

For Whom the Levy Tolls: The Case of a Macroprudential Stability Levy in South Korea*

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August 2019

Abstract

Can capital flow management measures (CFMs) lengthen the maturity structure of foreign currency debt, thereby reducing the external vulnerability of the economy? This paper studies the effectiveness of a macroprudential stability levy introduced in Korea, which was devised to incentivize the banking sector to switch from short- to long-term foreign currency debt. A detailed look at the bank-level foreign currency balance sheet data reveals that a dramatic shift in the aggregate maturity structure upon the introduction of the levy was almost entirely driven by foreign bank branches via their interoffice accounts, implying that there were only limited, if any, effects on macroeconomic stability. Moreover, the transaction-level loan rate data suggest that it had unintended consequences favoring foreign bank branches that exploited regulatory arbitrage and therefore were able to avoid passing the levy onto their borrowers.

JEL Classification Numbers: F31; F38; F42; G15; G21

Keywords: Capital flow management measure; Capital control; Macroprudential policy; Foreign borrowing; Bank levy.

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1 Introduction

Capital flow management measures (CFMs) are highly contentious international macroeconomic policies.¹ Conceptually, the traditional view that capital should move freely across countries to maximize efficiency has been increasingly challenged—particularly since the global financial crisis (GFC)—by alternative views that highlight the potential risks associated with excessive volatility and vulnerability to sudden stops and reversals.²

One of the most common types of CFMs aims to lengthen the maturity structure of foreign currency debt by making short-term foreign currency financing relatively expensive to long-term one (e.g., the Unremunerated Reserve Requirement (URR) in Chile or Colombia).³ Two underlying premises of such policy are (1) that more volatile short-term capital flows are detrimental to macroeconomic stability (i.e., fear of “hot money” *a la* Magud, Reinhart, and Rogoff (2018)), and (2) that banks prefer short-term borrowings mainly because they are cheaper (i.e., the maturity premium *a la* Alfaro and Kanczuk (2009)).⁴

This paper studies one of such CFMs implemented in Korea, namely, the macroprudential stability levy (henceforth, “the levy”) imposed on non-core foreign currency borrow-

¹According to the IMF’s institutional view, CFMs refer to measures that are designed to limit capital flows. They encompass both measures that discriminate on the basis of residency (i.e., capital controls) and those that do not. Macroprudential measures (MPMs) refer to measures that are designed to limit systemic financial risks, including risks associated with capital flows (IMF, 2012; 2015). As such, Korea’s macroprudential stability levy, the main focus of this study, is a good example of measures that are both CFMs and MPMs.

²Recent theoretical works have justified the use of CFMs in the presence of pecuniary externalities, whereby individual borrowers do not internalize the fact that their collective behavior could lead to the creation of a feedback loop of capital outflows, contractionary depreciations, and a tightening of collateral constraints (e.g., Bianchi, 2011; Jeanne and Korinek, 2010; Korinek, 2011, 2018; Korinek and Mendoza, 2014). Benigno, Chen, Otrok, Rebucci and Young (2016) considered the case in production economies, rather than in the endowment economies considered in the above studies. Brunnermeier and Sannikov (2015) and Schmitt-Grohé and Uribe (2016) derived similar conclusions, without imposing any exogenous debt constraints, from the incomplete market setting and downward nominal wage rigidity setting, respectively.

³The URR is an implicit tax on borrowings, the rate of which is essentially the opportunity cost of not receiving the interest rate. By exempting long-term borrowing from the URR (e.g., Colombia) or requiring a fixed holding period regardless of the maturity (e.g., Chile), it can be designed to lengthen the maturity structure of foreign borrowings. For more practical comparisons between URRs and a levy, please refer to Shin (2016).

⁴They are thus in line with Broner, Lorenzoni and Schmukler (2013) and Rodrik and Velasco (1999) among others, and strongly supported by recent theory models in Bengui (2013), Korinek (2018) and Zhou (2018) that pecuniary externalities are particularly severe for short-term foreign debts. However, there are alternative views in the literature that stress the role of short-term debt as a discipline mechanism for borrowers (e.g., Jeanne, 2009; Tirole, 2003) in which case short-term debt will be a symptom of distress in financial shocks rather than a cause (Benmelech and Dvir, 2013). Brunnermeier and Oehmke (2013) and Stein (2012) show that contractual externalities could also lead to short-term financing bias.

ings in the banking sector at a higher rate for short-term than for long-term borrowings, with the stated goal of lengthening the maturity composition of foreign currency debt.

In contrast to previous assessments of the levy based solely on aggregate-level observations, we show that a detailed look at the bank-level foreign currency balance sheet data reveals evidence that casts doubt on the effectiveness of the measure. Specifically, we begin by confirming previous findings that the aggregate maturity structure of foreign currency debt in the banking sector, indeed, shifted toward longer-term foreign currency debt immediately after the introduction of the levy, which has led to the conclusion in previous studies that the levy had likely contributed to reducing external vulnerability of the Korean banking sector (e.g., IMF, 2017; Bruno and Shin, 2014; Choi, 2014; Huh and An, 2014; Kim and Lee, 2017).

However, breaking down the data by bank and by type of borrowing, we find striking evidence that such a dramatic shift in the aggregate maturity structure was almost entirely driven by foreign bank branches that switched their interoffice borrowings from short- to long-term maturities. Since the maturity boundary of interoffice borrowings is blurry in practice, we reckon that the effect of the levy on enhancing macroeconomic stability must have been much more limited than once thought.⁵

The particular structure of the levy explains the observed pattern. A lack of response by domestic banks observed in the data reflects that the levy differential imposed on short- and long-term foreign currency borrowings—10 to 20 bps, depending on the maturity—was not enough to reverse the relative borrowing cost (i.e., the term spread) that was prevalent in the interbank market over the period (greater than 20 bps). By contrast, it was more than sufficient to incentivize foreign bank branches to shift the maturity of interoffice borrowings toward the longer term because the implicit term spread of interoffice borrowings must have been close to nil, not least due to the absence of any counterparty default risk.⁶

We also find suggestive evidence that the levy may have brought unintended consequences favoring foreign bank branches whose long-term interoffice borrowing was ex-

⁵When liquidity needs arise abroad, interoffice loans made by parent banks need not be held to maturity in a consolidated context because foreign parent banks may simply request early repayment or even borrow from local branches in Korea, thereby switching net-due positions.

