FX hedging and creditor rights

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Abstract

The paper draws on Mohanty and Sundaresan (2018) to explore the effects of bankruptcy laws on the ex ante incentive for firms to hedge FX exposures. We use a simple model in which the bankruptcy code may result in deadweight losses, and may allow equity holders a share of residual value of the firm's assets in the bankruptcy proceedings. The paper predicts that, while value-maximising firms promise to hedge a higher fraction of the value of their FX exposure when the debt is issued, they may renege subsequently and take on some FX exposures at the expense of foreign creditors. To preclude this, strong and enforceable loan/bond covenants must be in place. Furthermore, the model predicts that FX exposure affects credit spreads, and that thin FX hedging markets lead to greater FX exposure, and a higher probability of default. The paper tests these theoretical predictions and shows that unhedged corporate FX exposures at the country level are indeed negatively associated with the strength of creditor rights and the depth of hedging markets. Using loan-specific data from the Reserve Bank of India, and exploiting recent changes in the bankruptcy law, the paper uncovers a clear connection between the creditor rights and the hedging behaviour of non-financial firms.

Keywords: foreign currency exposure; corporate hedging; creditor rights.

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1. Introduction

"Original sin" refers to the practice of a country borrowing in foreign currency (Eichengreen and Hausmann (1999)). The most recent evidence points to a global tendency to engage in currency and maturity mismatches due to central bank policies. For instance, BIS (2017) reports that between 2009 and 2016, US dollar credit to non-bank borrowers outside the United States expanded by 50% to USD 10.5 trillion, and that to emerging market non-bank borrowers more than doubled to USD 3.6 trillion. Rajan (2014) argues that large-scale asset purchases by the Federal Reserve precipitated a worldwide "competitive easing" of monetary conditions, causing excessive build-up of leverage in emerging market economies (EMEs): this is the central bank channel through which dollarisation occurs for non-dollar-domiciled borrowers. Similarly, Bruno and Shin (2017) show that very low US interest rates have encouraged emerging market firms to engage in financial exposures that have attributes of a US dollar carry trade.

In this paper, we explore how far firms might wish to take on FX exposure: we consider a firm with dollar debt, generating domestic currency cash flows. An important motive for FX hedging, or more generally hedging, is that firms face bankruptcy costs, and to avoid costly bankruptcies due to increased volatility of unhedged revenues and costs, firms may hedge even though shareholders may be fully diversified, and may not care whether the firms are hedged or not. This motive is strong at the time the firm issues dollar debt. Subsequent to the issuance, however, equity holders have an incentive to take on some FX exposure at the expense of foreign creditors. To preclude this, strong and enforceable loan/bond covenants must be in place. This presumes that contract enforcement mechanisms such as the bankruptcy laws are efficient. In countries with a weak bankruptcy code and creditor protection, this argument is much less persuasive. In such countries, dollar debt may be priced to reflect such enforcement problems, and we may see firms taking on greater FX exposure.

We develop a simple theoretical framework in which a firm with domestic currency cash flows issues FX (USD) debt. This stark setting, without any natural currency hedge, helps us to focus on FX exposure and the circumstances under which the firms may hedge that exposure. The firm operates under a bankruptcy legal framework in which default can result in deadweight losses. The equity holders choose the optimal default boundary to maximise their value, and will internalise any inefficiencies in the bankruptcy code, by adjusting their default decision. We use this setting to develop propositions that link (a) the firm's credit spreads to its FX exposure; (b) the cost of hedging to FX exposure and the probability of default; (c) the value-maximisation objective to the optimal hedge; and (d) the conflicts of interest between equity holders and creditors in hedging exposure after the issuance of debt.

We empirically test these theoretical propositions by pursuing two distinct but complementary lines of investigation. First, we explore whether a country's aggregate corporate credit spread is informative of the unhedged currency exposure of its firms, after controlling for systematic risks. To the extent that such a relationship exists, it will help us to understand the nature of the link between fluctuations in the external value of a country's currency and the probability of firms domiciled in that country facing the threats of bankruptcy. Having estimated FX exposure at the individual country level, we then proceed to investigate the role of macroeconomic and institutional factors in explaining cross-country variations in such exposures. Second,

we supplement our cross-country analysis through a quasi-natural experiment by focusing on India's recent introduction of a new bankruptcy code in May 2016. Using granular loan-level information from the Reserve Bank of India (RBI) and combining this with the firm-level data, we attempt to identify the unique effect of this new law on the hedging behaviour of firms.

Consistent with the predictions of our model, we present evidence supporting a strong association between the credit spreads of firms and FX rates, after controlling for the sovereign spreads. This evidence is based on country-level data, wherein the corporate spreads are calculated at a portfolio level. Nearly three fifths of economies in our sample have a negative exposure to a dollar appreciation, and these dollar short positions tend to be concentrated in countries with sizeable current account deficits.

Our cross-country evidence supports the main intuition behind the theoretical model that there exists a negative relationship between the corporate sector's exposure to the exchange rate and the legal rights enjoyed by the creditors in the country where the firms are domiciled. We find that countries that score high on World Bank's strength of creditors' legal rights tend to benefit from lower degrees of currency mismatches on their corporate balance sheets. Among other factors, we also find strong evidence in favour of the incomplete market hypothesis that FX exposures are negatively associated with the degree of depth of the hedging markets (lower depth implying higher costs of hedging), implying that deeper FX markets may encourage firms to hedge a larger fraction of their FX exposures.

