Corporate earnings sensitivity to FX volatility and currency exposure: evidence from Peru*

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Abstract

Using firm-level information on currency risk positions, the effects of nominal foreign exchange shocks on non-financial corporate returns are assessed through a balanced-panel data approach. Depreciation shocks directly affect firms that have net short positions in foreign currency by decreasing their net asset valuation at higher exchange rates. Total earnings sensitivity to these pressures would depend on both the magnitude of the shocks (usually non-linear) and the extent of a firm's hedging strategy. The response from individual firms varies from adjusting their exposure through spot market operations to implementing derivative-hedging strategies. Indeed, an effective hedging policy might reduce significantly profit-loss sensitivity to currency volatility. Other enterprises just absorb currency losses considering shocks to be transitory or because core-business profits are large enough to overcome those losses. Interestingly, a significant depreciation episode does not necesarily induce non-user firms to start hedging through financial derivatives.

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1 Introduction

There had been a significant increment in firms issuing global (dollar-denominated) debt in Peru during 2017, prompted by local currency appreciation and global financial conditions. The total amount reached similar levels to previous issuance record of 2012. Expectations of the FED rising interest rates further (during 2018) and trade tensions (in 2019), however, encouraged moderate depreciation pressures instead. Short foreign exchange (FX) positions in non-financial firms expose them to exchange rate volatility so that depreciation shocks might affect their earnings negatively. Importantly, this mechanism could render the financial system vulnerable to currency shocks through increasing credit risk in these firms. Hedging strategies offsetting those effects are deployed by some firms, especially if exchange rate shocks are large and persistent. Some other firms tolerate the currency risks and absorb losses for their currency mismatch, although they might reduce exposure afterwards.

Previous appreciation-trend reversion (i.e., in May 2013) showed important negative effects in corporate returns, both in total earnings and in earnings from currency valuation. The larger the FX shocks, the larger the negative effects on earnings, especially if no proper risk management is in place. Some firms counterweight depreciation pressures on their profit-loss results through spot forex operations (reducing their currency mismatch and financial exposure) or by adopting hedging strategies with financial derivatives (for short- and long-term). Importance of net currency positions in the balance sheet (as proportion, for instance, of equity) seem to have played a defining influence in the decision to manage exchange rate volatility and risks. Neglecting this currency risk could expose a firm's equity significantly in a large depreciation episode.

This research aims at assessing the effects of FX shocks (usually non-linear) to corporate earnings by using firm-level disclosure of net foreign currency positions and profits, for the period 2011Q4 to 2019Q2. It reveals exchange-rate risk management responses to currency uncertainty, especially in highly volatile environments. Regrettably, not all local firms provide regularly this information in their (notes to the) financial statements. Where available, manual collection of data allowed us to build a balanced-panel dataset to assess these effects.

2 Theoretical background

Net foreign currency positions could be significant relative to the size of the non-financial firm's balance sheet for a number of reasons. Lower cost of funding in international capital (bond) markets would support foreign financing, similar to the carry trade rationale (Bruno and Shin, 2017). The Peruvian financial system is still highly dollarized, so credit supply to the

non-financial private sector could be readily available (with flexible time terms) in US dollars. Furthermore, business operating characteristics could require non-zero net foreign positions for enterprises (see, for instance, Kuzmina and Kuznetsova, 2018). Whatever the rationale for currency mismatch, exchange rate volatility would induce return uncertainty that might deteriorate firm profitability (and credit scoring) if not properly hedged against.

Altunok, Aytug and Oduncu (2014) provide firm-level evidence that net foreign exchange positions affect corporate earnings negatively in the presence of currency shocks. The larger those positions, the more intense the impact of a given currency depreciation on a firm's performance. We follow a similar approach in using hand-collected data from the Notes to the Financial Statements to assess the impact of those shocks in corporate returns for a sample of Peruvian firms.[1] Kamil (2012), also using hand-collected data from the financial explanatory notes for net FX positions, find supportive evidence of firms reducing their debt dollarization in response to more flexible exchange rate regimes, so that they prevent currency shocks affecting either corporate returns or output.[2] Krapl (2017) emphasizes that stock (corporate) returns react non-linearly to sign and magnitude of exchange rate shocks. Therefore, models capturing the asymmetry of these responses would perform better in detecting corporate returns' exposure to FX volatility.

Although intuitive reasoning would suggest that a firm's profitability would suffer from currency shocks if it has an open currency mismatch, empirical evidence is far from conclusive. Importantly, as Alvarez and Hansen (2017) show, hedging strategies combined with financially convenient non-zero net foreign currency positions could isolate the firm's performance from exchange rate volatility. Indeed, Muller and Verschoor (2005) provide evidence, for a large sample of European non-financial firms, that financial distress (not speculation) prompts hedging strategies (although to a small proportion of their currency risk). For a large international sample, using categorical data on derivatives (rather that precise positions on them), Bartram (2017) find no evidence of corporate speculation. On the contrary, however, in a study for Colombia, Barajas et al (2017) suggest speculative rather than hedging uses for derivative strategies.