⁶A class of models on the optimal debt maturity structure features a maturity premium stemming from counterparty default risks (e.g., Alfaro and Kanczuk, 2009; Arellano and Ramanarayanan, 2012; Broner, Lorenzoni and Schmukler, 2013; Rodrik and Velasco, 1999).

empted from the levy. To the extent that the levy would raise the effective marginal cost of funding and thus be eventually passed through to lending rates, such an exemption clause essentially created regulatory arbitrage for foreign bank branches, allowing them to avoid passing the levy onto their borrowers, unlike their peer domestic banks. Using transaction-level loan data, 2SLS estimation results confirm that for a given lender-borrower pair, once time-varying borrower-specific demand and risk factors are controlled for, domestic banks had to raise loan rates relative to foreign bank branches after the introduction of the levy due to a relative increase in the effective marginal funding cost.

Our findings deliver two key messages. First, a stark contrast between implications from aggregate- and disaggregate-level analysis in our example sheds light on mixed evidence concerning the effectiveness of CFMs in the literature (e.g., Blanchard, Dell’Ariccia and Mauro, 2013; Forbes, Fratzscher and Straub, 2015; Ostry, Ghosh, Chamon and Qureshi, 2012). Given a substantial degree of heterogeneity across various kinds of CFMs that are in place, our findings suggest that a detailed investigation into each CFM is warranted: it is not the presence of CFMs, *per se*, that is important, but rather a specific design of each CFM.⁷ For a CFM targeted at lengthening the maturity of foreign currency debts, our findings highlight the importance of precisely calibrating the required distortion of the maturity spread.

Second, our findings underscore the importance of distinguishing different types of cross-border bank flows in implementing CFMs, especially those by domestic banks and foreign bank branches, or, more precisely, arm’s length and interoffice flows. In general, it is not clear whether arm’s length flows are expected to be more stable than interoffice flows. On the one hand, there is ample evidence that the international transmission of adverse shocks across countries during the GFC was aggravated by interoffice flows by foreign bank branches of global banks (e.g., Hoggarth, Hooley and Korniyenko, 2013; Kwan, Wong and Hui, 2014; Cetorelli and Goldberg, 2012).⁸ At the same time, however, interoffice debt would be less vulnerable to rollover risks than arm’s length debt in times of

⁷A similar point is made in Ahnert, Forbes, Friedrich, and Reinhardt (2018) where CFMs on banks are shown to have led to the unintended consequence of causing non-financial corporations to increase foreign currency debt issuance. This is less of a concern in Korea because foreign currency debt issuance by non-financial corporations has been relatively negligible throughout the period.

⁸Peek and Rosengren (1997, 2000) offered early evidence on the international transmission of shocks by Japanese bank branches in the U.S. De Haas and van Horen (2013), De Haas and van Lelyveld (2014), and Ongena, Peydro and van Horen (2015) studied the transmission channel through foreign subsidiaries of global banks during the GFC.

local crisis, during which parent banks would stand as a stable and more efficient source of funding for their foreign branches (Goldberg, 2009; Fiechter, Ötcher-Robe, Ilyina, Hsu, Santos and Surti, 2011; Fillat, Garetto and Smith, 2018).

Previous studies on individual country experiences with CFMs mostly covered the Unremunerated Reserve Requirement (URR) in Chile and Colombia, and financial transaction taxes on portfolio inflows in Brazil. Cárdenas and Barrera (1997) find that URRs induced a composition of foreign liabilities in favor of long-term maturities in Colombia in the mid-1990s. Similarly, De Gregorio, Edwards and Valdés (2000) and Edwards (1999) report the positive role of URRs in tilting the composition of capital inflows toward longer maturity in Chile from 1991 to 1998, which likely came at the cost of increasing financial constraints for small and medium firms (Forbes, 2007). Baumann and Gallagher (2012) find that the Brazilian controls had a small effect on the exchange rate, whereas Chamon and Garcia (2016) find a stronger result possibly owing to a consideration of the delay in the implementation of the tax on derivatives. Alfaro, Chari and Kanczuk (2017) study the real effects of the Brazilian controls at the firm level.

Several researchers also studied the recent CFMs in Korea. Bruno and Shin (2014) find that the sensitivity of capital inflows in Korea to external conditions reduced relative to that in other countries after the introduction of CFMs. Others find a significant effect of CFMs on lengthening the maturity structure of foreign currency borrowings, mostly attributed to the leverage cap policy than to the levy itself (Choi, 2014; Huh and An, 2014; Kim and Lee, 2017; Yun, 2018). By contrast, we show that much of the effect actually stemmed from changes in the maturity structure of interoffice borrowings by foreign bank branches in response to the levy.

The remainder of the paper is organized as follows. Section 2 introduces the institutional background and dataset used in the study. Section 3 documents empirical patterns and reports econometric results regarding the effect of the levy on the maturity structure of FX borrowings. Section 4 investigates unintended consequences of the levy. Section 5 is the conclusion.

2 Institutional Background and Data

2.1 Macroprudential Stability Levy

Korea was one of the hardest-hit countries during the 1997 Asian Financial Crisis (AFC). Since then, Korean authorities have introduced supervisory procedures and numerous micro-prudential regulations to ensure that the banking sector complies with foreign currency risk management guidelines, which have greatly helped improve currency mismatches on their balance sheets.⁹ Nonetheless, maturity mismatches in their foreign currency balance sheets remained as a source of vulnerability to global liquidity shocks.

In the pre-Global Financial Crisis (pre-GFC) era of 2005 to 2007, there was a rapid increase in short-term foreign currency liabilities by domestic banks and foreign bank branches in Korea, only to be reversed by dramatic outflows at the onset of the GFC.¹⁰ The consequent deleveraging amplified financial instability by triggering depreciation of the Korean won against the U.S. dollar, thus elevating the borrowing banks' debt repayment burden. In the three months following the collapse of Lehman Brothers (September 2008), the outflow of short-term liabilities from the banking sector was over USD 50 billion, largely explaining the net reduction in Korea's foreign reserves from over USD 240 billion to USD 200 billion by the end of 2008 (e.g., Bruno and Shin, 2014).

