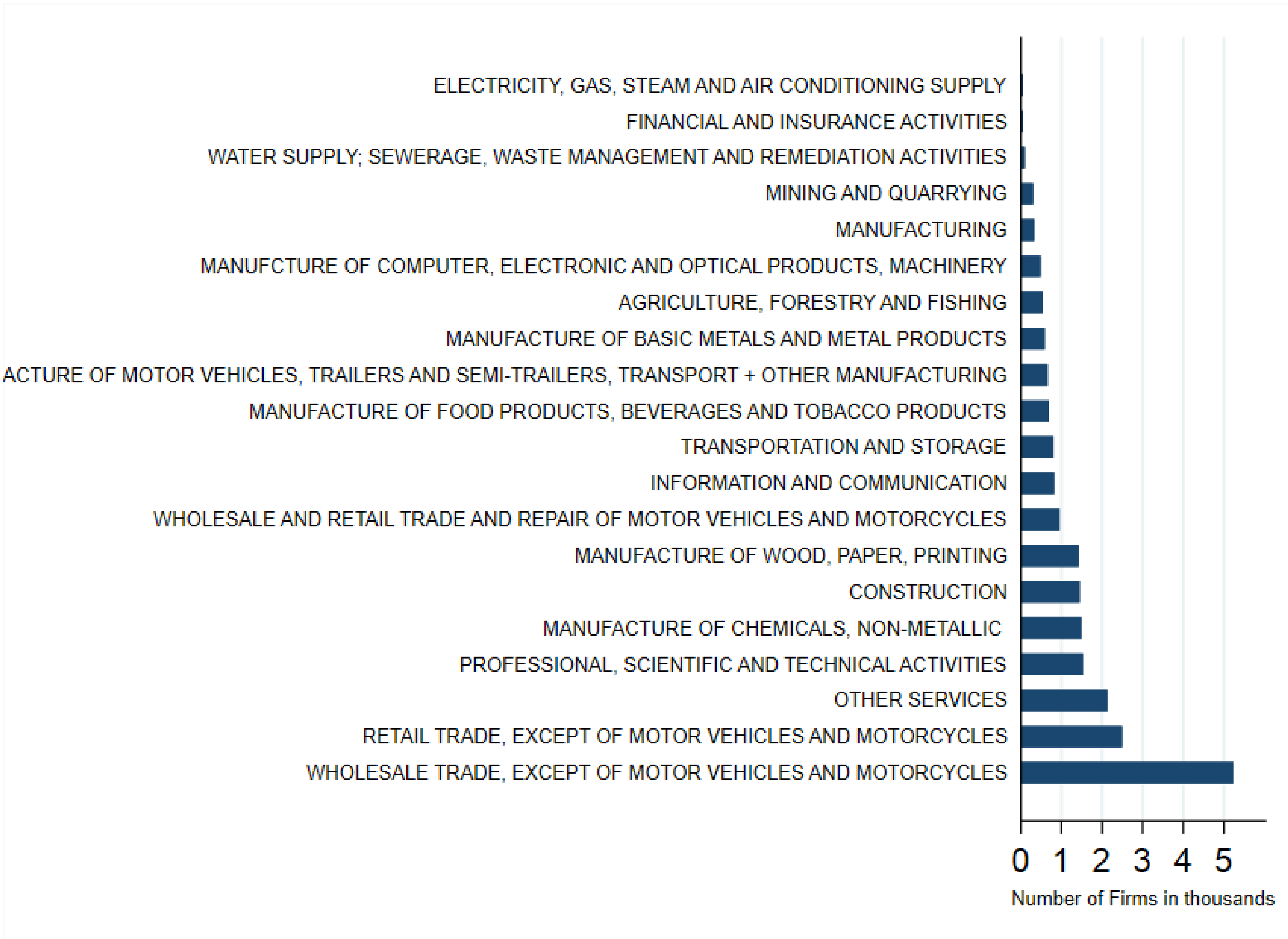
The figure plots the Oil Price (left axis) and the Colombian Peso/US dollar exchange rate (right axis).