Our quasi-natural experiment based on India confirms most of the findings obtained in the context of the cross-country analysis. Employing a probit model and dividing firms according to their ratio of foreign currency debt in total debt, we find a robust positive association between the new bankruptcy code and the probability of currency hedging by firms with a high share of foreign currency debt. Relative to the pre-new bankruptcy regime, the probability of these firms issuing loans on a currency-hedged basis rises by about 13%. Having said that, our results also point to significant differences in the behaviour of state-owned firms that are relatively insulated by the implicit government support and widely held public listed companies that are likely to face the full brunt of the new bankruptcy code.

Stepping outside our theory, we find that among the fundamental factors playing a role in hedging decisions is the availability of a natural hedge through export revenues. We find that firms that have a larger fraction of their sales in foreign currencies are more likely to issue unhedged loans. We also find that firms' growth opportunities have a significant effect on their hedging decisions, suggesting that firms that are higher in market value do tend to capitalise on that strength by hedging more of their currency and interest rate exposures, as suggested by the underinvestment theory of hedging.

The rest of the paper is organised as follows. Section 2 briefly surveys the relevant literature. In Section 3, we develop our main theoretical intuitions, which provides us with some testable implications. Section 4 contains our empirical analysis. Section 5 concludes.

2. Literature

A number of reasons have been advanced to explain why firms borrow in foreign currency, leading to currency mismatches. The depth of capital markets, credibility of

monetary and fiscal policies and supporting institutions are obvious drivers (Claessens et al (2007), Tirole (2003) and Jeanne (2002)). The rights of creditors and the efficient enforcement of contractual obligations also determine whether or not there will be a thriving domestic bond market. Aghion et al (2001) and Chamon (2001) emphasise this driver.

A second strand of literature focuses on the consequences of dollarised liabilities for firm balance sheets and borrowing costs in a dynamic equilibrium setting. This literature extends the original closed economy financial accelerator models of Bernanke and Gertler (1989) and Bernanke et al (1999) to an open economy setting where a firm is exposed to an unanticipated large devaluation of the exchange rate. Notable examples are Aghion et al (2000), Gertler et al (2007), and Cespedes et al (2004). A key aspect is that the lenders are exposed to an agency problem (the high costs of verifying bankruptcy of the borrowers), which they internalise by charging the firm an "external finance premium". In this setting, a surprise devaluation leads to a sharp deterioration in the firm's net worth, amplifying the negative effects of the shock on credit spreads and the costs of borrowing.

A third strand of research highlights the importance of the rule of law and legal institutional histories of countries for the development of credit markets. This includes the classic papers of La Porta et al (1997) and Djankov et al (2007), which establish a strong cross-country association between property rights and the degree of development of credit markets, as well as Goyal and Packer (2016) and Bae and Goyal (2009), who demonstrate the crucial role of contract enforcement in loan decisions. A related branch of the literature investigates the use of FX-denominated debt and hedging motives. Examples include Lei (2012) who examines the impact of the strength of external governance on firms' use of currency derivatives, and Kedia and Mozumdar (2003), who focus on firms' use of foreign currency-denominated debt to hedge FX exposure.

Our work focuses on the link between the provisions of the bankruptcy law, deadweight losses, and contract enforcement on the one hand, and the incentives to hedge on the other. Our paper complements others by examining yet another aspect of the bankruptcy law, that is, its implications for firms' decisions to take on unhedged currency exposures. We discuss a transmission mechanism where the deadweight costs of bankruptcy, the costs of hedging and the conflicts of interests between equity holders and creditors all influence the firm's optimal hedging strategy.

3. Theoretical intuitions

The theoretical model behind the analysis is developed in Mohanty and Sundaresan (2018). The model assumes that a typical emerging market firm has dollarised debt outstanding and must decide what fraction of its FX exposure should be hedged. The firm may need to import capital equipment to generate domestic currency revenues, for example, as would be the case in industries such as infrastructure. The firm may face some costs associated with hedging. This is related to the opportunities that the borrower has to hedge its exposure. If hedging markets are incomplete, the costs can be high. The firm also realises that hedging can reduce the upside potential to equity holders, while making its creditors better off. This will limit their incentives to hedge. On the other hand, by hedging, the firm can lower its probability of default, and this can improve the ability of the firm to realise upside potential, conditional on its survival.

Consider a firm whose unhedged asset value in domestic currency units evolves as follows:

$$dA = r_d A dt + \sigma_1 A d\omega_1 \tag{1}$$

In equation (1), $\{\omega_1\}$, is the driving process that causes A_t to evolve over time as a Geometric Brownian Motion. We assume that r_d is the domestic currency risk-free rate.

We will formalise this idea as follows. Let C be the coupon rate of the debt issued by the firm. These liabilities are in US dollars, which we assume is the foreign currency throughout the paper. The interest payments are tax deductible so that the effective cost of servicing debt for the firm is $C(1-\tau)$ where τ is the tax rate.

The risk-neutral process for the foreign currency spot exchange rate [in units of domestic currency per unit of USD] is specified below:

$$dS = (r_d - r_f) S dt + S \sigma_2 d\omega_2 \tag{2}$$

The firm is therefore exposed to both shocks in the domestic currency asset values, which arise from domestic currency revenue fluctuations, as well as the possibility of a significant depreciation in domestic currency, which can hurt its ability to service its dollar liabilities. This is the tension that we capture in our model.

In its hedging decisions, the firm really cares about the FX-denominated value of its domestic assets as its liabilities are in foreign currency. So, we define $\alpha \equiv \frac{A}{S}$ as the asset value in FX. Its dynamics is the relevant variable in the firm's optimal hedging and default decision.