Moreover, the unconventional post-GFC monetary policies in developed economies reinforced mounting concern about the banking sector's vulnerability to external shocks. Against this background, Korean authorities, increasingly wary of the potential risk from excessive capital influx, introduced a macroprudential stability levy on non-depository foreign currency-denominated borrowings (i.e., excluding foreign currency deposits and other operational/ trading liabilities) in August 2011. The goal was to restrain excessive foreign currency borrowings, as well as restructure the maturity structure of the banking sector's foreign currency liabilities, thereby reducing the external vulnerability of the

⁹In fact, foreign currency assets and liabilities of domestic banks have been almost balanced since the AFC, leaving their foreign currency balance sheets practically ring-fenced from domestic currency balance sheets (Kang and Jeong, 2016).

¹⁰A surge in short-term foreign currency liabilities in the pre-GFC period is explained by several factors (Cho and Hahn, 2012). First, a global liquidity glut led to a dramatic increase in short-term capital inflows to emerging market economies including Korea. Second, a rise in arbitrage incentive from covered interest parity—declining foreign exchange swap rates below interest rate differentials between Korea and the U.S.—incentivized foreign bank branches to be actively involved in arbitrage transactions financed by short-term interoffice foreign currency borrowings. Third, a sharp increase in hedging demands by large exporting companies led Korean banks to piling up short-term foreign currency liabilities as a way to offset potential currency risks taken on behalf of exporters.

banking sector.

As of end-2013, a total of 59 foreign exchange banks—19 domestic commercial banks and 40 foreign bank branches—were subject to this levy.¹¹ It accounted for 95 percent of total foreign currency non-core borrowings by all financial institutions in Korea. The levy rate was initially set from 2 to 20 basis points (bps), depending on the maturity of the targeted debt instruments, for the purpose of switching the maturity structure from highly volatile short-term foreign currency debt to more stable longer-term ones. The underlying premise was that a higher levy on short-term borrowings should affect the relative costs of short-term to long-term debt, such that banks would be incentivized to switch from short-term to long-term borrowings.

Specifically, short-term foreign currency debt of maturity of up to 12 months was subject to 20 bps, while 10 bps was imposed on debt of a maturity from 1 to 3 years, 5 bps on that from 3 to 5 years, and 2 bps on maturity of more than 5 years. On the other hand, the exemption clause was made in the legislation that the levy shall not be imposed on interoffice long-term foreign currency borrowings of maturity of more than 1 year on the basis of treating them as capital, which would help alleviate the burden of foreign bank branches that rely heavily on interoffice borrowings, as shown in Table 1.

Together with other macroprudential measures, such as the ceiling on banks' foreign currency derivative positions¹², the levy was expected to help mitigate the volatility of capital flows, thereby enhancing the economy's resilience to external shocks. The proceeds of the levy were to be earmarked in a special account of foreign exchange reserves to provide foreign currency liquidity to financial institutions in times of crisis.

2.2 Data

All financial institutions in Korea—including both domestic banks and foreign bank branches—are required to report every single transaction in foreign currencies on a daily basis, as well as all foreign currency denominated assets and liabilities on a monthly basis, to the Bank

¹¹Throughout the paper, we classify two foreign bank subsidiaries present in Korea (Citibank Korea and Standard Chartered Korea) as domestic banks since their operations are much closer to domestic commercial banks than to foreign bank branches.

¹²A leverage cap on the notional value of foreign exchange derivative contracts—including both currency swaps and forwards—was introduced and became effective in October 2010. Specifically, the leverage cap was initially set at 250 percent of their capital for foreign bank branches, while it was set at 50 percent of their capital for domestic banks.

of Korea, in accordance with the Foreign Exchange Transaction Regulation, the Banking Supervision Regulation, the Financial Investment Business Supervision Regulation, the Insurance Business Supervision Regulation, and the Credit Guarantee Financial Supervisory Regulation.

The main dataset for this study is the monthly frequency foreign exchange balance sheet data compiled by the Bank of Korea, covering the period from 2007 to 2013. This dataset provides detailed bank-level information about foreign currency denominated assets and liabilities by line item, allowing for investigating the structure of foreign currency liabilities, exactly what is necessary for our study. In particular, foreign currency liabilities are categorized by the nature of funding—core liabilities (e.g., deposits), non-core liabilities (e.g., interbank borrowings, interoffice borrowings, debt issuance), and other operational/trading liabilities (e.g., accounts payable, on-balance derivative items)—all of which are further broken down by maturity date (less than versus more than 1 year).

Using this dataset, we compute the share of short-term and long-term non-core foreign currency borrowings in total foreign currency liabilities by the type of entity (domestic banks versus foreign bank branches) or the type of borrowing (e.g., interoffice versus non-interoffice borrowings), of which key summary statistics are provided in Table 2.

The second dataset comes from transaction-level lending data that covers all kinds of foreign currency loans by both domestic banks and foreign bank branches, with detailed information about the maturity, currency, interest rate, volume, lender, borrower, etc. Based on this dataset, we construct the monthly frequency borrower-lender-level average interest rate data by focusing on loans with fixed interest rates, which tend to be concentrated at short-term loans with maturity of less than one year. Once merged with the main foreign exchange balance sheet data by lending banks at the monthly level, this will be used for a later analysis investigating unintended consequences of the levy on lending rates.

3 Maturity Structure of non-core Foreign Currency Borrowings

3.1 Illustrative Evidence

We begin by illustrating the aggregate-level time-series evolution of the share of non-core foreign currency borrowings in total foreign currency liabilities in the Korean banking sec-

tor. Figure 1 describes a marked shift in the maturity composition of non-core foreign currency borrowings in the banking sector occurring immediately at the introduction of the levy in August 2011. The share of short-term non-core foreign currency borrowings in total foreign currency liabilities (blue solid line) declined by 8 percentage points over 12 months from 28 percent in July 2011 to 20 percent in July 2012, while the share of long-term non-core foreign currency borrowings (red solid line) rose by 6 percentage points from 25 percent to 31 percent over the same period. As a result of such offsetting movements, there was relatively little change in the overall share of non-core foreign currency borrowings in total foreign currency liabilities (green dashed line).

Although there had already been a declining trend in short-term and a corresponding increasing trend in long-term foreign currency borrowings prior to the introduction of the levy¹³, a steep shift in the maturity structure from short- to long-term foreign currency borrowings at the onset of the levy suggests that the levy appears to have been highly effective in changing the maturity structure of foreign currency borrowings in the banking sector. This is indeed the extent to which previous academic studies and policy reports assessed the levy as successful in shifting the maturity composition of foreign currency borrowings toward the longer term, thereby contributing to the stability of banking sector financial flows (IMF, 2014; 2017).