Figure A4: Colombian GDP growth and the Peso



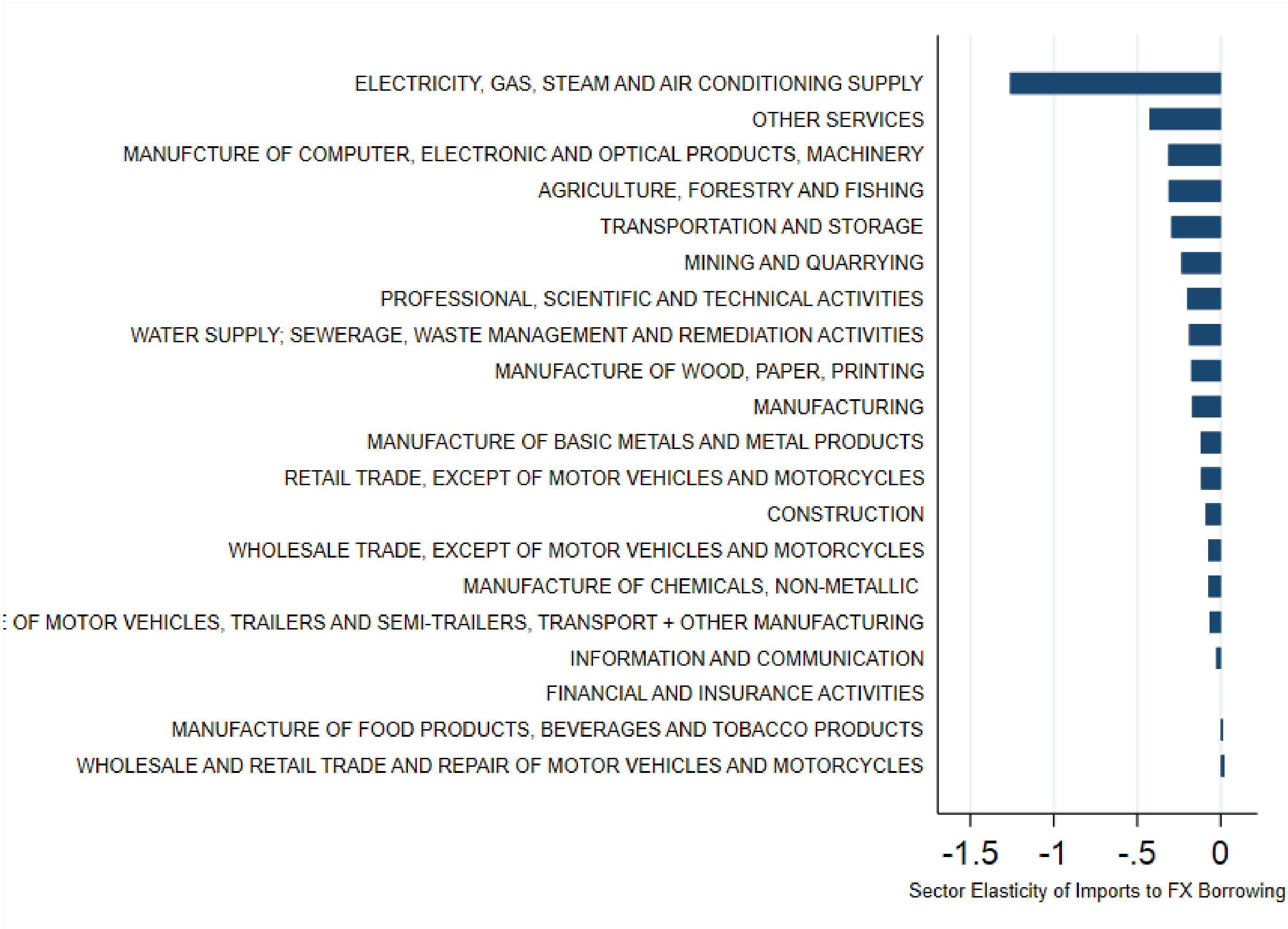
The figure plots the real GDP growth (left axis) and the Colombian Peso/US dollar exchange rate (right axis).

Figure A5: Number of Firms per Sector



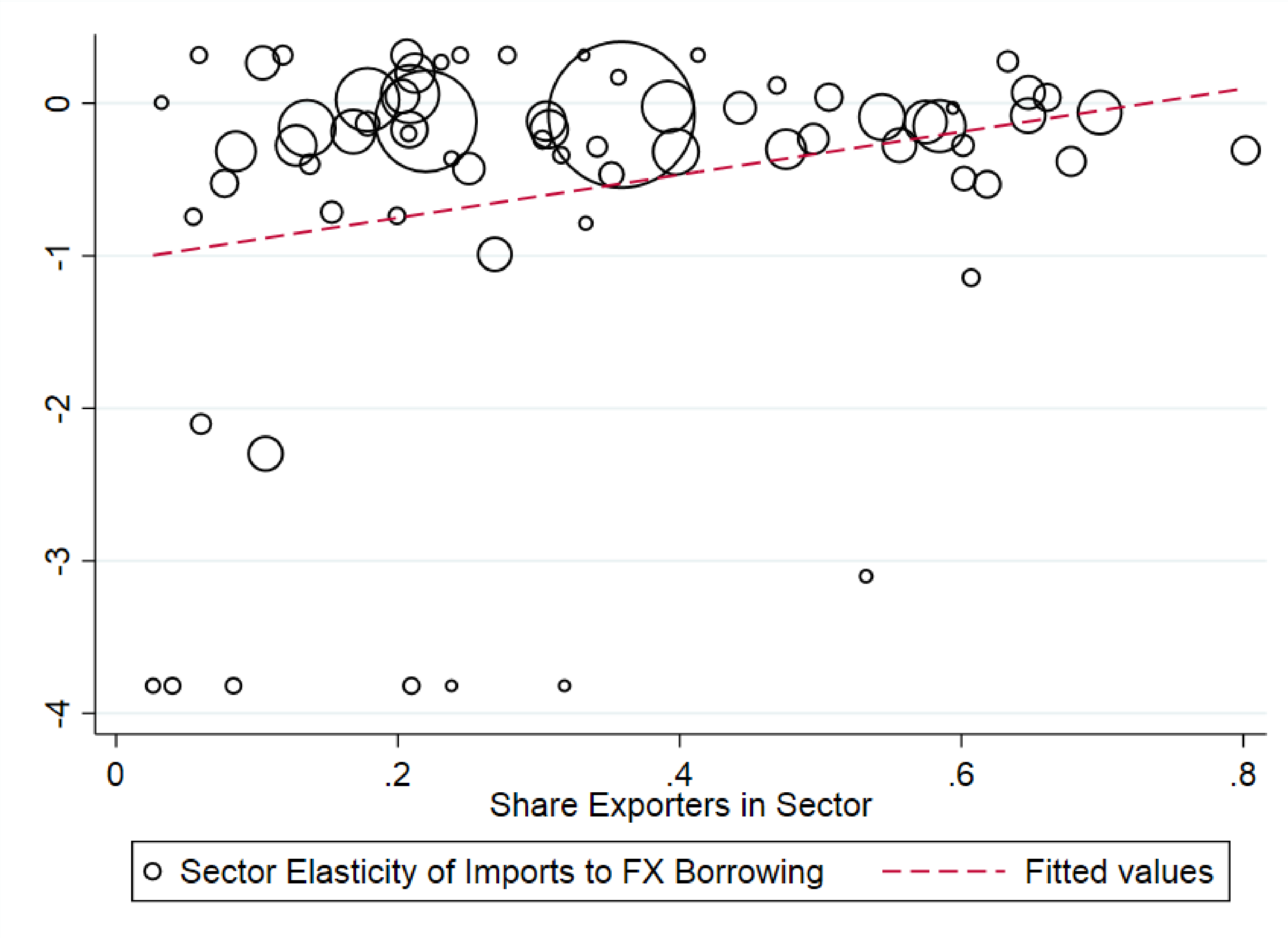
The figure plots the number of firms in each sector considered in our regression sample.