In another approach to study why firms hedge their currency risks, Lel (2012) find evidence, for a large country sample, that closely-monitored risk management from shareholders provide incentive for using derivatives to reduce exposure to exchange rate risk. Although we have not tested directly for this effect in Peruvian firms, it seems that bigger firms are those most prepared to invest in managerial structures to use derivatives for their currency risk. In fact,

[1] See Papaioannou (2006) for a review on the types of currency risks faced by firms and their measurement.

[2] It is not an unusual feature for corporate empirical research on net foreign exchange positions to use hand-collected data. Since financial reports are presented in the main working currency (generally, the local currency), details on other currencies' positions are not readily (electronically) available, specially in emerging economies.

Lievenbrtick (2014) find strong evidence that firm size has a significant economic impact in the decision to hedge financial risks, along with cultural factor such as short-term valuation of results. Furthermore, Paligorova and Staskow (2014) emphasize financial rationale for using derivatives to reduce volatility of their earnings stream in Canadian firms. Again, those non-financial firms using derivatives to hedge currency risks are usually larger and more profitable than their non-hedging counterparts. Nguyen (2012) adds that (for British firms) forwards are the most used derivatives to hedge against exchange rate risks, because of its flexibility to match commercial transaction features. Swaps would be the next preferred derivative, especially for hedging foreign currency denominated debt.

Non-lineal features of FX returns would induce high volatility in derivative (hedging) positions, since risk managers adjust their net positions only with lags, as Beber and Fabbri (2012) explored from a panel of large non-financial firms. But currency exposure does not necessarily reveal negligent risk-management or high-risk tolerance. As Bleakley and Cowan (2005) argue, FX shocks might not affect business operations because any increasing indebtedness would be offset by higher current and future business returns (feasibly though real-side effects or expansionary depreciations). Actually, it might be the case that if properly hedged against, a currency depreciation might end up being positive for the business in some economic sectors (exporters, usually).[3] Döhring (2008) explore, for instance, how domestic-currency invoicing and hedging with financial derivatives in internationally active firms isolate them from currency shocks (for the euro area). Echeverry et al (2003) provide evidence for a large sample of firms in Colombia that real depreciations have a negative balance sheet effect on corporate returns, but a non-significant effect on investment (especially for large dollar-indebted firms). Furthermore, Restrepo et al (2014) find that there is indeed a significant negative effect of real depreciation on investment for dollar-indebted firms in Colombia.

Depreciation pressures could measurably affect valuation of net foreign currency positions that are reported in the profit-losses statement of a firm. This, in turn, might decrease its credit rating and, with it, increase financial system vulnerability to macro financial risks. As Chan-Lau et al (2017) suggest: "*While this is a low-probability scenario, the results suggest the need to closely monitor vulnerabilities and strengthen contingency plans.*" The Committee on IEPR (2015) emphasizes that "*Should risks to nonfinancial corporates materialize, and their financial health becomes impaired, these shocks can be transmitted to the financial system both directly and indirectly.*" The IMF (2015) also points out three crucial results of their Global Financial Stability report: "*i) global drivers playing a larger role in leverage growth, ii) rising foreign currency exposures, and iii) firms have managed to issued bonds at better terms.*" All

[3] This research focuses, however, on the financial risks of currency depreciations rather than in their economic risks (inducing product volatility).

in all, it is clear that FX vulnerability could impose systemic risks to the financial sector.

3 Foreign exchange and corporate exposure

The Peruvian financial system is still partially dollarized, with 27,3 percent of credit to the private sector and 37,6 percent of private sector deposits in the financial system in US dollars (as of June 2019). The inflation targeting regime keeps inflation expectations generally anchored at its (2 percent +/- 1 percent) target band. The central bank intervenes the forex market to reduce excessive currency volatility.[4] Considering only enterprises, those ratios of dollarization are 38,8 percent for credits and 48,1 percent for deposits. Thus, corporate currency risk could undermine the financial system soundness (for instance, through deterioration of credit risk) if FX shocks are sufficiently large or no hedging strategies are adopted for currency mismatches.

3.1 FX shocks

Global financial conditions exert a significant influence on exchange rate volatility through capital flows. In line with loose monetary conditions in developed economies after the global financial crisis of 2008/2009 and the capital inflows to emerging markets that followed, the Peruvian Sol (PEN) appreciated during most of the 2009 - 2012 period. After news of the FED considering reverting gradually its monetary policy, in May 2013, a 3-year period of significant depreciation followed. Although with a less clear pattern, appreciation pressures continued during 2016-2017. Moderate depreciation followed in 2018 and 2019. The aim of this research is to unveil the effects of depreciation pressures (in particular, those from 2013-2015) in corporate returns for firms that are significantly exposed to currency risk. Figure 1 shows, in the left-hand panel, quarterly exchange rate variations from (the end of) 2011 to 2019 (second quarter). Over the 2013-2015 episode, the PEN accumulated a 29-percent depreciation (21 percent over the entire period up to 2019Q2).