Considering the underlying interbank spread between the short- and long-term interest rates, however, the seemingly effective levy is rather puzzling. Figure 2 shows that the spread between 6-month and 1-year LIBOR rates was ranging from 20 bps (JPY) to 50 bps (GBP) across major currencies around that period, well above the 10 bps differential imposed by the levy. In other words, to the extent that the levy differential was devised to give incentives to banks to move from short-term to long-term foreign currency borrowings by switching the relative cost of short- to long-term foreign currency borrowings, its effect was bound to be limited because, even after taking the levy into account, the cost of short-term foreign currency borrowings was still lower than that of long-term foreign currency borrowings, and hence no strong incentives for the banks to change their maturity composition of foreign currency borrowings.¹⁴

¹³Although it is not the main focus of this paper, Figure 5 below is telling in that a declining trend in short-term borrowings prior to the levy was due to foreign bank branches' arm's length borrowings whereas a subsequent decline after the levy was driven by their interoffice borrowings.

¹⁴That is, acknowledging that the maturity premium may not be the only reason behind short-term financing bias, the levy differential should have been at least greater than the spread prevalent in the interbank

That said, one exception could be made for interoffice accounts whereby foreign bank branches borrow from the headquarters or some other branch abroad. In principle, apart from inflation expectations, interbank spreads largely stem from underlying counterparty default risk, typically rising over the maturity. In the case of interoffice borrowings, however, such counterparty default risk is irrelevant. After all, the notional price for internal transactions is offset in the consolidated account such that the headquarters should be indifferent as to the maturity of any interoffice lending. Therefore, the argument goes, the maturity structure of interoffice borrowing should be highly sensitive to any distortion in the relative price introduced by the levy. In practice, this means that, foreign bank branches that used to periodically roll over their short-term interoffice borrowings would simply mark the maturity of their interoffice borrowings as a longer term to avoid higher levy associated with short-term borrowings.¹⁵

To check if the aggregate pattern was indeed driven exclusively by foreign bank branches, Figure 3 breaks down the aggregate share of short-term non-core foreign currency borrowings in foreign currency liabilities into those by domestic banks (in red) and those by foreign bank branches (in blue). Several points clearly stand out. First, foreign bank branches rely much more heavily on short-term non-core foreign currency borrowings than domestic banks do. Second, the share of short-term non-core foreign currency borrowings had been declining for both domestic banks and foreign bank branches prior to the levy. Third, and most interestingly, it was only foreign bank branches that reduced the share of short-term foreign currency borrowings immediately after the introduction of the levy.

Similarly, Figure 4 describes the share of long-term foreign currency borrowings in total foreign currency liabilities for domestic banks (in red) and foreign bank branches (in blue), highlighting that a steep increase in the share of long-term foreign currency borrowings upon the introduction of the levy was seen exclusively in foreign bank branches.

To confirm that a major shift in the maturity structure observed exclusively in foreign bank branches stems from interoffice borrowings, Figure 5 further breaks down total short-term non-core foreign currency borrowings by foreign bank branches (green dashed line) into arm's length (in blue) and interoffice borrowings (in red). It clearly shows that the

market during the period to incentivize domestic banks to lengthen their foreign currency debt maturities.

¹⁵Even without the exemption clause on long-term interoffice borrowing by foreign bank branches, foreign bank branches might have had been incentivized to switch their short-term interoffice borrowings to long-term interoffice borrowings, which must be only strengthened due to the exemption clause in place.

response to the levy occurred exclusively via interoffice borrowings. Moreover, it further shows that the trend decline in short-term foreign currency borrowings by foreign bank branches prior to the levy was mostly driven by arm’s length borrowing.

Similarly, Figure 6 breaks down total long-term foreign currency borrowings by foreign bank branches (green dashed line) into arm’s length (in blue) and interoffice borrowings (in red), revealing that long-term foreign currency borrowings are made mostly via interoffice accounts, with long-term borrowings from arm’s length counterparty banks almost negligible throughout the period. It also shows a steep increase in the share of interoffice long-term foreign currency borrowings at the introduction of the levy.

Overall, a lack of response in the maturity composition of arm’s length foreign currency borrowings by foreign bank branches as well as that of total foreign currency borrowings by domestic banks that relied heavily on arm’s length borrowings is fully consistent with the notion that the levy differential imposed on short-term and long-term foreign currency borrowings was not enough to reverse the relative borrowing cost prevalent in the inter-bank market. On the other hand, it was more than sufficient to incentivize foreign bank branches to shift the maturity of interoffice borrowings toward the longer term.

To verify that these patterns are not driven by only a few large domestic banks or by foreign bank branches, we now turn to a formal econometric analysis.

3.2 Econometric Evidence

Discrete Difference-in-Difference Specification This section conducts a set of econometric investigations to confirm the main findings from the illustrative approach above. The baseline specification suitable for the current context is a difference-in-difference estimator, exploring a differential effect of the levy across foreign bank branches and domestic banks as a source of identification:

$$Y_{it} = \beta_1 Foreign_i + \beta_2 Post_t + \beta_3 Foreign_i \times Post_t + \varepsilon_{it}, \quad (1)$$

where Y_{it} measures the bank-level maturity structure of non-core foreign currency borrowings, i.e., the share of total, interoffice, or arm’s length short-term foreign currency borrowings in total foreign currency denominated liabilities; $Foreign_i$ is an indicator variable that is turned on for foreign bank branches; $Post_t$ is an indicator variable for the post-levy pe-

riod (starting in August 2011); and, $Foreign_i \times Post_t$ is an interaction term between two indicator variables.

For such difference-in-difference specification to be valid, two conditions should be met. First, the policy should be exogenous, and second, foreign bank branches and domestic banks should have had a parallel trend in the dependent variable prior to the policy, which started diverging after the policy. It is clear that the former condition is likely to be satisfied, and Figures 3 and 4 also support the second assumption. Still, it will be useful to formally test the second assumption by running the following specification using the pre-levy period sample:

$$Y_{it} = \beta_1 Foreign_i \times T_t + FE_i + FE_t + \varepsilon_{it},$$

where FE_i and FE_t denote individual bank and monthly fixed effects, respectively, and the coefficient estimate of the interaction term (β_1) would effectively measure the extent of differing time trends between foreign bank branches and domestic banks prior to the levy.