Figure A6: Sector Heterogeneity



The figure plots the sector-level coefficient of our baseline specification Equation 9 for each sector.

Figure A7: Sector Heterogeneity and Export Share



The figure plots the sector-level (2-digit NAICS) coefficient of our baseline specification Equation 9 estimated for each sector separately against the share of exporters in this sector. The size of the circle represents the number of firms in the sector.

C Analytical model

This Appendix details the proofs used in the paper. We start with a simple model that follows Bernanke et al. (1999) first, and later add exporting.

C.1 Simple model

C.1. 1 Set-up

Define the following objects:

$$\Psi\left(\bar{\delta}\right) = \mathbb{E}\left[\delta|\delta < \bar{\delta}\right]]F(\bar{\delta}) + \bar{\delta}(1 - F(\bar{\delta})) \tag{14}$$

$$\zeta(\bar{\delta}) = \gamma\mathbb{E}\left[\delta|\delta < \bar{\delta}\right] F(\bar{\delta}). \tag{15}$$

WLOG assume that $\mathbb{E}[\delta] = 1$, then:

$$\Psi'(\bar{\delta}) = 1 - F(\bar{\delta}) \tag{16}$$

$$\zeta'(\bar{\delta}) = \gamma\bar{\delta} f(\bar{\delta}) \tag{17}$$

and

$$\bar{\delta}(1 - F(\bar{\delta})) = \Psi(\bar{\delta}) - \frac{\zeta(\bar{\delta})}{\gamma}. \tag{18}$$

We can then express firm profits as:

$$\pi^f = \rho(M)\left(1 - \Psi(\bar{\delta})\right)$$

Here $\rho(M)$ are expected revenues of the firm. M are the inputs of the firm (imports). $1 - \Psi(\bar{\delta})$ is the share of revenues that goes to the firm. $\Psi(\bar{\delta})$ is the share of profits that goes to the bank inclusive of monitoring costs. Note that bank profits can be written as:

$$\pi^b = \left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\rho(M)$$

and so $\zeta(\bar{\delta})$ is the share of revenues that goes to monitoring costs. M is procured at price p^M and is financed by debt (B) and equity (A). $p^M M = B + A$. Hence, the problem can be written as:

$$\max_{M,\bar{\delta}} \rho\,(M)\left(1-\Psi(\bar{\delta})\right) \tag{19}$$

$$s.t.\;\; \rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right) = R(p^M M - A) \tag{20}$$

where the constraint implies that the profits of the bank are equal to the risk-free rate R times the amount lent to the firm $p^M M - A$, as banks are competitive. The properties of functions Ψ and ζ will depend on the functional forms of the distribution of δ.

C.1. 2 Optimization

Lagrangian is given by:

$$L = \rho(M)\left(1-\Psi(\bar{\delta})\right) + \lambda\left(\rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right) - R(p^M M - A)\right) \tag{21}$$

FOC:

$$M:\;\; \frac{1}{p^M}\rho_M(M)\left[1-\Psi(\bar{\delta})+\lambda\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right] - \lambda R = 0 \tag{22}$$

$$\bar{\delta}:\;\; -\rho(M)\Psi'(\bar{\delta}) + \lambda\rho(M)\left(\Psi'(\bar{\delta})-\zeta'(\bar{\delta})\right) = 0 \tag{23}$$

$$\lambda:\;\; \rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right) = R(p^M M - A) \tag{24}$$

Assume for now that ER affects only net worth of the firm and that there is an interior solution.[40] Then from Equation 23 we can express:

$$\lambda\left(\bar{\delta}\right) = \frac{\Psi'(\bar{\delta})}{\Psi'(\bar{\delta})-\zeta'(\bar{\delta})}.$$

Let

$$r \equiv \frac{\frac{1}{p^M}\rho_M(M)}{R}. \tag{25}$$

[40] See Bernanke et al. (1999) for the conditions under which unique solution exists.

This is the ratio between marginal revenues from a dollar spend on imported inputs and a rate of return to the bank. From Equation 22 we get:

$$r(\bar{\delta}) = \frac{\lambda(\bar{\delta})}{\left[1 - \Psi(\bar{\delta}) + \lambda(\bar{\delta})\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\right]} \tag{26}$$

We can show that $r'(\bar{\delta}) > 0$ and thus $\varepsilon_{r\bar{\delta}} > 0$,[41] in other words the wedge between cost of funds to the bank and expected return to capital is increasing with the cutoff. Note that we can express the actual interest rate on the loan as:

$$1 + i = \frac{\bar{B}}{B} = \frac{\rho(M)\bar{\delta}}{B}. \tag{27}$$

Since $\bar{B} = \rho(M)\bar{\delta}$, as revenues at cutoff must be the same as total payments. From Equation 24:

$$\frac{\rho(M)}{B} = \frac{R}{\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)}. \tag{28}$$

Plug Equation 28 into Equation 27 to get

$$1 + i = \frac{R\bar{\delta}}{\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)}.$$

C.1. 3 Derivations of elasticities

We can now derive several elasticities of interest.

$$\begin{aligned}
\varepsilon_{1+i,\bar{\delta}} &= R\frac{\Psi(\bar{\delta}) - \zeta(\bar{\delta}) - \bar{\delta}(\Psi'(\bar{\delta}) - \zeta'(\bar{\delta}))}{\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)^2} \frac{\bar{\delta}}{\frac{R\bar{\delta}}{\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)}} \\
&= 1 - \bar{\delta}\frac{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})} \\
&= 1 - \varepsilon_{\Psi-\zeta,\delta}
\end{aligned}$$

[41] See Bernanke et al. (1999) for the proof.

$$\varepsilon_{\Psi-\zeta,\delta} = \bar{\delta}\frac{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})} \tag{29}$$

$$= \frac{(1-F(\bar{\delta}))\bar{\delta} - \gamma\bar{\delta}^2 f(\bar{\delta})}{(1-F(\bar{\delta}))\bar{\delta} + (1-\gamma)\mathbb{E}[\delta|\delta < \bar{\delta}]F(\bar{\delta})} < 1 \tag{30}$$