Moving standard deviations for daily data (over the period of 2011Q1 - 2019Q2)) are calculated to show short-term cycles in currency returns, in the right-hand panel of Figure 1. Indeed, volatility in currency returns seem to alternate in cycles, with different depth and amplitude, along longer-term trends in the exchange rate. Interestingly, although standard deviations show a significant increase in currency volatility by mid-2016 to early 2017, this period corresponds to a reversion of the 3-year period of PEN depreciation of 2013-2015.

In order to describe exchange rate dynamics appropriately, a regime shifting autoregressive representation of exchange rate returns is estimated over an extended period (monthly data

[4] See, for instance, Humala and Rodríguez (2010) for a non-linear description of the link between intervention and exchange rate dynamics.

from 1994.09 to 2019.06). Higher volatility in error terms coincide mostly with identifiable periods of global currency distress. Crises episodes such as the Mexican Peso (1994), South East Asia (1997), Argentina (2001) and the global crisis (2008-2009) are spotted out in a high-volatility regime. Figure 2, display in the left-hand panel probabilities of those periods being in (a Markov-switching type) highly volatile scenario, with standard deviation of error three times larger than in the less volatile regime. Episodes of cyclical large volatility are not infrequent in the forex market. In the righ-hand panel, those same probabilities are reproduced for the period of 2011-2019. Notice out that the tampering announcement of 2013Q2 is followed by more mid-volatile periods that accumulate over until the end of 2015. Thereafter, the high volatile scenario correspond to a somewhat trend reversion towards moderate appreciation.

3.2 Data description

Quarterly information on net foreign exchange positions is hand-collected from the Notes to the Financial Statements that firms report to the Superintendence of Securities Markets in Peru (SMV, for its Spanish acronym). Other corporate variables, such as total assets, total liabilities and (different definitions of) earnings are electronically taken from their financial statements. Enterprises included in our sample are those that have information available for the initial period of study, 2011Q4 – 2018Q2. That is, 27 quarterly observations for each firm in the sample.

From a database of the 160 largest firms that provide regularly their financial statements to the SMV, we have excluded financial firms, since they have a different rationale to manage their currency exposure. Firms from the mining industry have also been excluded because of their natural hedge against currency risks. These firms have usually net long FX positions and are rather subject to appreciation risks. Similarly, public-good suppliers (i.e. electricity and watering plants) were not included either, because they tend to have regulated pricing-strategies in Peru.

A remaining pool of 78 firms were initially selected to assess their currency mismatch based on the information they report to the SMV. Their total cumulative assets are equivalent to USD 33 919 millions, as of 2017Q4 (see Figure 3). Although these firms report their financial statements to the SMV, not all of them report their net FX positions . Thus, our sample includes only those 27 non-financial firms that provide regularly their currency mismatch (in the Notes to Financial Statements) . Their total collective assets are equivalent to USD 17 689 millions or 52 percent of the selected non-financial frms (or 8 percent of total firms in the database). Grouping them by size, we have 11 firms with more than USD 500 million in total assets (58 percent of their respective group of non-financial firms); 9 medium-size enterprises with total assets in the range of USD 100 - 500 millions (33 percent of their group

of non-financial firms); and 7 firms with total assets less than USD 100 million (31 percent of non-financial firms).[5]

The use of derivative hedging is concentrated in the bigger firms in the sample. Only 4 firms (large- and medium-size) use regularly financial derivatives to hedge their FX risk exposure. Another 7 enterprises use them but only sporadically. The remaining firms do not use derivatives for hedging their FX risk (See Figure 4). Alternatively, these firms reduce their exposure through spot forex operations or by dedollarizing their liabilities. Those that hedge through derivatives, monitor hedging costs closely, although their response would usually come with lags after significant FX shocks.

Alternatively, the sample has been increased succesively to 2018Q4 and to 2019Q2, but the number of firms were reduced each time (to 25 and 23, respectively) because a few firms interrupted their provision of information on currency mistmatch.

3.3 Corporate FX exposure

Local currency depreciation will directly affect earnings of firms with net short FX position by decreasing their valuation of all dollar-denominated items in the balance sheet at a higher exchange rate. We use three definitions for a firm's net foreign currency positions. First, the net FX spot position (FXSP) is the sum of all dollar-denominated assets minus the sum of all dollar-denominated liabilities in the balance sheet of the firm.[6] This measure would represent the actual net position in US dollars, but not the total exposure to currency risk. Second, the net FX derivative position (FXDP) is the difference between long and short positions in all exchange rate derivatives (usually, forwards, options and cross currency swaps, and their different strategies and combinations). And third, the net FX global position (FXGP) that sums up those spot and derivative positions. This global measure accounts for the total exposure of the firm to currency volatility. That is: $FXSP = Asset_{USD} - Liability_{USD}$; $FXDP = D_{Long} - D_{Short}$ (where D stands for all outstanding derivatives), and $FXGP = FXSP + FXDP$.

Thus, for instance, a firm with a negative $FXSP$ would have larger USD liabilities than their USD assets could hedge. If this firm does not have any derivative position, its $FXSP$ is actually equivalent to its $FXGP$. Then, this firm would be exposed to the risk of a US dollar appreciation with respect to its local currency. In terms of the exchange rate expressed as units of the local currency for units of the US dollar, an increase of the exchange rate

[5] Smaller firms (less than USD 50 million in assets) tend to have non-market significant currency mismatch (i.e., less than USD 1 million). Although, they might be colectively relevant, it is not common that they provide detail information on their FX exposure. Therefore, they are not considered in the sample.