Table 3 summarizes the regression results and tests the parallel pre-trend condition. Statistically insignificant coefficient estimates that are close to zero across most columns confirm that the parallel pre-trend condition likely holds, suggesting that a coefficient of our interest from the difference-in-difference specification—that on their interaction term, (β_1), in specification 1—should correctly reflect the effects of the levy on foreign bank branches relative to domestic banks.

Baseline OLS regression results are reported in Table 4. Column 1 corresponds to the regression specification with the dependent variable measuring the share of all non-core short-term foreign currency borrowings in total foreign currency liabilities, which is then broken down into that of interoffice short-term borrowings (column 2) and that of arm’s length short-term borrowings (column 3). Note that the coefficient estimates in column 2 and column 3 sum to the coefficient estimate in column 1 in each row.

On the other hand, the dependent variable in column 4 is the share of arm’s length long-term borrowings in total foreign currency liabilities, and that in column 5 is the share of all non-core foreign currency borrowings that are subject to the levy, which essentially includes all short-term and arm’s length long-term borrowings. As such, the coefficient estimates in column 5 are the sum of those in column 1 and column 4.

The estimated coefficient on the $Foreign_i$ variable in column 1 shows that foreign bank branches tended to rely more on short-term foreign currency borrowings than domestic banks by 39 percentage points on average before the levy was imposed. The coefficient estimate of the $Post_t$ variable implies that domestic banks reduced the share of short-term foreign currency borrowings by 14 percentage points on average in the post-levy period, while that of the interaction term suggests that foreign bank branches reduced their reliance on short-term foreign currency borrowings even more by another 14 percentage points.

Columns 2 and 3 further reveal that the dominance of short-term foreign currency borrowings by foreign bank branches in the pre-levy period as well as a greater decline in the share of foreign currency borrowings for foreign bank branches in the post-levy period is mainly explained by their interoffice borrowings, whereas a change in the maturity structure of foreign currency borrowings by domestic banks occurred largely via their arm's length borrowings.

Likewise, column 4 shows that domestic banks, which used to rely more on arm's length long-term borrowings than foreign branches by around 29 percentage points, raised their reliance even more by around an additional 10 percentage points after the levy. On the other hand, foreign bank branches did not see much change in the share of arm's length long-term borrowings. As a result, column 5, which is the sum of columns 1 and 4, confirms that domestic banks ended up with a larger share of foreign currency liabilities subject to the levy by around 23 percentage points, compared to foreign bank branches.

Although quite revealing, there are several caveats in the baseline OLS regression specification. First, it is likely that there is potential heterogeneity across individual banks even among foreign bank branches or domestic banks regarding the composition of foreign currency liabilities. Second, time-series movements in aggregate shocks common to all Korean banks—such as common trends, exchange rate, or interest rate shocks—might have been somehow related to the timing of the levy introduction, making it hard to identify the effect of the levy from other shocks.

Such concerns can be addressed by including additional bank- and month-level fixed effects at the cost of separate coefficient estimates on $Foreign_i$ and $Post_t$ variables that would be absorbed by such fixed effects. Table 5 shows the fixed effects regression results on the interaction term, basically confirming the finding from the baseline OLS estimation

that foreign bank branches reduced their share of short-term foreign currency borrowings significantly more than domestic banks by around 12 percentage points, entirely via interoffice borrowings (columns 1 and 2). Moreover, domestic banks increased their share of arm's length long-term foreign currency borrowings more than foreign bank branches by 9 percentage points (column 4), leading to an overall increase in the share of all foreign currency borrowings that are subject to the levy by around 21 percentage points, compared to foreign bank branches (column 5).

Continuous Difference-in-Difference Specification At this stage, it is still hard to discern whether the coefficient estimate on the $Post_t$ variable in Table 4 can be interpreted as the effect of the levy on domestic banks or as a mere reflection of trends. Likewise, one may argue that the coefficient estimate on the interaction term in Tables 4 and 5 could be interpreted either that the levy was effective exclusively to foreign bank branches or that the trend decline in the share of foreign currency borrowings happened to be diverging more between foreign bank branches and domestic banks at a later period.

As such, a continuous version of the difference-in-difference specification as below is considered to investigate the effect of the levy more precisely:

$$Y_{it} = \beta_1 Foreign_i + \beta_{2,t} Time_t + \beta_{3,t} Foreign_i \times Time_t + \varepsilon_{it}, \quad (2)$$

where $Time_t$ is monthly-level time dummy variable, which is also interacted with the $Foreign_i$ variable.

Figures 7 and 8 illustrate the coefficient estimate on the interaction term over time, $\beta_{3,t}$, whereby the coefficient on one month prior to the introduction of the levy (July 2011) is normalized to zero. The dependent variable is the share of all short-term foreign currency borrowings and that of interoffice short-term foreign currency borrowings in Figure 7 and 8, respectively.

An abrupt drop right after the levy strongly suggests that the relative decline in the share of short-term FX borrowings for foreign bank branches indeed reflects the fact that the levy was particularly effective on them. Moreover, it is clear that the effect was mainly through their interoffice borrowings. Regression results with additional bank-level fixed effects yield almost identical patterns (not reported).

On the other hand, a closer look at the evolution of the coefficient estimate, $\beta_{2,t}$, shows

a continuing and gradual trend decline in the share of short-term foreign currency borrowings without an immediate drop after the levy. Moreover, such a trend is entirely driven by arm’s length borrowings, as shown by almost identical results in Figures 9 and 10. This suggests that the levy had, if any, a limited effect on the maturity structure of foreign currency borrowings by domestic banks.

4 Unintended Consequences of the Levy

Our findings so far have confirmed that the effect of the levy on restructuring the maturity composition of foreign currency debt occurred almost exclusively through the shift in interoffice borrowings by foreign bank branches from short- to long-term maturities. Given that interoffice long-term borrowings by foreign bank branches were exempt from the levy, it is further shown that the share of overall foreign currency borrowings that were subject to the levy actually increased in domestic banks relative to foreign bank branches.

Such evidence essentially reflects the extent to which foreign bank branches exploited regulatory arbitrage to reduce their tax burden. As a consequence of the levy, therefore, the marginal cost of funding—after taking into account the levy—may have increased more for domestic banks than for foreign bank branches, possibly passed onto borrowers through lending rates.