Since $\gamma\bar{\delta}^2 f(\bar{\delta}) > 0$ and $(1-\gamma)\mathbb{E}[\delta|\delta < \bar{\delta}]F(\bar{\delta}) > 0$, the numerator is higher than denominator. It follows that $\varepsilon_{\Psi-\zeta,\delta} < 1$ and so $\varepsilon_{1+i,\bar{\delta}} > 0$

Consider Equation 25:

$$\varepsilon_{r,\bar{\delta}} = \varepsilon_{\rho_M,M}\varepsilon_{M,\bar{\delta}}$$
$$\varepsilon_{M,\bar{\delta}} = \frac{\varepsilon_{r,\bar{\delta}}}{\varepsilon_{\rho_M,M}} < 0,$$

as $\varepsilon_{r,\bar{\delta}} > 0$ and $\varepsilon_{\rho_M,M} < 0$ by assumption that marginal revenues are decreasing in inputs. Consider FOC for λ:

$$\varepsilon_{\rho,M}\varepsilon_{M\bar{\delta}}\varepsilon_{\bar{\delta},A} + \varepsilon_{\Psi-\zeta,\bar{\delta}}\varepsilon_{\bar{\delta},A} = \varepsilon_{p^M M-A,A}$$

$$\varepsilon_{\rho,M}\varepsilon_{M\bar{\delta}}\varepsilon_{\bar{\delta},A} + \varepsilon_{\Psi-\zeta,\bar{\delta}}\varepsilon_{\bar{\delta},A} = \varepsilon_{p^M M,A}\frac{p^M M}{p^M M - A} + \varepsilon_{A,A}\frac{-A}{p^M M - A}$$

$$\varepsilon_{\rho,M}\varepsilon_{M\bar{\delta}}\varepsilon_{\bar{\delta},A} + \varepsilon_{\Psi-\zeta,\bar{\delta}}\varepsilon_{\bar{\delta},A} = \varepsilon_{M,\bar{\delta}}\varepsilon_{\bar{\delta},A}\frac{p^M M}{p^M M - A} - \frac{A}{p^M M - A}$$

$$\varepsilon_{\bar{\delta},A} = \frac{-\frac{A}{p^M M}}{\varepsilon_{M,\bar{\delta}}\left(\varepsilon_{\rho,M} - \frac{p^M M}{p^M M - A}\right) + \varepsilon_{\Psi-\zeta,\bar{\delta}}} < 0.$$

Note that by assumption $\varepsilon_{\rho,M} < 1$. Since firms start with non-negative net worth $A > 0$ and $\frac{p^M M}{p^M M - A} > 1$ (assuming that $p^M M - A > 0$ or there would be no need to borrow in the first place), otherwise they would default before the beginning of the period and start with zero net worth. Since we proved that $\varepsilon_{M,\bar{\delta}} < 0$, the first term in the denominator is positive as a product of two negative numbers. Bernanke et al. (1999) show that $\varepsilon_{\Psi-\zeta,\bar{\delta}}$ is positive, so denominator is positive, and the ratio is negative as the numerator is negative. Hence, the demand shock cutoff for default decreases with net worth (firms with higher net worth have lower probability of default).

C.2 Model with exporting

C.2. 1 Set-up

To make progress, assume that revenue function takes an explicit form

$$\rho_{NX}(M) = M^{\frac{\sigma-1}{\sigma}} \tag{31}$$

for non-exporters, and

$$\rho_X(M) = M_D^{\frac{\sigma-1}{\sigma}} + M_F^{\frac{\sigma-1}{\sigma}} Fe; \quad M_D + M_F = M \tag{32}$$

for exporters. These functional forms can arise when demand curves are isoelastic up to some normalization. Here F reflects the relative size of the foreign market. Note that export revenues now depend on exchange rate e.

C.2. 2 Optimization

We can rewrite Lagrangian Equation 21 as:

$$L = \left(M_D^{\frac{\sigma-1}{\sigma}} + M_F^{\frac{\sigma-1}{\sigma}} Fe\right)\left(1-\Psi(\bar{\delta})\right) + \lambda\left(\left[M_D^{\frac{\sigma-1}{\sigma}} + M_F^{\frac{\sigma-1}{\sigma}} Fe\right]\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right) - R(p^M(M_D+M_F)-A)\right) \tag{33}$$

Taking FOCs with respect to M_D, M_F yields

$$\frac{1}{p^M}\frac{\sigma-1}{\sigma} M_D^{\frac{-1}{\sigma}}\left[1-\Psi(\bar{\delta}) + \lambda\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\right] = \lambda R p^M \tag{34}$$

$$\frac{1}{p^M}\frac{\sigma-1}{\sigma} M_F^{\frac{-1}{\sigma}} Fe\left[1-\Psi(\bar{\delta}) + \lambda\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\right] = \lambda R p^M \tag{35}$$

From which it follows that:

$$M_D^{\frac{-1}{\sigma}} = M_F^{\frac{-1}{\sigma}} Fe \tag{36}$$

or

$$M_F = M_D(Fe)^{\sigma} \tag{37}$$

Note that since $M = M_D + M_F$:

$$\begin{align}
M_D\left(1+(Fe)^{\sigma}\right) &= M \tag{38}\\
M_D &= \frac{M}{1+(Fe)^{\sigma}} \tag{39}\\
M_F = (Fe)^{\sigma} M_D &= \frac{M(Fe)^{\sigma}}{1+(Fe)^{\sigma}} \tag{40}
\end{align}$$

The previous equation tells us that the firm will use the share $\frac{1}{1+(Fe)^{\sigma}}$ of inputs to produce goods sold domestically, with this share falling in F – the relative size of the foreign market