The firm takes into account both the potential for domestic currency depreciation as well as a depreciation in its own domestic revenues in designing its value-maximising hedge. The interest payments on debt generate a tax shield and the continuation value of the firm is the present value of the tax shield generated by the firm in good states, net of hedging costs that must be paid for in good states to avoid losses in bad states. The costs are the deadweight losses imposed by the bankruptcy code.

Let $a^* > a$ be a fixed boundary where default occurs. The characterisation of default is central to our theory. This is where the effectiveness of the bankruptcy code comes in. If the bankruptcy causes the equity holders to be completely wiped out, they get nothing upon bankruptcy: this is consistent with the absolute priority rule. This may incentivise equity holders to default sooner, ex ante. To capture the variations in the code, we define the payoffs to the equity holders and creditors at the default boundary, a^*.

When the value of the hedged firm's assets reach the default boundary, the following payoffs are earmarked for the claim holders.

$$E(a^*) = \psi_1 a^* \tag{3}$$

and

$$D(a^*) = \psi_2 a^* \tag{4}$$

Note that $\psi_i\,(i = 1,2) \in [0,1]$ is a crucial parameter: it is the fraction of the residual value that accrues to equity holders when the firm defaults. This is a leakage from the

creditors to the equity holders. In addition, we assume that $\psi_1 + \psi_2 > 1$ so that there are deadweight losses associated with bankruptcy. We assume that the equity holders can hedge a fraction $\theta \in [0,1]$ of their FX-adjusted domestic asset value a. It costs the firm c per unit time per unit fraction of the FX-adjusted asset value that the firm hedges. The hedged asset value will have the risk-neutral dynamics, shown below.

$$da = ar_f dt + a(1-\theta)[\sigma_1 d\omega_1 - \sigma_2 d\omega_2]$$

We can think of hedging costs as capturing the extent of incompleteness in hedging opportunities, as well as the basis risk in hedging. In this setting, the equity is a down-and-out call option, and reducing the volatility will generally lower the equity value. But, if there is default risk, and the equity holders are wiped out upon default, they may have an incentive to hedge, ex ante. Since hedging reduces the overall volatility, the debt claims issued by the firm will become more valuable. Hence the total value of the firm, which is the sum of the values of equity and debt claims, may well increase when the firm pursues a value-maximising strategy. For a rational equity holder, hedging at the time of issuance of debt will reduce the cost of issuing debt, and hence will increase the overall equity value, by increasing the continuation value of the firm, and reducing the odds of an expensive bankruptcy.

Using this framework, we develop several testable propositions:

1. After the firm issues debt, a subsequent depreciation of domestic currency increases the credit spreads. Corporate credit spreads thus have a strong FX exposure;
2. An increase in the cost of hedging (implicit, such as agency costs, or explicit, such as thin FX hedging markets) increases the optimal default boundary;
3. Value-maximising firms find it optimal to hedge their FX exposure when they issue FX debt. This increases the overall value of the firm;
4. Firms hedge more if (a) the value of tax shields is high and (b) if the deadweight losses arising from bankruptcy are high. If the bankruptcy code is efficient in avoiding deadweight losses, firms hedge less. Firms hedge more if the FX volatility is high, and if the correlation between domestic currency revenues and spot currency exchange rates is negative.

The last proposition connects the bankruptcy code with incentives to hedge. If the continuation value is high enough, the firm would like to hedge. If the bankruptcy code is effective in the sense that the deadweight losses are low, the firms need to hedge less.

4. Cross-country evidence

In this section, we test our optimal hedging hypotheses by first estimating country-level FX exposures from corporate spreads and then exploring the extent to which bankruptcy regimes can explain the cross-country variations in such exposures. Drawing on the capital-asset-pricing models (eg Jorion (1990), and Dominguez and Tesar (2001)), we hypothesise that a part of the risk premium on corporate bonds represents the risk exposure of firms due to the fluctuations in the exchange rate. Our empirical model therefore takes the following form:

$$CS_t^i = \alpha_0 + \alpha_1 ss_t^i + \alpha_2 \Delta e_t^i + \varepsilon_t^i \qquad (5)$$

Where cs is corporate credit spread, ss is a market benchmark, which in our case is represented by the sovereign spread, e is the log exchange rate (a depreciation of the home currency vis-a-vis foreign currency representing a negative change in e) and i is the country subscript.

Corporate debt theory, such as Merton (1974), would suggest that the credit spreads are influenced by firm-specific factors such as (a) leverage; (b) volatility of assets; and (c) debt term to maturity. Since we work with country-level data, in our specification, we are unable to directly control for these important variables.

The coefficients α_1 and α_2 measure the market risk and the residual default risk associated with the exchange rate, respectively. In this setting, the exposure to market risk could arise from two sources: (a) macroeconomic factors that are likely to be correlated with the exchange rate and (b) exogenous changes in the exchange rate that are priced into sovereign spreads. A zero value of α_2 means that the corporate sector has the same exchange rate exposure as the sovereign. Conversely, a rejection of $\alpha_2 = 0$ implies that the corporate sector is exposed to additional exchange rate risk over and above that of the sovereign – a negative sign indicates that the firm has a short FX position so that a depreciation of the exchange rate is associated with an increase in its credit spread.