We can check this possibility of the levy-induced price distortion. We use relative changes in the share of non-core short-term foreign currency borrowings (or that of all non-core foreign currency borrowings subject to the levy) as a proxy for relative changes in the marginal cost of funding due to the levy. Moreover, to the extent that the levy would have affected foreign currency lending rates differently across banks only through its effects on the maturity composition of foreign currency debt, the interaction term between a foreign bank branch and time dummies could serve as reasonable instrumental variables for the share of non-core foreign currency borrowings. The subsequent 2SLS estimation would then be naturally interpreted as an effect of the levy on lending rates.

In other words, our findings in the previous section could be considered to be a valid first stage regression for 2SLS estimation of the following specification:

$$r_{ijt} = \beta_1 Y_{it} + FE_{jt} + FE_{ij} + \varepsilon_{ijt}, \quad (3)$$

where the dependent variable r_{ijt} is the monthly average lending interest rate (annualized) by lending bank i to borrower j in time t . The main explanatory variable, Y_{it} , is the lending bank's share of non-core short-term foreign currency borrowings (or the share of all non-core borrowings that are subject to the levy) in total foreign currency liabilities by the lending bank, which was the main dependent variable of our focus in equations (1) and (2). FE_{jt} denotes the borrower-time fixed effect that would capture all the time-varying borrower characteristics, such as the default risks, while also absorbing any common time-varying macroeconomic shocks. FE_{ij} is the borrower-lender fixed effect, such that the relationship banking aspects of the lending rate determinants are fully controlled for.

Columns 1 and 2 in Table 6 report the second stage regression results with the first stage regression results coming from the discrete version of difference-in-difference estimator summarized in columns 1 and 5 in Table 5. Depending on whether only short-term or all foreign currency borrowings that are subject to the levy are considered, a 10 pp relative reduction in the foreign currency borrowings share due to the levy led to a 16 to 19 bps (relative) drop in the foreign currency denominated lending interest rate.

Alternatively, the first stage regression could feature the continuous version of difference-in-difference estimator as specified in equation 2, the second stage results from which are reported in columns 3 and 4 in Table 6: a 10 pp relative reduction in the foreign currency borrowings share due to the levy led to a 26 to 27 bps (relative) drop in the foreign currency denominated lending interest rate.

All of these results strongly suggest that the levy had unintended consequences that induced price distortions favoring foreign bank branches over domestic banks.

5 Conclusion

This paper studied one of the capital flow management measures (CFMs) implemented in Korea, namely, the macroeconomic stability levy that was imposed on non-core foreign currency borrowings in the banking sector at a higher rate for short-term borrowings than for long-term borrowings. Consistent with the stated goal of lengthening the maturity composition of foreign currency debt, we first confirmed that the aggregate maturity structure of foreign currency debt in the banking sector indeed shifted toward longer-term foreign currency debt immediately after the introduction of the levy. However, we further

showed that a detailed look at the bank-level foreign currency balance sheet data reveals striking evidence that such a dramatic shift in the aggregate maturity structure was almost entirely driven by foreign bank branches that switched their interoffice borrowings from short- to long-term maturity. As a result, we conclude that the effect of the levy on enhancing macroeconomic stability must have been much more limited than once previously thought. Moreover, we also found suggestive evidence that the levy may have brought unintended consequences favoring foreign bank branches whose long-term interoffice borrowing was exempt from the levy and thus were able to exploit regulatory arbitrage. Overall, our findings point to the importance of considering the granular structure of any given CFMs in evaluating the effectiveness of those CFMs, while making a strong case for distinguishing arm's length foreign currency liabilities from interoffice foreign currency liabilities in measuring the external vulnerability of the banking sector.

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Figure 1: Aggregate non-core FX Borrowings: Short-term vs. Long-term



Figure 2: Libor Spread (12 month - 6 month)