Plugging Equation 39 and Equation 40 into the expression for the revenues for exporters Equation 32 we get:

$$\begin{align}
\rho_X(M) &= \left(\frac{M}{1+(Fe)^{\sigma}}\right)^{\frac{\sigma-1}{\sigma}} + Fe\left(\frac{M(Fe)^{\sigma}}{1+(Fe)^{\sigma}}\right)^{\frac{\sigma-1}{\sigma}} \tag{41}\\
&= M^{\frac{\sigma-1}{\sigma}}\left(\left[\frac{1}{1+(Fe)^{\sigma}}\right]^{\frac{\sigma-1}{\sigma}} + Fe\left[\frac{(Fe)^{\sigma}}{1+(Fe)^{\sigma}}\right]^{\frac{\sigma-1}{\sigma}}\right) \tag{42}
\end{align}$$

Let

$$\begin{align}
1+\kappa(e) &= \left[\frac{1}{1+(Fe)^{\sigma}}\right]^{\frac{\sigma-1}{\sigma}} + Fe\left[\frac{(Fe)^{\sigma}}{1+(Fe)^{\sigma}}\right]^{\frac{\sigma-1}{\sigma}} \tag{43}\\
&= \frac{1+(Fe)^{1+\sigma\frac{\sigma-1}{\sigma}}}{(1+(Fe)^{\sigma})^{\frac{\sigma-1}{\sigma}}} \tag{44}\\
&= \frac{1+(Fe)^{\sigma}}{(1+(Fe)^{\sigma})^{\frac{\sigma-1}{\sigma}}} \tag{45}\\
&= \left(1+(Fe)^{\sigma}\right)^{\frac{1}{\sigma}} \tag{46}
\end{align}$$

Note that $1+\kappa(e)>1$ it is increasing in e since $\sigma>1$

$$\rho_X(M)=(1+\kappa(e))\rho_{NX}(M) \tag{47}$$

The last expression tells us the revenues of exporters are $1+\kappa(e)$ times larger than the revenues of non-exporters conditional on the same amount of inputs used M where $\rho_{NX}(M)\equiv\rho(M)=M^{\frac{\sigma-1}{\sigma}}$. So now we can solve the problem:

$$\max_{B,\bar{\delta}}(1+\kappa(e))\rho(M)\left(1-\Psi(\bar{\delta})\right) \tag{48}$$

$$s.t.\ \ (1+\kappa(e))\rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)=R(p^M M-A) \tag{49}$$

and compare the elasticities of interest across exporters and non-exporters by setting $\kappa(e)=0$. Note that in this case exchange rate will affect the firms also through parameter $\kappa(e)$

C.2. 3 Optimization

We start with setting the Lagrangian:

$$L=(1+\kappa(e))\rho(M)\left(1-\Psi(\bar{\delta})\right)+\lambda\left((1+\kappa(e))\rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)-R(p^M M-A)\right) \tag{50}$$

FOC:

$$M:\ \ (1+\kappa(e))\frac{1}{p^M}\rho_M(M)\left[1-\Psi(\bar{\delta})+\lambda\left(\bar{\delta}\right)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]-\lambda\left(\bar{\delta}\right)R=0 \tag{51}$$

$$\bar{\delta}:\ \ -(1+\kappa(e))\rho(M)\Psi'(\bar{\delta})+\lambda(1+\kappa(e))\rho(M)\left(\Psi'(\bar{\delta})-\zeta'(\bar{\delta})\right)=0 \tag{52}$$

$$\lambda:\ \ (1+\kappa(e))\rho(M)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)=R(p^M M-A) \tag{53}$$

From Equation 52 we get the same expression for λ as before:

$$\lambda\left(\bar{\delta}\right)=\frac{\Psi'(\bar{\delta})}{\Psi'(\bar{\delta})-\zeta'(\bar{\delta})} \tag{54}$$

Now the wedge between marginal product and risk free rate is given by:

$$r \equiv \frac{\frac{1+\kappa(e)}{p^M}\rho_M(M)}{R} \tag{55}$$

From Equation 51 we get:

$$r(\bar{\delta}) = \frac{\lambda(\bar{\delta})}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]} \tag{56}$$

Note that the expression for the interest rate is now going to be:

$$1+i = \frac{\bar{B}}{B} = \frac{(1+\kappa(e))\rho(M)\bar{\delta}}{B} \tag{57}$$

From Equation 53

$$\frac{(1+\kappa(e))\rho(M)}{B} = \frac{R}{\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)} \tag{58}$$

and hence

$$1+i = \frac{R\bar{\delta}}{\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)} \tag{59}$$

The expression for the nominal interest rate is the same as before and we will have the same expression for the elasticity of interest rate with respect to $\bar{\delta}$. Note that from Equation (53) we can show that exporters have lower probability of default. Since increase in $1+\kappa(e)$ increases LHS, by contradiction we can show that in response $\bar{\delta}$ has to decrease to make both sides of the equation equal again.[42]

C.2. 4 Elasticities

Let $\varepsilon_{1+\kappa(e),e} \equiv \vartheta > 0$. We can now use Equation 55 to get:

$$\varepsilon_{r,e} = \vartheta + \varepsilon_{\rho_M,M}\varepsilon_{M,e} \tag{60}$$

[42]This is driven by the fact that RHS elasticity with respect to M is greater than 1, while elasticity of $\rho(M)$ with respect to M is less than 1, so if $\bar{\delta}$ increases for exporters, which leads to a fall in M and RHS falls much more than LHS.