In the next stage, we explore the extent to which firms' FX exposures are determined by the legal settings of countries in which they are domiciled. Our cross-country regression therefore takes the following form.

$$\hat{a}_{2i} = \eta_0 + \eta_1 cr_i + \eta_2 z_i + \gamma_i \tag{6}$$

Where η_1 measures the response of the estimated exposure to the creditors' rights (cr) while (z) is a set of controls. Our controls include several country-level structural and macroeconomic factors that are likely to be correlated with firms' incentive and ability to hedge, ie the degree of external imbalances (measured by a country's current account deficit as percent of GDP), corporate currency mismatches (FX debt of the non-financial corporate sector as a share of GDP), the depth of hedging markets (bid-ask spreads in FX markets), and the degree of openness (share of exports and imports in GDP), and the growth rate of GDP.

Given that our measure of currency exposure is based on the aggregate corporate spreads rather than firm-level spreads, an important concern is potential bias to the estimate arising from possible reverse causation from spreads to the exchange rate. To the extent that an industry-level shock affects credit quality and exchange rates, our model will not correctly identify exposures. To correct for this endogeneity bias, we employ a 2SLS estimator. Our benchmark model is estimated using 365-day rolling exchange rate returns and spreads based on daily data. We instrument the exchange rate by gold prices and lagged exchange rates.

We estimate exchange rate exposures for 31 EMEs and two advanced Asia-Pacific economies ie Australia and Japan. The corporate bond spread series refer to the JP Morgan corporate emerging market broad bond index (CEMBI), which is a US dollar-based bond index for EM firms. For Japan and Australia, the corresponding series are the iTraxx Japan and iTraxx Australia five-year theoretical indices. Given the focus on dollar debt, we first estimate the model with the bilateral dollar exchange rate and then compare the results with a trade-weighted exchange rate and a debt-weighted exchange rate.

4.1 First-stage results

Several findings stand out from the estimates of FX exposures presented in Tables 1–3. First, as shown in Table 1, the coefficient on the exchange rate is statistically significant in many countries, irrespective of the exchange rate indicators used. In roughly three fifths of the countries in our sample (19 out of 33), the exposure coefficient is negative (first column). This means that, in these countries, a depreciation of the exchange rate against the dollar is associated with a higher probability of corporate default and therefore higher credit spreads. Conversely, in the remaining two fifths of the countries, the coefficient is positive, suggesting that currency depreciation is associated with improved corporate credit quality and lower spreads.

Second, the results appear consistent with our initial hypothesis that the dollar plays a more prominent role than other international currencies in determining the FX exposure of non-financial firms. The middle panel of Table 1 reports the estimates of exposure coefficients using the nominal effective exchange rates (NEER).[2] Of the 26 countries for which the NEER series is available, fewer than half (12 countries) have negative exposures to the dollar, which is considerably lower than the estimate using the bilateral dollar exchange rate. At the same time, replacing the bilateral dollar exchange rate with the NEER weakened the explanatory power of the regression. This is particularly true for China where the R^2 fell from 0.77 to 0.61. In contrast, in the case of Japan, Israel and the Czech Republic, the NEER seems to outperform the bilateral dollar exchange rate in explaining corporate FX exposures.

We also tested the sensitivity of the exposure coefficients using a debt-weighted exchange rate (DWER).[3] As pointed out by Kearns and Patel (2016), the purpose of constructing the DWER is to explore the possibility that there may exist a "financial channel" of the exchange rate, which can act as a potential offset to the trade channel in the sense that a depreciation of the exchange rate reduces GDP growth through tighter financial conditions. Assuming that investors price such risks into bond prices, we can expect to see a tighter link between the DWER and spreads. The main finding is that the introduction of the DWER does not substantially alter the direction of exposure estimated using the bilateral dollar exchange rate. In some cases, however, the introduction of DWER weakened the model's statistical significance.

[2] To the extent that firms hedge their net short dollar positions by running long positions on other international currencies, the bilateral dollar exchange rate can overstate exposures. Moreover, a trade-weighted exchange rate is more appropriate indicator if firms hedge their FX exposure by issuing debt in the currencies in which their exports are invoiced (Kedia and Mozumdar (2003)). On the other hand, as pointed out by Dominguez and Tesar (2001), a trade-weighted exchange rate may lack power if the weights assigned to the currencies in the basket do not correspond to the nature of firms' exposures.

[3] The methodology for computing the DWER is discussed in BIS (2016) and Kearns and Patel (2016). It is constructed as the geometric average of the bilateral exchange rate of a country against each of the five major global currencies (US dollar, euro, Japanese yen, pound sterling and Swiss franc), weighted by the shares of these global funding currencies in that country's foreign currency debt.