[6] Only positions in US dollar are considered. Although, some firms also have net positions in other foreign currencies, they are substantially less important that the exposure to the American currency.

(a depreciation of the local currency) would induce valuation losses on this firm's currency position. This difference in valuation effect is reported (in its local currency equivalent) in a special item in the profit-losses financial statement. It accounts for the difference in valuation at the initial (lower) and final (higher) exchange rate, over a given period of time, of all foreign currency-denominated assets and liabilities. The larger the depreciation, the greater the loss (given its $FXGP$) and the higher chance this result would pass-through to total returns. However, this might represent only an accountability effect if assets and liabilities remain in the balance sheet in their original foreign currency for a particular quarter. But it would end up being an effective loss (or profit) if an actual exchange to local currency is conducted in that quarter or afterwards. Otherwise, the FX shock might not even generate an impact on returns if it is properly hedged away (i.e. through a non-zero $FXDP$) during a particular quarter.

Furthermore, the larger the exposure to exchange rate volatility, the larger effect of any given FX shock (positive or negative). If not properly hedged, that position would increase the resulting effect in total returns. However, in such a scenario, the firm would have a greater incentive to a more active hedging strategy, feasibly involving financial derivatives. An effective hedging policy might reduce significantly results sensitivity to currency volatility.

A number of mechanisms would prevent FX shocks (even large ones) impacting on total earnings, despite the firm having an important exposure to FX risk.[7] Depending on the persistence of the shock, a firm could reduce its exposure by either increasing its total assets in foreign currency or dedollarizing its liabilities. Effects are not necessarily contemporary but with lags. Enterprises might consider previous FX shocks to react (by decreasing their exposure) rather than current volatility. Moreover, financial derivatives could help reducing global exposure to currency risks, especially if the firm is already experienced in assessing hedging costs (interest rate differentials). Some arbitrage activities might also be considered to counterbalance liquidity effects from FX shocks. Even if hedging strategies add to total losses (due to large basis risks), a firm might still access banking refinancing so that its credit scoring is not altered.[8]

By the end of 2011, most local firms with net short FX positions were confident that the local currency appreciation trend would continue or that, at least, no large depreciation would arrive. In the second quarter of 2013, however, when the FED announced that it might start tampering its liquidity policy, that trend changed and depreciation pressures challenged risk management strategies from these firms. Some firms used derivatives regularly to hedge their

[7] Bear in mind that if a firm has a non-zero $FXSP$ (beyond what the nature of its operating procedures requires) is because it benefits from the currency mismatch in the first place.

[8] The basis risk assumed by the firm (the difference between the derivative and the spot market price of the underlying asset) might be large enough so that an adverse price change for the derivative position might add a loss to the resulting loss in the asset position.

currency risks. Some others used them only eventually or in connection to specific (usually long-term) debt. Bigger firms were mainly in these two groups. Most middle-size and small firms did not use derivative hedging strategies.

Given the exchange rate shocks described previously, there are three well defined sub-periods between 2011Q4 and 2018Q4. A 5,6 percent appreciation during 2012; 29 percent depreciation over 2013-2015; and a mild 1,1 percent appreciation during 2016-2018 (with a further 2.6 percent appreciation up to 2019Q2). Figure 4 contains a table describing the effects of those FX shocks on earnings (losses), that are generated by difference in valuation of dollar-denominated items in the balance sheet (FX earnings). A distincion of those effects is made for firms that hedge regularly using derivatives and those that do not hedge regularly through derivatives. For all groups, the negative impact on earnings from the 29 percent-depreciation period of 2013-2015 is a significant 24 percent of total Earnings Before Interest and Taxes (EBIT). That is, losses generated by difference in valuation represented 24 percent of their combine EBIT obtained during that period. This proportion adds up to 36 percent for firms that do not hedge regularly through derivatives, but it is less severe (12 percent) for those enterprises that hedge regularly with them.

Notice out the different impacts over the two appreciation periods (2012 and 2016-2018). The appreciation (5,6 percent) of 2012 had a positive impact of around 18 percent of total EBIT for all firms as a group. That is, firms benefited from their net short FX position because of the PEN (USD) appreciated (depreciated). However, the purpose of having a currency mismatch in the balance sheet is not usually seeking profits from exchange rate variations, but getting higher returns from the corporate core business than its cost of funding in the foreign currency. After the period of 2013-2015, most enterprises adjusted their $FXGP$ so that the second appreciation period (2016-2018) had a near-zero impact on earnings by difference in valuation relative to total EBIT.[9] Those firms without regular derivative hedging benefited the most with the initial apreciation period (2012), but were also the most affected in their EBIT during the 29-depreciation period.