Note that we can also express elasticity of the wedge as:

$$\varepsilon_{r,e} = \varepsilon_{r,\bar{\delta}} \varepsilon_{\bar{\delta},e} \tag{61}$$

and hence

$$\varepsilon_{r,\bar{\delta}} \varepsilon_{\bar{\delta},e} = \vartheta + \varepsilon_{\rho_M,M} \varepsilon_{M,e} \tag{62}$$

$$\varepsilon_{\bar{\delta},e} = \frac{\vartheta + \varepsilon_{\rho_M,M} \varepsilon_{M,e}}{\varepsilon_{r,\bar{\delta}}} \tag{63}$$

Let $\frac{p^M M}{p^M M - A} = n$ and $\varepsilon_{A,e} = -l$. As a result, $n > 1$ $\frac{-A}{p^M M - A} = 1 - n < 0$ and $l > 0$ by assumption (we assume that firms' net worth is negatively affected by a depreciation, which will happen, for example, when they borrow more in foreign currency than they own foreign currency assets). From Equation 53

$$\vartheta + \varepsilon_{\rho,M} \varepsilon_{M,e} + \varepsilon_{\Psi-\zeta,\bar{\delta}} \varepsilon_{\bar{\delta},e} = n \varepsilon_{M,e} + (1-n)(-l) \tag{64}$$

Substitute Equation 63 into Equation 64 to get:

$$\vartheta + \varepsilon_{\rho,M} \varepsilon_{M,e} + \varepsilon_{\Psi-\zeta,\bar{\delta}} \frac{\vartheta + \varepsilon_{\rho_M,M} \varepsilon_{M,e}}{\varepsilon_{r,\bar{\delta}}} = n \varepsilon_{M,e} + (1-n)(-l) \tag{65}$$

$$\varepsilon_{M,e} \left(\varepsilon_{\rho,M} + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}} \varepsilon_{\rho_M,M}}{\varepsilon_{r,\bar{\delta}}} - n \right) = -l(1-n) - \vartheta \left(1 + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} \right) \tag{66}$$

And hence:

$$\varepsilon_{M,e} = l \frac{(n-1)}{\varepsilon_{\rho,M} + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}} \varepsilon_{\rho_M,M}}{\varepsilon_{r,\bar{\delta}}} - n} + \frac{-\vartheta \left(1 + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} \right)}{\varepsilon_{\rho,M} + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}} \varepsilon_{\rho_M,M}}{\varepsilon_{r,\bar{\delta}}} - n} \tag{67}$$

Equation 67 tells us that foreign exchange rate movements have two effects on firm size. The first term is the effect through foreign currency liabilities. The second term is the conventional effect through higher export earning in local currency. Since $n > 1 > \varepsilon_{\rho,M}$ (the last inequality is by assumption), $\varepsilon_{\rho_M,M} < 0$ (also one of the assumptions), $\varepsilon_{\Psi-\zeta,\bar{\delta}} > 0$, and $\varepsilon_{r,\bar{\delta}} > 0$ the denominator in both terms is negative. Since $n > 1$ and $l > 0$, the numerator in the first term is positive and hence the whole term is negative – as was the case with non-exporters, exchange rate depreciation reduces net worth of the firm which makes it riskier for the banks to lend.

Note that the second term in Equation 67 is positive. The denominator is negative as we discussed above the numerator is negative since $\vartheta > 0$. Depreciation leads to higher revenues and stimulates firm's expansion through this channel.

Note that because of this second channel, exporters will also be larger and have lower probability of default. In the empirical specification, we will estimate the effect of exchange rate depreciation conditional on foreign currency borrowing, capture by l in this model. In other words, we will estimate the term proportional to:

$$\beta \propto \frac{(n-1)}{\varepsilon_{\rho,M} + \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}\varepsilon_{\rho_M,M}}{\varepsilon_{r,\bar{\delta}}} - n} \tag{68}$$

while the second term in Equation 67 that is common within exporters (and within non-exporters) who have different initial levels of foreign currency leverage will be captured by firm fixed effects. Note that under our simplifying assumptions on revenues, $\varepsilon_{\rho,M} = \frac{\sigma-1}{\sigma}$ and $\varepsilon_{\rho_M,M} = \frac{-1}{\sigma}$ and thus

$$\beta \propto \frac{(n-1)}{\frac{\sigma-1}{\sigma} - \frac{1}{\sigma}\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} - n} \tag{69}$$

Hence the relative strength of the lending channel between exporters and non-exporters will depend on the ratio of $\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}}$. Note that

$$\begin{aligned}
\varepsilon_{\Psi-\zeta,\delta} &= \bar{\delta}\frac{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})} &(70)\\
&= \bar{\delta}\frac{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})}\frac{1-F(\bar{\delta})}{1-F(\bar{\delta})} &(71)\\
&= \bar{\delta}\frac{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})}\frac{1-F(\bar{\delta})}{\Psi'(\bar{\delta})} &(72)\\
&= \bar{\delta}\frac{1-F(\bar{\delta})}{\Psi(\bar{\delta}) - \zeta(\bar{\delta})}\frac{1}{\lambda(\bar{\delta})} &(73)
\end{aligned}$$

where the third line come from Equation 16 and the fourth line comes from Equation 54.

Note that

$$\varepsilon_{r,\bar{\delta}} = \frac{r'(\bar{\delta})}{r(\bar{\delta})}\bar{\delta} \tag{74}$$

Using Equation 56:

$$r'(\bar{\delta}) = \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]-\lambda(\bar{\delta})\left[-\Psi'(\bar{\delta})+\lambda'(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)+\lambda(\bar{\delta})\left(\Psi'(\bar{\delta})-\zeta'(\bar{\delta})\right)\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]^2} \tag{75}$$

Plug Equation 54 into Equation 74 to get:

$$\begin{aligned}
r'(\bar{\delta}) &= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]-\lambda(\bar{\delta})\left[-\Psi'(\bar{\delta})+\lambda'(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)+\frac{\Psi'(\bar{\delta})}{\Psi'(\bar{\delta})-\zeta'(\bar{\delta})}\left(\Psi'(\bar{\delta})-\zeta'(\bar{\delta})\right)\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]^2} && (76)\\
&= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]-\lambda(\bar{\delta})\left[-\Psi'(\bar{\delta})+\lambda'(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)+\Psi'(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]^2} && (77)\\
&= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})\right]+\lambda'(\bar{\delta})\lambda(\bar{\delta})\left[\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]-\lambda(\bar{\delta})\lambda'(\bar{\delta})\left[\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]^2} && (78)\\
&= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]^2} && (79)\\
&= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]\lambda(\bar{\delta})}\frac{\lambda(\bar{\delta})}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]} && (80)\\
&= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]\lambda(\bar{\delta})}r(\bar{\delta}) && (81)
\end{aligned}$$

where in Equation 80 we multiplied numerator and denominator by $\lambda(\bar{\delta})$ and in Equation 81 we substituted Equation 56. Plug Equation 81 into Equation 74 to get:

$$\begin{aligned}
\varepsilon_{r,\bar{\delta}} &= \frac{\lambda'(\bar{\delta})\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]\lambda(\bar{\delta})}r(\bar{\delta})\frac{\bar{\delta}}{r(\bar{\delta})} && (82)\\
&= \frac{\lambda'(\bar{\delta})\bar{\delta}}{\lambda(\bar{\delta})}\frac{\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]} && (83)
\end{aligned}$$