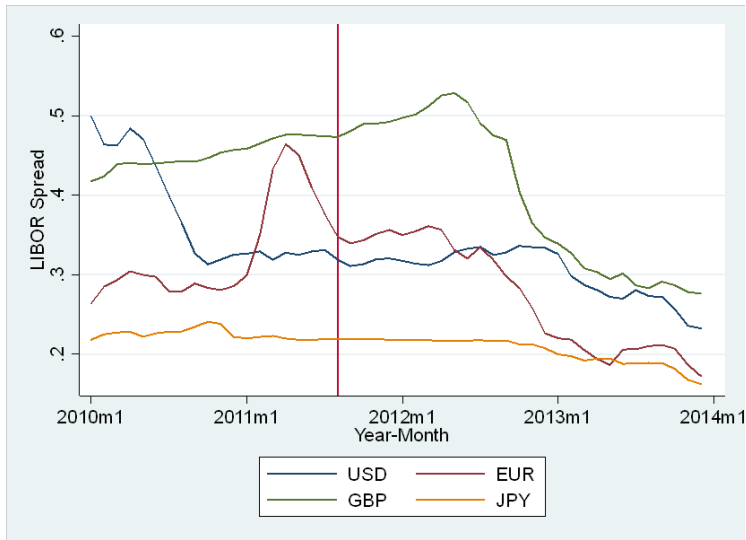


Figure 3: Short-term non-core FX Borrowings: Foreign vs. Domestic

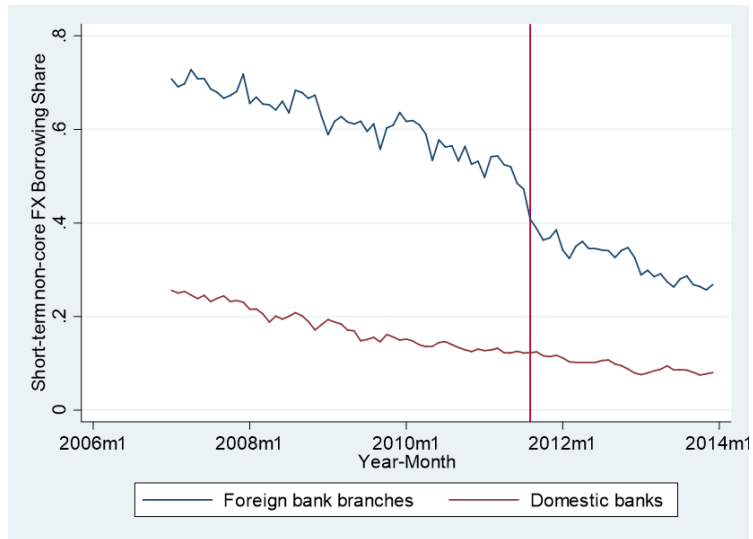


Figure 4: Long-term non-core FX borrowings: Foreign vs. Domestic

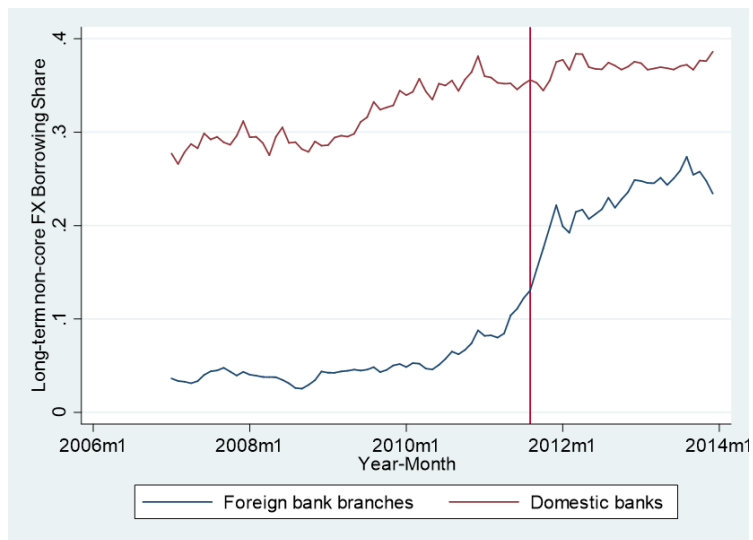


Figure 5: Short-term non-core FX Borrowings by Foreign Bank Branches: Arm's length vs. Interoffice

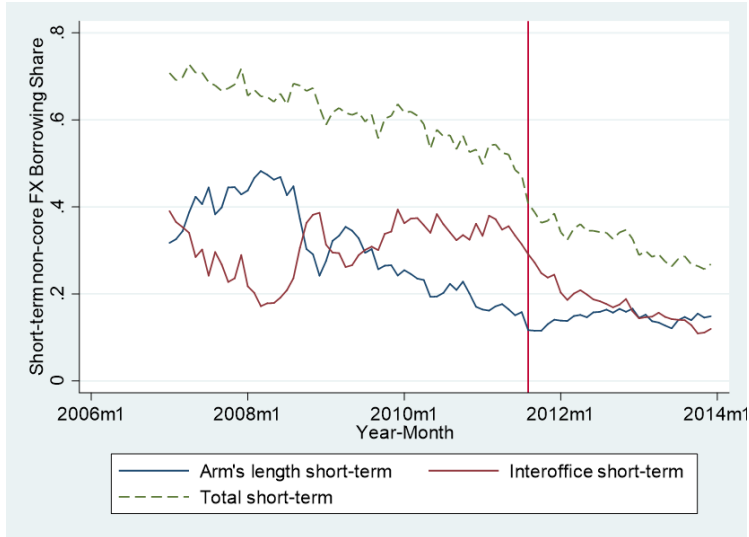


Figure 6: Long-term non-core FX Borrowings by Foreign Bank Branches: Arm's length vs. Interoffice

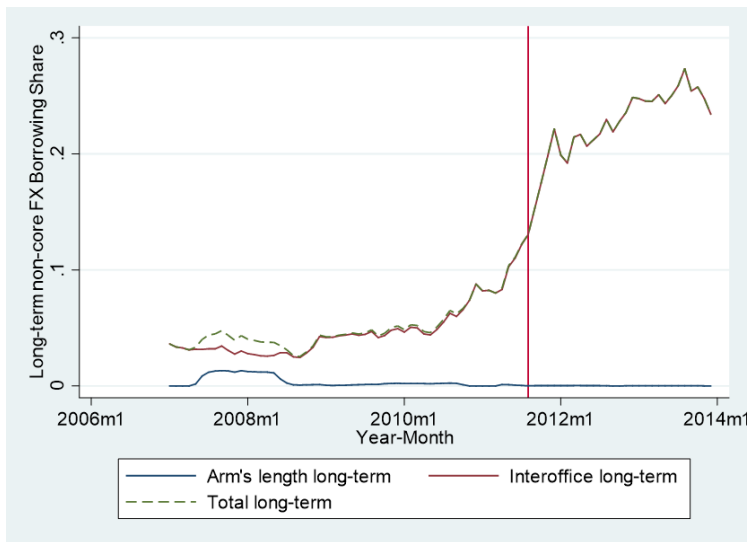


Figure 7: The Evolution of the Coefficient Estimate on the Interaction Term (Dependent variable: All Short-term non-core FX Borrowings)

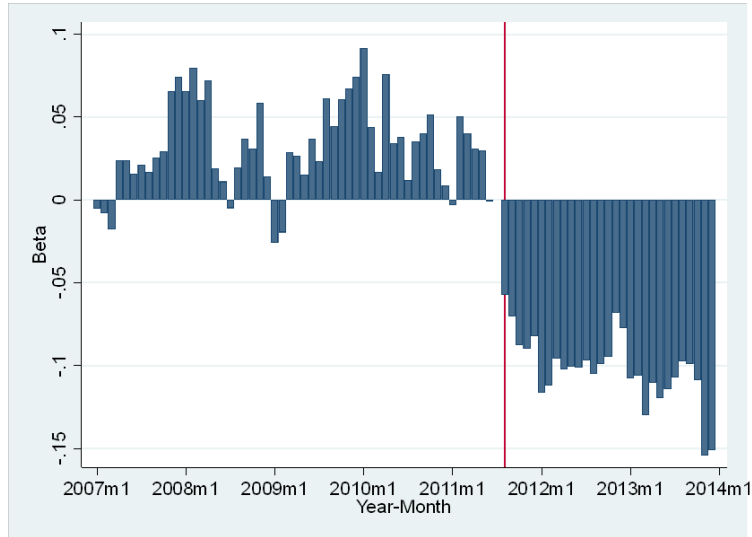


Figure 8: The Evolution of the Coefficient Estimate on the Interaction Term (Dependent variable: Interoffice Short-term non-core FX Borrowings)