The table in Figure 5 shows how much firms have reduced their debt dollarization or increase their hedge after the depreciation period. Again, there are some differences among firms that hedge regularly with derivatives, those that do it eventually, and those that do not use derivative hedging at all. In general, dollar-denominated assets (FXA) and $FXDP$ hedge 65 percent of dollar-denominated liabilities (FXL) in the period 2016-2018, a hedging ratio that was only 39 percent in the period 2013-2015. Importantly, firms with no regular use of derivatives, have increased the most (almost doubled) this hedging ratio (from 30 to 58

[9] Some dedollarization programs were also implemented by the central bank through reserve requirements on foreign currency liabilities. For a description of these programs see Castillo et al. (2016).

percent) by either augmenting FXA or reducing FXL. Curiously, firms that had not used derivatives before the depreciation period did not start using them afterwards.

The left-hand graph of Figure 6 shows in perspective the cumulative currency depreciation over the period 2011Q4 to 2018Q2 and the evolution of different measures of corporate earnings. Despite the significant impact on earnings, in particular during 2013-2015, corporates earned positive and growing results from their core businesses. EBIT performance and earnings before taxes (EBT) show still a clear positive trend (in line with Peru's moderate economic growth in those years). FX shocks have indeed reduced importantly their financial results, but firms could cope with them because of their more business-related profits. The right-hand panel in Figure 6 shows the evolution of (negative) $FXGP$ (or FX risk position) along FXA, FXL, and $FXDP$. After 2015, although there were some rises in FXA and $FXDP$, it was FXL that decreased the most to reduce total FX risk positions.

Information on currency mismatch is useful to assess how much of the firm's equity is compromised with a large FX shock. In Figure 7, this sensitivity analysis is reported. It uses the equivalent concept of FX risk positon ($FXRP$) rather than the $FXGP$ (the difference being only the sign) to align a local currency depreciation (an increase in the exchange rate) with a higher exposure to FX risk.[10] The average FX risk exposure of all firms during 2013-2015 represented 29 percent of its equity. In that scenario, an additional 30 percent depreciation would have exposed up to 38 percent of all firms' equity. An additional 80 percent depreciation would have compromised 52 percent of equity. However, after the actual impact of depreciation during the 2013-2015 period, the $FXRP$ decreased to 12 percent, so that an additional 30 (80) percent depreciation would compromise 15 (21) percent of their equity. This is a significant improvement in terms of hedging their FX risk exposure; although still economically relevant, far less that in the previous period.

4 Empirical model

In order to assess the magnitude of the effect of exchange rate movements on corporate returns, a balanced-panel data representation is considered for FX-valuation earnings (with equity as a scale variable) against FX shocks and the extent of the currency risk position.

The following baseline panel data representation is estimated:

$$EFX_{it} = \alpha + \beta_1 DFX_t + \beta_2 FXRP_{it} + \beta_3 DFX_{t-1} * FXRP'_{it} + X_{it} + \upsilon_{it} \tag{1}$$

where $i = 1, ...27$ stands for the number of firms and $t = 1, ...27$ represents quarters for the

[10] In the panel data estimation that follows, the $FXRP$ is used.

period 2011Q4 to 2018Q2. EFX represents earnings from FX-valuation (expressed in units of local currency) as a percentage of the firm's equity. This measure of earnings results from the difference in valuation of all dollar-denominated items on the balance sheet (including derivative valuation). Since these earnings (or losses) are the direct consequence of exchange rate movements, they are measured as a proportion of equity (that serves as a scale variable).[11] A firm's equity is determined by the difference between its total assets and its total liabilities (all in local currency). DFX is the percentual exchange rate variation (log differences of the exchange rate). $FXRP$ is the FX risk position as a percentage of equity and it is determined as the negative of $FXGP$.

Enterprises report its dollar-denominated assets, liabilities and net derivatives positions in US dollars. Considering the bid-ask exchange rate quotes that firms use to report their regulatory financial staments in local currency, the following expression to determine $FXGP$ applies:

$$FXGP_i = FXA_i * bid - (FXL_i - FXDP_i) * ask \tag{2}$$

where *bid* and *ask* are the respective exchange rate quotes in units of Soles (Peruvian currency) for unit of US dollars. Thus, $FXRP = -FXGP$. For assessing the interaction of DFX and $FXRP$ and not repeating the percentage expression in both variables, the latter enters directly ($FXRP^{'}$) as the ratio to equity (not as a percentage of it).

Some control variables for firm idiosincracies are considered in X (such as firm size and leverage).[12] Following Baltagi (2005), $\upsilon_{it} = \mu_i + \nu_{it}$ with μ_i representing the unobservable individual-specific effects and ν_{it} stands for all remainder disturbance.

On the right-hand side of Equation (1), the first explanatory variable (and presumably the most important one) is the log-difference of the exchange rate (DFX). As depicted in Figure 1, a depreciation trend started in 2013Q2 with an FX shock of 7 percent (quarterly) increase. As previously described with the regime shifting representation of FX dynamics, these FX shocks have occurred with different intensities, making worthwhile exploring for regime- or time-changing parameters. However, at this stage (given data availability), the balanced panel data is estimated with constant parameters.

The second explanatory variable, $FXRP$, accounts for the total risk exposure to currency depreciation. For a given FX shock, the effect on earnings would be larger, the larger this exposure is. Recall that this measure includes all derivative positions (in contrast to $FXSP$).