Note that from Equation 69 we know that the reaction of imports as a function of a probability to default will depend on the ratio of $\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}}$ which we can calculate using Equation 73 and Equation 83:

$$\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} = \frac{\bar{\delta}\frac{1-F(\bar{\delta})}{\Psi(\bar{\delta})-\zeta(\bar{\delta})}\frac{1}{\lambda(\bar{\delta})}}{\frac{\lambda'(\bar{\delta})\bar{\delta}}{\lambda(\bar{\delta})}\frac{\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]}} \tag{84}$$

$$= \frac{\frac{1-F(\bar{\delta})}{\Psi(\bar{\delta})-\zeta(\bar{\delta})}}{\lambda'(\bar{\delta})\frac{\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]}} \tag{85}$$

Assume that exporters are very unlikely to default (the probability of default approaches zero). We know that the ratio above is positive. Consider the limit of the ratio when $\bar{\delta} \to 0$:

$$\lim_{\bar{\delta}\to 0}\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} = \lim_{\bar{\delta}\to 0}\frac{\frac{1-F(\bar{\delta})}{\Psi(\bar{\delta})-\zeta(\bar{\delta})}}{\lambda'(\bar{\delta})\frac{\left[1-\Psi(\bar{\delta})\right]}{\left[1-\Psi(\bar{\delta})+\lambda(\bar{\delta})\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right)\right]}} \tag{86}$$

and note that:

$$\lim_{\bar{\delta}\to 0}\left[1-F(\bar{\delta})\right] = 1 \tag{87}$$

by definition of CDF

$$\lim_{\bar{\delta}\to 0}\left[\Psi(\bar{\delta})-\zeta(\bar{\delta})\right] = 0 \tag{88}$$

from Equation 14 and Equation 15 as both expectations go to zero and density is assumed to be bounded

$$\lim_{\bar{\delta}\to 0}\left[1-\Psi(\bar{\delta})\right] = 1 \tag{89}$$

for the same reason as above

$$\lim_{\bar{\delta}\to 0}\lambda(\bar{\delta}) = 1 \tag{90}$$

as

$$\lim_{\bar{\delta}\to 0} \lambda(\bar{\delta}) = \lim_{\bar{\delta}\to 0} \frac{\Psi'(\bar{\delta})}{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})} \tag{91}$$

$$= \lim_{\bar{\delta}\to 0} \frac{1 - F(\bar{\delta})}{1 - F(\bar{\delta}) - \gamma\bar{\delta} f(\bar{\delta})} = 1 \tag{92}$$

where Equation 92 comes from Equation 16 and Equation 17. As a result:

$$\lim_{\bar{\delta}\to 0} 1 - \Psi(\bar{\delta}) + \lambda(\bar{\delta})\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right) = 1 \tag{93}$$

Finally:

$$\lim_{\bar{\delta}\to 0} \lambda'(\bar{\delta}) = \lim_{\bar{\delta}\to 0} \frac{\Psi''(\bar{\delta})\left(\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})\right) - \Psi'(\bar{\delta})(\Psi''(\bar{\delta}) - \zeta''(\bar{\delta}))}{\left(\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})\right)^2} \tag{94}$$

$$= \lim_{\bar{\delta}\to 0} \frac{-\Psi''(\bar{\delta})\zeta'(\bar{\delta}) + \Psi'(\bar{\delta})\zeta''(\bar{\delta})}{\left(\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})\right)^2} \tag{95}$$

$$= \lim_{\bar{\delta}\to 0} \frac{f(\bar{\delta})\gamma\bar{\delta} f(\bar{\delta}) + (1 - F(\bar{\delta})(\gamma f(\bar{\delta}) + \gamma\bar{\delta} f'(\bar{\delta}))}{\left(1 - F(\bar{\delta}) - \gamma\bar{\delta} f(\bar{\delta}))\right)^2} \tag{96}$$

$$= \gamma\bar{\delta} f'(\bar{\delta}) = 0 \tag{97}$$

where the last line comes from the (Assumption 4). As a result,

$$\lim_{\bar{\delta}\to 0} \frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}} = \infty \tag{98}$$

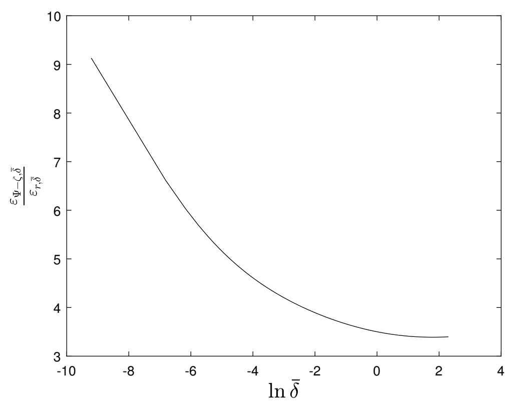
and hence

$$\lim_{\bar{\delta}\to 0} \beta = 0 \tag{99}$$

Hence, exporters who have a probability of default close to zero will not react to the effects of exchange rate through the balance sheet. In addition, there is theoretical and empirical evidence that firms who price their exports in dominant currency are more profitable. In terms of this model, higher probability implies a lower probability of default and thus DCP exporters are even more likely than exporters not to react to exchange rate movements through their balance sheets.