Estimated FX exposures

Table 1

	USD		NEER		DWER	
	β_2 coeff.	R^2	β_2 coeff.	R^2	β_2 coeff.	R^2
Australia	–0.64***	0.78	–1.22***	0.79	–0.37	0.77
China	40.13***	0.77	13.32**	0.61	37.41***	0.72
Hong Kong SAR	33.71***	0.85	2.79***	0.85	5.43	0.86
Indonesia	43.49***	0.63	45.20***	0.61	20.65	0.60
India	–4.14***	0.48	–3.37***	0.47	–5.75	0.47
Japan	2.74***	0.34	4.32***	0.45	4.09***	0.36
Korea	–2.01***	0.86	–3.33***	0.88	–1.77	0.90
Malaysia	2.36***	0.72	2.86***	0.71	2.78**	0.75
Philippines	–10.27***	0.59	–8.93***	0.51	–12.25***	0.59
Singapore	–5.53***	0.44	1.39*	0.36	–4.57	0.35
Thailand	4.48***	0.43	–1.20***	0.40	2.83	0.40
Argentina	–10.83***	0.63	–8.97***	0.59	–7.07***	0.80
Brazil	–4.79***	0.91	–5.06***	0.89	–4.37***	0.88
Chile	–2.43***	0.75	–2.72***	0.74	–2.98***	0.77
Colombia	–5.09***	0.47	–5.77***	0.44	–5.51***	0.42
Mexico	1.01***	0.72	–1.60***	0.72	–4.01	0.74
Peru	–2.06***	0.77	3.24***	0.77	–2.94**	0.82
Czech Republic	1.38***	0.16	6.87***	0.45	10.97***	0.56
Hungary	–1.11***	0.91	–0.60**	0.91	–4.00	0.94
Poland	–1.50***	0.78	8.56***	0.79	0.86	0.84
Russia	–0.16	0.86	1.35***	0.87	1.68	0.88
Turkey	0.73***	0.61	1.54***	0.62	3.56	0.72
South Africa	2.90***	0.09	3.73***	0.12	4.00*	0.05
Croatia	1.58***	0.09	6.58***	0.11		
Israel	0.17	0.59	2.79***	0.62	1.02	0.65
Saudi Arabia	–39.13**	0.35	–4.16***	0.38	–0.73	0.35
Dominican Republic	–26.78***	0.05				
Egypt	17.97***	0.13				
Ghana	41.62***	0.65				
Guatemala	–17.61***	0.68				
Jamaica	–7.14***	0.21				
Kazakhstan	–3.11***	0.75				
Ukraine	–35.98***	0.57				

Note: */**/*** indicate the significance at 10%, 5% and 1% level. The table provides estimates of foreign exchange exposures based on the bilateral exchange rate against the US dollar (USD), the nominal effective exchange rate (NEER), and the debt-weighted exchange rate (DWER), using 365-day rolling exchange rate returns. The underlying specification is the 2SLS equation: $CS_t^i = \alpha_0 + \alpha_1 ss_t^i + \alpha_2 * \Delta e_t^i + \varepsilon_t^i$. Business daily data are used for the USD and NEER and quarterly data for the DWER estimation.

Third, the results also illustrate a clear regional pattern in the distribution of FX exposures. To shed further light on this issue, we summarise the direction of exposure of countries in Table 2. The countries are grouped according to whether they have a negative or positive exposure to dollar. Interestingly, most negative coefficients and therefore short dollar positions in EMEs tend to be associated with the non-Asian region. This group includes most countries from Latin America, Africa and the Middle East that tend to run sizeable current account deficits. On the other hand, most positive exposure coefficients and hence long positions on the dollar seem to be

concentrated in Asia (China, Hong Kong SAR, Japan, Indonesia, and Thailand) that have traditionally run current account surpluses. In terms of the magnitude of impact, a 1% depreciation of the RMB against the dollar is associated with a reduction in China's corporate dollar bond index by 40 basis points. The corresponding numbers are 33 basis points for Hong Kong, 43 basis points for Indonesia, and 2–6 basis points for Japan, Malaysia and Thailand.[4]

Direction of corporate FX exposure

Table 2

Bilateral dollar exchange rate	
Negative exposure to depreciation	Positive exposure to depreciation
(1)	(2)
Australia, India, Korea, the Philippines, Singapore, Argentina, Brazil, Chile, Colombia, Peru, Hungary, Poland, Russia, Saudi Arabia, Dominican Republic, Guatemala, Jamaica, Kazakhstan, Ukraine.	China, Hong Kong SAR, Indonesia, Japan, Malaysia, Mexico, Czech Republic, Thailand, Turkey, South Africa, Croatia, Israel, Egypt, Ghana.

Finally, in terms of hedging behaviour, the results suggest that firms are likely to be more sensitive to exchange rate changes at longer horizons than at shorter horizons, as suggested by several previous studies (eg Allayannis (1997) and Bodnar and Wong (2003)). To get at the time-sensitivity issue, we estimated exposure coefficients using exchange rate returns over weekly, monthly, quarterly and half-yearly horizons.[5] The results are summarised in Table 3. Our results are consistent with previous studies that exposures are an increasing function of the horizon of exchange rate returns. This is evident from the fact that the number of significant coefficients at 5% or below increased considerably between seven-day and 90-day returns and somewhat modestly between 90-day and 180-day returns. However, lengthening the exchange rate horizon beyond 180 days does not seem to yield statistically better results. This finding remains unchanged if we judged the model sensitivity by the number of positive and negative significant coefficients rather than by the total number of significant coefficients.

However, expanding the horizon of exchange rate return does seem to change the magnitude of the exposure coefficients, and moreover this effect appears to be asymmetrical for the groups of countries with negative and positive exposures. As can be seen from the bottom rows of Table 3, a lengthening of the return horizon appears to reduce the average value of the exposure for the group of countries that have a positive exposure to the dollar. This reduction seems to be quite substantial, moving from the 180-day return horizon to the 365-day horizon. In contrast, in the group of countries that have negative exposures to the dollar, the average magnitude of exposure is roughly similar for horizon of returns above three months. Such an asymmetry does seem to suggest the possibility that firms with long and short dollar positions may respond differently to exchange rate shocks. While firms with long

[4] At the same time, there are cross-country variations in exposures that cannot be explained by macroeconomic variables alone. For instance, in Mexico, South Africa and Turkey, positive dollar exposure coefficients have been correlated with large current account deficits. On the other hand, in the Philippines and Korea, negative dollar exposures are associated with current account surpluses and a modest corporate FX debt-to-GDP ratio.