Since we are interested in the financial short-term impact on earnings, all variables are in

[11] This scale variable is determined by its value on every quarter over the entire sample period (dynamic equity) or, alternatively, as its value on 2017Q4 (fixed equity). Estimation results are qualitatively similar.

[12] Since EFX is earnings (losses) for difference in valuation, no macroeconomic measures are used as control variables.

nominal terms. Besides, we are not considering real-term economic variables, such as GDP outcomes (global or sectorial). On a broader approach, these terms would explain a large proportion of the business performance. Indeed, one would expect that a well-managed FX risk, would prevent FX shocks affecting significantly corporate returns. Therefore, those returns would depend mainly on developments on the core business of the firm, that might be better represented in real terms.

The objective of this research is to document if FX shocks have a significant impact on corporate returns and if this sensitivity is enhanced by the firm's net exposure to currency risks. Although econometric estimation of a panel data would empirically require a larger i dimension, data availability restrains us to a relatively short (still representative) number of firms in our sample. Therefore, a static panel data is used for all alternative representations.

There could be a case for discussing the endogeneity of the second explanatory variable (that could bias parameter estimates), since the firm's chosen FX risk exposure might be adjusted gradually should frequent and large FX shocks ocurr (and as a response to those shocks). Preliminary, though, it is assumed that no adjustment takes place or that firms respond sluggishly to those shocks, adjusting their exposure only with long lags. However, this endogeneity should be addressed more cautiously at a later stage and with more data availability.

We use Haussman (1978) test to find supporting evidence for either fixed or random effects. As Baltagi (2005) reminds us, a rejection of the null hypothesis (zero correlation between idiosyncratic errors and the explanatory variables) does not necessarily imply accepting the fixed effect specification for the panel estimation (but to further search for empirical evidence).[13]

A number of alternative specifications are estimated, either to include additional explanatory variables or to consider alternative measures of variables (for robustness). For instance, instead of using the level of FX risk exposure on any particular quarter, the change in that exposure from the previous to the current quarter is considered. Lags on the FX shocks are also included. Furthermore, this balanced panel data is also formulated with the variables scaled by the EBIT, rather than by equity. Although econometric results are somewhat similar, it requires the use of more macroeconomic control variables to account for industry-specfic trends in business returns if EBIT is considered as the scale variable. Besides, variability of these earnings renders parameter estimates less straightforwardly interpretable. A number of exercises are also conducted to estimate the panel data for sub-samples: differentiating groups by firm-size and use of derivative (regular, sporadic or none at all). Most results are qualitatively similar to those from Equation (1).

[13] Actually, a-priori, we would prefer the random effects, since FX shocks would hit firm returns irrespective of idiosyncratic features, especially when those shocks are large (and persistent) in nature.

4.1 Estimation results

Parameter significance and interpretability is obtained in several of the estimated representations. Figure 8 reports estimation results for fixed efffects specifications of balanced panel data for the period 2011Q4 to 2018Q2. The first group of parameter estimates considers dynamic equity as the scale variable and the second group reports estimations with fixed equity (as of 2017Q4) as the scale variable. The firs two equations in each group are the results of estimating Equation 1 directly (either with or without leverage as a control variable). The last two equations in each group contain as explanatory variable the change in the FX risk position rather than the $FXRP$ itself. That is, the following equations are estimated:

$$EFX_{it} = \alpha + \beta_1 DFX_t + \beta_2 DFXRP_{it} + \beta_3 DFX_{t-1} * FXRP'_{it} + X_{it} + \upsilon_{it} \tag{3}$$

Most estimation results in Figure 8 are qualitatively similar. There is a significant negative impact of FX depreciation shocks to corporate returns. The estimated coefficient for DFX is -0.242 when dynamic equity as scale variable is considered and -0.17 when fixed equity serves this purpose. The FX risk position affects also negatively a firm's return (parameter estimates range from -0.017 to -0.023). Alternatively, the change in this FX risk position also impacts negatively corporate returns. The interaction of the FX shock (with a quarterly lag) and the level of the risk position further reduces corporate earnings (parameter estimates range from -0.114 to -0.329). Although a total firm leverage (not only in US dollars) is statistically significant, its magnitude is relatively small. In most cases, the intercept is also statistically significant but its magnitude and sign varies significantly. One particular relevant result is from the penultimate column in the table in Figure 8, where this intercept is rather not significant (as it would be expected).

Thus, empirical evidence emphasizes the important negative effects of FX shocks on corporate returns and the relevance of the inicial currency risk position of the firm. Still, further evidence on the mechanism by which firms adjust their net FX position in front of currency volatility need to be explored. Specifically, how endogenous this exposure is in the econometric representation of the panel data. There is heterogeneity in the response of firms to persistence and intensity of FX shocks. Firm size and previous use of financial derivative play a role in determining their hedging management.