Assuming that demand shocks are distributed lognormally, we can also show that the $\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}}$ term is decreasing for any $\bar{\delta}$ and since exporters have a lower cutoff demand shock, they will be less elastic to exchange rate movements via the financing channel (see Figure A8) .

Figure A8: Demand shock cutoff and $\frac{\varepsilon_{\Psi-\zeta,\bar{\delta}}}{\varepsilon_{r,\bar{\delta}}}$ under lognormal distribution



C.3 Dominant currency pricing

Consider now the case in which all intermediate inputs are imported, the firms start with an optimal pricing and production decision, but can't change the price of the exported good after the exchange rate shock. There are two types of firms: some set prices in pesos (PCP exporters), and some set prices in dollars (DCP exporters). Finally, assume that foreign demand is isoelastic. Assume that domestic currency depreciates. In a frictionless world, the firms would prefer to keep their markup constant, and since 100% of inputs is priced in foreign currency, export price would comove with the exchange rate. In this world, the optimal export price would be constant in dollars and DCP firms would hence be more profitable. Note that since the price of their exports in foreign currency doesn't change, the DCP exporters will use the same amount of inputs M^F to produce exported goods as before the exchange rate depreciation. What happens when we introduce financial frictions into the analysis? Using Equation (54), Equation (55), and Equation (56) we can show that optimal production and hence export would weakly decrease.[43][44] Since DCP exporters would use the same amount of inputs for the production of exported goods M^F while PCP firms would increase their exports (as their price in foreign currency drops) – they would be further away from the optimal allocation, hence less profitable, which would induce banks to charge them a higher interest rate and decrease their output domestically by relatively more than the DCP firms.

More formally, consider the following optimization problem:

$$\max_{M^D,\bar{\delta}} \rho\left(M^D, M^F\right)\left(1-\Psi(\bar{\delta})\right) \tag{100}$$

$$s.t.\;\; \rho(M^D, M^F)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right) = R(p^M(M^D+M^F)-A). \tag{101}$$

Here the firm only chooses the amount of inputs to produce goods domestically as foreign production is determined by the fixed price. Let $M^{F,DCP}$ and $M^{F,PCP}$ be the levels of inputs used for the production of exported good. Assume that the firm starts with the optimal purchases of inputs that corresponds to the case of flexible prices. After depreciation, $M^{F,DCP} < M^{F,PCP}$ as under DCP the price in foreign currency is fixed, moreover $M^{F,DCP}$ corresponds to the initial optimal amount of inputs. In addition, let $M^{D,*}, M^{F,*}$ denote the optimal input mix under flexible prices after depreciation, and $M^{D,DCP}, M^{D,PCP}$ be the optimal amount of inputs for the production of goods that are not exported under the two paradigms. Also let:

$$\widetilde{\rho}(M^F) \equiv \sup_{M^D,\bar{\delta}} \;\rho\left(M^D, M^F\right)\left(1-\Psi(\bar{\delta})\right) \tag{102}$$

$$s.t.\;\; \rho(M^D, M^F)\left(\Psi(\bar{\delta})-\zeta(\bar{\delta})\right) = R(p^M(M^D+M^F)-A). \tag{103}$$

Assuming that $\rho\left(M^D, M^F\right)\left(1-\Psi(\bar{\delta})\right)$ is concave in M^F, we can invoke the Maximum theorem to prove that $\widetilde{\rho}(M^F)$ is concave as well. Assuming that after depreciation, the optimal level of M^F falls (due to the presence of foreign currency leverage), if follows that $\widetilde{\rho}(M^{M^F,*}) > \widetilde{\rho}(M^{F,DCP}) > \widetilde{\rho}(M^{F,PCP})$. In other words, the DCP firms will be more profitable after depreciation than PCP firms (but both less profitable than in the case with absolutely flexible

[43] By contradiction, assume that production is constant or increases, then from Equation (55) we would have a drop in r as p^M would increase by more than $1+\kappa(e)$ and from Equation (56) this would lead to a drop in $\bar{\delta}$. This would violate Equation (56) as M would increase faster than $\rho(M)$ and p^M would increase faster than $1+\kappa(e)$

[44] Output wouldn't change for those firms who only export as then $\kappa(e)$ and p^M would move one-to-one.

prices). Setting up the Lagrangian and calculating the FOCs, we get the following conditions:

$$\lambda\left(\bar{\delta}\right) = \frac{\Psi'(\bar{\delta})}{\Psi'(\bar{\delta}) - \zeta'(\bar{\delta})} \tag{104}$$

$$r(\bar{\delta}) = \frac{\frac{1}{p^M}\rho_{M^D}(M^D, M^F)}{R} = \frac{\lambda(\bar{\delta})}{\left[1 - \Psi(\bar{\delta}) + \lambda(\bar{\delta})\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right)\right]} \tag{105}$$

$$R(p^M(M^D + M^F) - A) = \rho(M^D, M^F)\left(\Psi(\bar{\delta}) - \zeta(\bar{\delta})\right) \tag{106}$$

What happens to the optimal choice of domestic inputs and probability of default when the amount of inputs used for the production of export goods increases (from $M^{D,*}$ to $M^{D,DCP}$ to $M^{D,PCP}$). Assume that revenue function ρ is separable in M^D and M^F. From Equation (105) and Equation (104), there is an inverse relationship between M^D and $\bar{\delta}$ – an increase in inputs for the production of domestic goods, decreases the marginal product of inputs, the wedge r and hence the cutoff demand shock $\bar{\delta}$. From Equation (106), and increase in M^F hence needs to be accompanied by a decrease in M^D and an increase in $\bar{\delta}$.[45] Hence a firm with larger fixed M^F relative to the optimal level will be more likely to default and hence, applying the logic of the previous section, will also be more responsive to the exchange rate shocks through the balance sheet effects. Hence, DCP firms will be less responsive than PCP firms.

[45] If M^D increase with M^F and $\bar{\delta}$ drops, then LHS of Equation (106) would increase more than RHS.