[5] As pointed out by Dominguez and Tesar (2006), the time-sensitivity of currency exposures arises because firms may adapt their operational and financial strategies to offset some of the impact of the exchange rate.

dollar positions seem more averse to an appreciation of their home currency at longer horizons, those with short dollar positions do not seem to adjust their positions substantially in response to a sustained depreciation of the exchange rate.

Estimate of FX exposure with different return horizons

Table 3

Number of countries with significant coefficient[3] (<5%)					
	Seven-day	30-day	90-day	180-day	365-day
Number of coefficients:					
USD[1]	21	27	29	32	31
NEER[2]	14	21	21	23	25
Of which have positive coefficients:					
USD[1]	13	15	14	12	13
NEER[2]	8	11	12	14	13
Of which have negative coefficients:					
USD[1]	8	12	15	20	18
NEER[2]	6	10	9	9	12
Simple average of positive coefficients:					
USD[1]	45.44	26.9	22.74	21.3	14.93
NEER[2]	24.06	15.47	13.51	8.84	7.86
Simple average of negative coefficients:					
USD[1]	–25.89	–16.06	–10.17	–9.85	–10.11
NEER[2]	–7.24	–4.61	–4.64	–4.88	–3.91

Notes: [1] 33 countries in total. [2] 26 countries in total. [3]The underlying specification is the 2SLS equation: $cs_t^i = \alpha_0 + \alpha_1 * ss_t^i + \alpha_2 * \Delta e_t^i + \varepsilon_t^i$. Business daily data are used for e_t^i, which changes depending on the return horizon

4.2 Second-stage results

Thus far we have focused on the extent to which corporate spreads provide information on FX exposures. Next we explore the potential determinants of such exposures. Several recent studies provide evidence in favour of the link between creditors' rights and corporate risk-taking. For instance, using country-level data, Acharya et al (2011) show that stronger creditor rights not only incentivise firms to diversify risks through acquisition of other firms but also strengthen their incentive to reduce leverage. On the other hand, using firm-level data for Asian economies, Goyal and Packer (2016) report a positive association between creditors' rights and firm leverage. The authors argue that the positive effects of stronger creditors' rights on credit supply more than compensate for the negative credit demand effects that stem from managers' actions to reduce cash-flow risks to avoid costly bankruptcies.

Among the previous studies that have directly explored the role of bankruptcy laws in firms' decisions to hedge currency risks are Huston and Stevenson (2010) and Lei (2012). Huston and Stevenson (2010) report a strong negative association of creditors rights with country-level FX exposures, which they attribute to creditors being to able to impose ex ante bankruptcy costs on the shareholders, preventing them from undertaking high-risk investment policies. Similarly, Lei (2012) shows that firms' use of derivatives is correlated with property rights and the efficiency in law enforcement, but also suggests that weakly and strongly governed firms may use

derivatives for different reasons. While the former use derivatives for managerial reasons (to reduce mangers' own exposures to losses) the latter may use them for financial reasons, ie having better access to external financing.

Determinants of FX exposure

Table 4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
RGDP growth rate	1.5	1.35	1.05	1.01	1.15	1.51	1.53	1.27	1.11	0.74	0.79	0.93	1.28	1.32
Degree of openness	0.04	0.05	0.06	0.06	0.07*	0.05	0.04	0.07**	0.09***	0.08**	0.08**	0.09***	0.07*	0.07**
Depth of FX market ('000 units)	2.97***	3.14***	2.25***	2.72***	2.84***	2.86***	2.84***							
Current account balance								–1.04	–1.38*	–0.59	–0.68	–0.86	–0.95	–1
Strength of creditors' legal rights		–1.39*							–1.62**					
Resolving insolvency			–0.25**							–0.33***				
Enforcing contracts				–0.29							–0.27			
Political risk					–0.58**							–0.55**		
Investment profile						–1.02							–0.99	
Corruption							–1.65							–2.52
Constant	0.1	6.97	14.15*	18.16	37.53**	8.27	4.08	2.74	10.36*	21.14**	20.32	38.44*	10.81	8.7
Observations	33	33	32	33	33	33	33	32	32	31	32	32	32	32
Adjusted R-squared	0.17	0.21	0.31	0.21	0.25	0.15	0.15	0.03	0.08	0.23	0.04	0.09	0	0.02

Note: */**/*** indicate the significance at 10%, 5% and 1% level. The dependant variables are the absolute values of the α_2 coefficients obtained from the first stage regression using 365-day rolling exchange rate returns. The specification is: $\alpha_{2,i}=\beta_0+\beta_1 cr_i+\beta_2 z_i+\gamma_i$, where cr_i are different definitions for the creditors' rights explanatory variable; a higher score indicating a greater degree of protection of creditors.

Source: Authors' estimation.

Table 4 presents our cross-country results using estimates of exposures. As suggested by Domingeuz and Tesar (2006), we use absolute exposure coefficients to estimate equation (6) to eliminate the truncation bias that could arise from having positive and negative coefficients in the regression. Our results are consistent with previous studies about the existence of a cross-country negative relationship between the bankruptcy code and the corporate sector currency exposure. The coefficient on the strength of creditors' legal rights is significant in most models. Another factor that seems to matter for FX exposure is the depth of the hedging markets, which enters with a significant positive sign. This suggests that deeper FX markets (lower bid-ask spreads) help to reduce hedging costs, encouraging firms to hedge a larger fraction of their currency exposures. This result is consistent with the proposition developed in our model. The results also confirm that currency exposure is negatively associated with the external current account position but positively associated with the degree of openness, although the relevant coefficients are not consistently significant across all specifications.