5 Conclusions

We have assessed the effects of FX shocks to corporate returns by using firm-level data on net foreign currency positions over the period 2011 - 2018. Empirical evidence is consistent with an

important negative impact on a firm profits of depreciation shocks. A firm's currency mismatch would exacerbate those negative effects from currency shocks, specially if its level of risk exposure is high or if the firm does not properly hedge its currency mismatch. Hedging strategies in response to those shocks vary according to firm size and experience in monitoring currency risk. Firms with no previous use of derivative tend to manage their dollar-denominated assets or liabilities correspondingly, but do not advance to derivative hedging. The time (or regime) variant nature of return volatility prompts heterogenous responses from firms. Monitoring currency positions of a larger number of firms would increase explanatory performance of either linear or non-lineal panel data representations.

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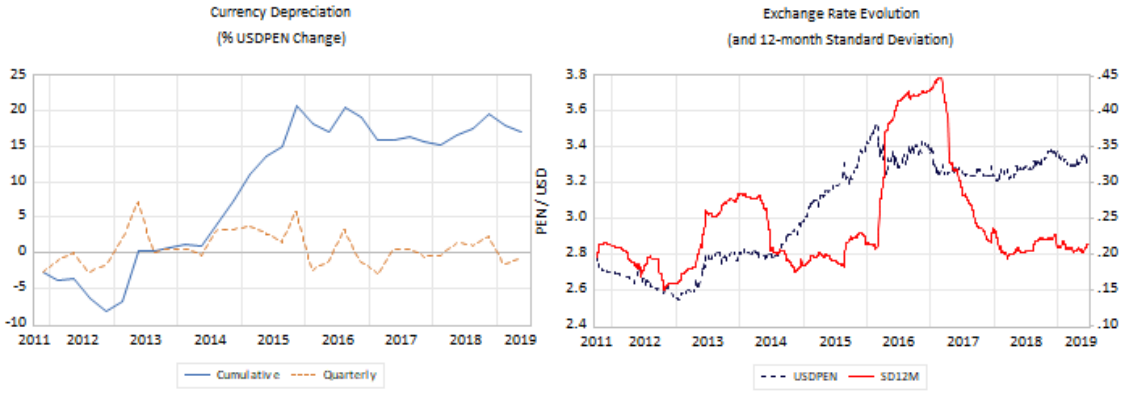

Figure 1: *Exchange Rate Dynamics*

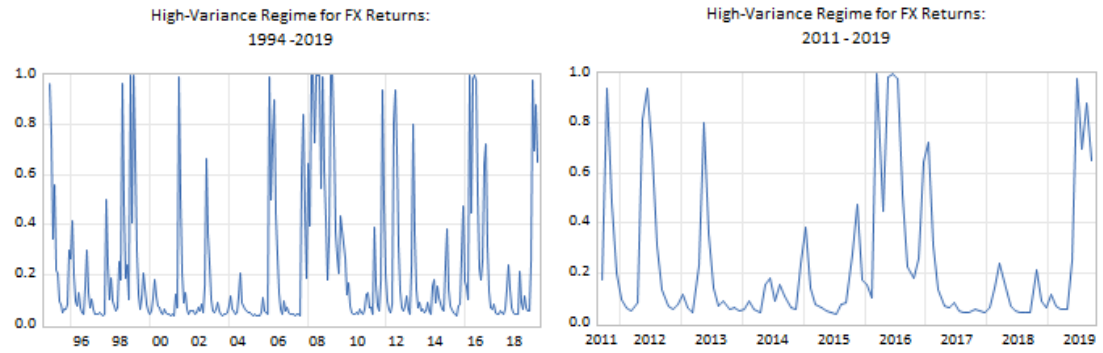

Figure 2: *Transition Probabilities for USDPEN Returns*

Representativeness of Sample Firms

Firm Size	Number of Firms			Total Assets (USD millions)			Sample as % of	
(USD millions)	Database	Selected	Sample	Database	Selected	Sample	Database	Selected
500+	59	20	11	201 529	26 212	15 183	7.5%	57.9%
100 - 500	54	33	9	11 469	6 556	2 155	18.8%	32.9%
Up to 100	47	25	7	2 276	1 152	351	15.4%	30.5%
Total	160	78	27	215 273	33 919	17 689	8.2%	52.2%

Use of Derivative Hedging

Firm Size	Number of Firms			
(USD millions)	Regular	Sporadic	No Use	Total
500+	3	4	4	11
100 - 500	1	2	6	9
Up to 100	0	1	6	7
Total	4	7	16	27

Figure 3: *Firm size and derivative hedging*

Period	USDPEN	Regular Derivative Hedging		No Regular Derivative Hedging		All Firms	
	Change	FX Earnings/ EBIT	Financial Earnings/EBIT	FX Earnings/ EBIT	Financial Earnings/EBIT	FX Earnings/ EBIT	Financial Earnings/EBIT
2012	-5.6	8.1	28.8	26.4	-1.0	17.7	13.2
2013 - 2015	29.1	-12.3	-23.9	-35.7	-69.4	-23.8	-46.3
2016 - 2018	-1.1	0.1	-18.3	-0.5	-26.3	-0.3	-23.7
2012 - 2018	22.4	-5.4	-16.3	-10.8	-39.5	-8.6	-29.8

* Financial Earnings equals Earnings Before Taxes (EBT) minus Earnings Before Interest and Taxes (EBIT). It includes FX earnings.