We tested the sensitivity of our results by including additional legal institutional variables. In one specification we replaced the strength of the creditors' rights variable with the World Bank's resolving insolvency index and enforcing contract index. In a second specification, we replaced the same variable with the ICRG's political risk indicator, as a proxy for creditor rights, as suggested by Bae and Goyal (2009). In

separate regressions, we also included the subcomponents of political risk, ie the investment profile (contract viability and expropriation risks) and corruption index (the degree of political corruption), to evaluate their distinct role in firms' hedging decisions.

As can be seen from Table 4, the inclusion of new variables did not change our main findings about the importance of the bankruptcy regime. The resolving insolvency variable enters with a significant negative sign, suggesting that the time and costs required to resolve insolvency play an important role in firms' hedging decisions, as suggested by theory. This finding is also validated by the political risk indicators. On the other hand, none of the subcomponents of the political risk index is significant in the model.

5. A quasi-natural experiment

In this section, drawing on the empirical framework developed in Mohanty and Sundaresan (2018), we present the results of an event study analysis based on India's experience with a new bankruptcy law. In May 2016, the Indian Parliament passed the new Insolvency and Bankruptcy Code, 2016, creating for the first time in India a uniform and comprehensive insolvency code for companies and individuals (but excluding the financial firms). An important feature of the new code is that it transfers the right to initiate insolvency resolution from the debtors to the creditors by mandating the establishment of a creditors committee, which must decide the revival or liquidation of a defaulting firm within a period of 180 days, with a maximum grace period of 90 days. This represents a major improvement for the rights of creditors, given the fact that under the earlier regime it took almost 10 years for creditors to receive court judgement on insolvency litigation and about five years to wind up companies or recover debt (Ravi (2015)).

A seemingly related issue in India has been the persistence of a high degree of currency mismatches in the Indian corporate sector. The recent Committee to Review the Access to Domestic and Overseas Capital Markets (2015)[6] by Indian companies attributed the unhedged corporate borrowing problem to the lack of a well developed onshore derivative market and a managed exchange rate regime that provides an implicit guarantee to firms against future fluctuations in the exchange rate. Analysing firm-level data, Patnaik et al (2015) note that, while Indian firms undertaking external commercial borrowing (ECB) were generally large in size and had adequate debt-servicing capacity, they ran the risk of losing a substantial part of their equity in the event of a large depreciation of the exchange rate. A question that has not been explored is the extent to which unhedged foreign currency borrowings in the corporate sector also reflected a deeper, structural problem related to the subordination of creditors' rights in India.

Our analysis is facilitated by a loan-level ECB data base made available to us by the Reserve bank of India, providing information on the terms of each ECB (type of borrowing, maturity, currency, and spread) and whether the borrower intended to hedge the underlying currency and interest rate exposures as well as the instruments

[6] Under the restricted capital account regime of India, external commercial borrowing (ECB) by Indian firms is governed by the Foreign Exchange Management Act of 1999, which is administered by the Reserve Bank of India. The act provides the terms and conditions under which firms can access ECB financing, as well as the maximum spreads to be paid on such borrowing.

used for hedging (whether currency or interest rate swaps). In other words, for each of these loans, the data set refers to the intention of the borrower to hedge but not the actual hedging. We combine a probit model with the differences-in-differences (DID) identification strategy to investigate the effect of the new bankruptcy code on the hedging behaviour of Indian firms. To do this, we divide our sample of firms into terciles according to the share of foreign currency debt in total debt. We define firms in the top tercile with the highest shares of foreign currency debt as the treated group and those in the bottom tercile with the lowest shares of foreign currency debt as the control group. The impact is then studied by comparing the differences in the behaviour of the treated group before and after the introduction of law with differences in the behaviour of the control group.

Our results are summarised in Table 5. We find that, relative to the years before the law change, the probability of the treated group of firms hedging currency exposures increased, particularly when we exclude the state-owned enterprises from the sample, which are likely to be less sensitive to changes in the bankruptcy regime. The likelihood of firms with a high degree of currency mismatch issuing ECB loans on a fully hedged basis went up by 13.7% following the introduction of the new bankruptcy law.

The positive effect of the bankruptcy code on currency hedging decisions is interesting in the context Vig's (2013) paper, which finds a negative impact of the SARFAESI Act[7] on the flow of secured credit. Vig shows that a strengthening of creditors' rights produces an income effect and a substitution effect that can go in opposite directions. The positive income effect arises from the fact that stronger creditors' rights increase the liquidation value of the firm, reducing the costs of borrowing. On the other hand, stronger creditor rights increase the threat of bankruptcy and the probability of premature liquidation, encouraging firms to reduce collateral, with negative effects on the supply of secured credit.

Using the same analogy, our results seem to suggest the operation of a stronger demand channel in the hedging decisions, to the extent that stronger creditors' rights incentivise firms to reduce cash flow risks by hedging a larger fraction of their currency and interest rate exposures. This, in turn, helps them to access cheaper external funding. It is consistent with our theoretical results that value-maximising firms internalise costly bankruptcies (when the law is enforced efficiently) and make a credible commitment to bondholders to preserve the liquidation value in the case of default.

Among other factors, the availability of a natural hedge through export revenue plays a crucial role in the hedging decision. The results suggest that firms that have a larger fraction of their sales in foreign currencies are more likely to issue unhedged loans than those with a lower fraction of FX revenues in total sales. A 1% increase in the exports-to-sales ratio reduces the marginal probability of an ECB loan being issued on currency-hedged basis by 19%. We also find a strong and significant effect of market-to-book value on hedging decisions. Firms that are higher in value do capitalise on that strength by hedging more of their currency and interest rate exposures, which helps them to have better access to the international capital markets. This is consistent with the underinvestment theory of hedging.

[7] The Securitisation and Reconstruction of Financial Assets and Enforcement of Securities Interest Act, passed by the Indian Parliament in 2002, empowered secured creditors (particularly banks) to seize assets in the case of default.

Results of probit model on the effect of bankruptcy law on hedging behaviour of Indian firms (excluding state-owned firms) Table 5

	(1) Curr swap	(2) Int swap	(3) Both swaps	(4) Any swaps
LAW × TREAT	1.914***	0.541	1.728***	1.007*
	(3.38)	(1.06)	(3.20)	(1.83)
	[0.137]	[0.182]	[0.070]	[0.294]
ForCurr2Tot	–1.868	0.846	–2.123	0.647
	(–1.12)	(0.58)	(–1.07)	(0.42)
ExportSales	–0.923***	–0.830***	–1.365***	–0.733**
	(–2.76)	(–2.66)	(–3.88)	(–2.45)
Size	0.040	0.009	0.018	0.039
	(0.84)	(0.20)	(0.34)	(0.85)
Mkt2book	0.974**	1.315***	1.786***	0.739**
	(2.54)	(3.59)	(3.74)	(2.04)
Dividend yield	0.096	0.054	0.143**	0.032
	(1.62)	(0.95)	(2.20)	(0.55)
Leverage	–0.148	0.981	1.267	–0.258
	(–0.19)	(1.34)	(1.50)	(–0.35)
Roa	2.701	3.925**	–0.018	6.097***
	(1.35)	(2.12)	(–0.01)	(3.19)
Const.	4.718***	3.955***	4.594***	3.887***
	(7.16)	(6.31)	(6.82)	(6.15)
Obs	464	464	464	464
Pseudo R-sq	0.159	0.130	0.197	0.136

This model estimates the marginal effect of the new bankruptcy code on hedging intentions, excluding state-owned firms, using a probit model of the following form: $P\left(y_{ijt}=1\right)=\beta_0+\beta_1\tau_t+\beta_2\delta_j+\beta_3 LAW+\beta_4 TREAT+\beta_5\left(LAW\times TREAT\right)+\beta_6 X_{ijt}+\eta_{ijt}$. where y is a binary variable, which takes on the value of one for hedged loans and zero for unhedged loans; y i represents firm-loan observation, j represents industry, t represents time. τ and δ are time and industry fixed effects; LAW is a dummy variable that takes on the value of one for all ECB loans issued after May 2016, that is, when the new bankruptcy law was passed by the Parliament, and zero for loans issued prior to May 2016; $TREAT$ is a dummy that takes on the value of one if the loan belongs to the treated group (issued by firms with a high FX debt to total debt ratio) and zero if it belongs to the control group (firms with a low FX debt ratio); and X is a vector of control variables: *ForCurr2Tot*: FX debt to total liabilities; *ExportSales*: Exports to total sales; *Size*: Total assets; *Mkt2book*: Market capitalisation to enterprise book value; *Dividend yield*; *Leverage*: non current liabilities to total assets; *Roa*: After tax profit to total assets. t-statistics using robust standard errors in parentheses; ***/**/* denotes statistical significance at the 1/5/10% level. Marginal effects of D-I-D are given in the square brackets. State-owned firms have been dropped.

Source: Authors' estimation.

6. Conclusion

Various hypotheses have been proposed to explain the recent large increase in unhedged dollar borrowings by emerging market firms. In this paper, we developed a simple model of a firm with dollarised debt, which produces its revenue in domestic currency. The firm operates under a certain bankruptcy code, which can lead to deadweight losses, and creditor losses upon financial distress. The model developed

several testable propositions, linking the provisions of bankruptcy law, deadweight losses and contract enforcement on the one hand, and the incentive to hedge on the other.

Our empirical results are consistent with the theoretical prediction that corporate credit spreads in emerging markets are informative of the unhedged exposure of the firms domiciled in these economies. This result is robust to different measures of the exchange rate and alternative horizons of exchange rate returns. We also find that the bilateral exchange rates of EMEs against the dollar play a more important role than the trade or debt-weighted exchange rates in determining corporate FX exposures. Our cross-country results confirm the hypothesis that FX exposures are negatively associated with the strength of creditors' rights and the depth of hedging markets.

Our quasi-natural experiment confirms most of the findings of the cross-country investigation. Using a unique loan-level data base from the RBI, we find significant evidence of the positive effects of the new bankruptcy law on Indian firms' incentive to hedge currency and interest rate exposures on their external commercial borrowing. Having said that, we also find evidence that the ownership structure of firms may play a role. To the extent that the state-owned firms dominate the corporate sector, this can undermine the beneficial effects of the new bankruptcy regime on hedging decisions and on resource allocation, more generally, in the economy. In addition, we also find that natural hedging from export revenues plays a clear part in the decision of firms to hedge their FX exposures. Our results are broadly consistent with previous research on the link between legal institutions and the hedging behaviour of non-financial firms (eg Huston and Stevenson (2010) and Lei (2012)).

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