Figure 4: *Currency Depreciation Effects on Corporate Earnings*

PERIOD	USDPEN	Regular Derivative Hedging		No Regular Derivative Hedging		All Firms	
	Change	(FXA+FXDP) / FXL	FXL / TL	(FXA+FXDP) / FXL	FXL / TL	(FXA+FXDP) / FXL	FXL / TL
2012	-5.6	68.8	26.6	27.6	50.7	37.5	41.7
2013 - 2015	29.1	55.0	37.8	30.2	50.0	38.5	45.1
2016 - 2018	-1.1	77.4	26.0	58.1	33.4	64.6	30.5
2012 - 2018	22.4	65.0	30.9	39.8	42.4	47.9	37.8

* FXA = FX Assets; FXL = FX Liabilities; FXD = FX net derivative position.

Figure 5: *Hedging Corporate FX Risk*

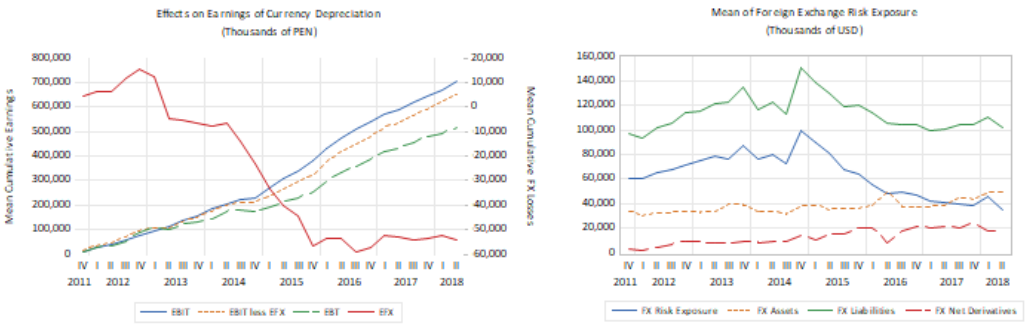

Figure 6: *Effects on Earnings and Hedging Response*

PERIOD	USDPEN Change	Regular Derivative Hedging FXRP / Equity			No Regular Derivative Hedging FXRP / Equity			All Firms FXRP / Equity		
		Actual	30% ?FX	80% ?FX	Actual	30% ?FX	80% ?FX	Actual	30% ?FX	80% ?FX
2012	-5.6	10.0	13.0	18.0	30.6	39.8	55.1	24.6	32.0	44.3
2013 - 2015	29.1	24.1	31.4	43.4	31.0	40.3	55.8	29.0	37.7	52.2
2016 - 2018	-1.1	8.4	10.9	15.1	13.3	17.3	23.9	11.8	15.3	21.2
2012 - 2018	22.4	15.4	20.0	27.6	23.4	30.4	42.0	21.0	27.3	37.8

* FX Risk Position (FXRP) = USD Liabilities - (USD Assets + Net Derivative Position).

Figure 7: *FX Risk Position Sensitivity to Depreciation*

	Dependent Variable: Earnings for FX Variation (EFX)															
	Scale Variable: Dynamic Equity								Scale Variable: Fixed Equity (2017Q4)							
	FX Risk Position				FX Risk Position Change				FX Risk Position				FX Risk Position Change			
Depreciation (DFX)	-0.242	***	-0.242	***	-0.242	***	-0.235	***	-0.171	***	-0.172	***	-0.177	***	-0.177	***
	(0.020)		(0.019)		(0.020)		(0.019)		(0.012)		(0.012)		(0.013)		(0.013)	
FX Risk Position (FXRP)	-0.023	***	-0.017	***					-0.019	***	-0.018	***				
	(0.002)		(0.003)						(0.002)		(0.002)					
Fx Risk Position Change (DFXRP)					-0.040	***	-0.034	***					-0.030	***	-0.031	***
					(0.004)		(0.004)						(0.004)		(0.004)	
DFX (-1) * FXRP'	-0.124	***	-0.114	***	-0.329	***	-0.233	***	-0.122	***	-0.114	***	-0.252	***	-0.228	***
	(0.040)		(0.040)		(0.037)		(0.038)		(0.036)		(0.036)		(0.034)		(0.034)	
Leverage (TL)			-0.008	***			-0.014	***			-0.003	**			-0.006	***
			(0.003)				(0.002)				(0.001)				(0.001)	
Constant	0.426	***	1.093	***	-0.085	*	1.249	***	0.250	***	0.459	***	-0.051		0.377	***
	(0.068)		(0.210)		(0.051)		(0.185)		(0.046)		(0.118)		(0.033)		(0.119)	
Observations	729		729		729		729		729		729		729		729	
R^2	0.422		0.431		0.426		0.470		0.415		0.419		0.395		0.407	
Adjusted R^2	0.397		0.406		0.401		0.446		0.390		0.393		0.368		0.380	

Note: ***, **, and * indicate parameter significance at 1%, 5% and 10%, respectively.

Figure 8: *Parameter Estimates for Earnings by FX Variation (EFX)*