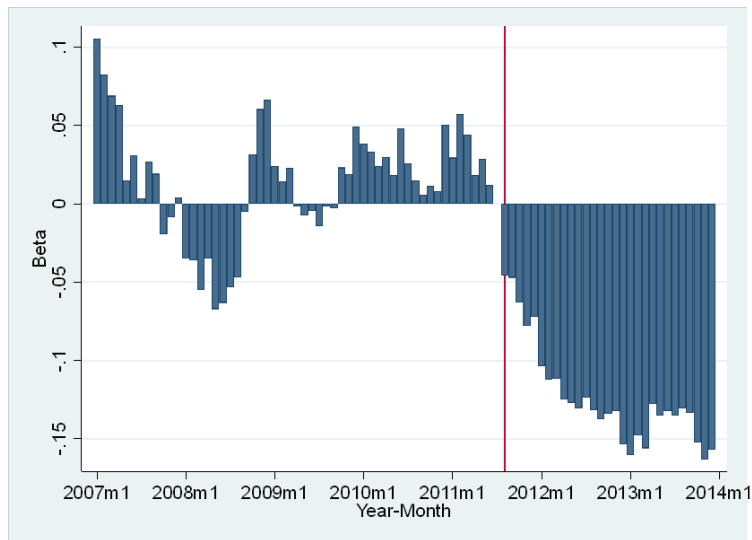


Figure 9: The Evolution of the Coefficient Estimate on Monthly Dummy Variables (Dependent variable: All Short-term non-core FX Borrowings)

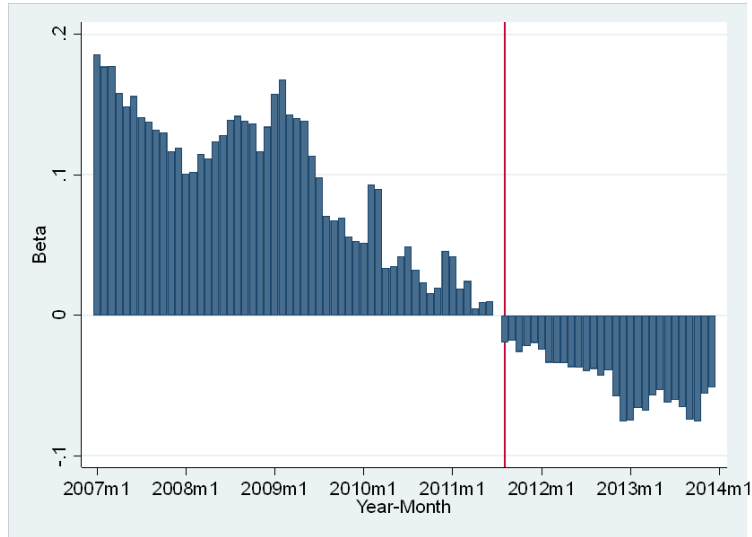


Figure 10: The Evolution of the Coefficient Estimate on Monthly Dummy Variables (Dependent variable: Arm's Length Short-term non-core FX Borrowings)

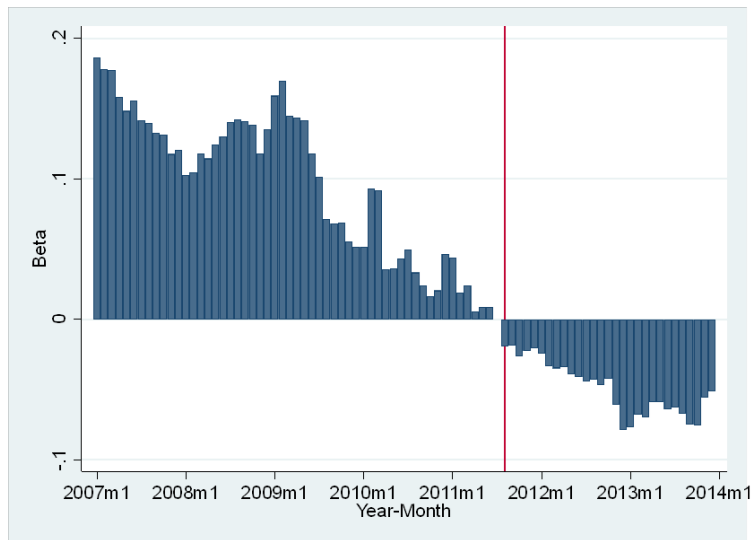


Table 1: Structure of the Macroprudential Levy

Maturity	Domestic banks		Foreign bank branches	
	arm's length	interoffice	arm's length	interoffice
less than 1 year	20 bps	20 bps	20 bps	20 bps
between 1 and 3 years	10 bps	10 bps	10 bps	0 (exempt)
between 3 and 5 years	5 bps	5 bps	5 bps	0 (exempt)
greater than 5 years	2 bps	2 bps	2 bps	0 (exempt)

Note: This table summarizes the structure of the macroprudential levy imposed on domestic banks and foreign bank branches differentially for short-term and long-term FX liabilities.

Table 2: Summary Statistics for Bank-level FX Liability Structure

	Domestic banks			Foreign bank branches		
	mean	median	s.d.	mean	median	s.d.
non-core FX borrowings	52.3%	49.2%	20.6%	65.1%	72.2%	28.9%
of which short-term	19.6%	14.9%	18.2%	54.2%	56.3%	30.6%
of which interoffice	1.3%	0.0%	1.9%	43.1%	39.3%	30.0%
core FX borrowings	14.8%	12.0%	12.0%	2.7%	0.4%	7.6%
# of unique entities		19			43	

Note: This table provides summary statistics for domestic banks and foreign bank branches over the sample period (2007-2013). Each component of FX liabilities is expressed in percent of total FX liabilities.

Table 3: Parallel Pre-trend Between Foreign Bank Branches and Domestic Banks

	(1)	(2)	(3)	(4)	(5)
non-core FX borrowings include:	All short-term	Interoffice short-term	Arm's length short-term	Arm's length long-term	All s.t. levy
(Foreign bank branches) _t X T _t	0.000 (0.001)	0.001 (0.001)	-0.000 (0.001)	-0.002** (0.001)	-0.002 (0.001)
Observations	3,024	3,024	3,024	3,024	3,024
R-squared	0.873	0.863	0.754	0.893	0.833
Bank and Time FE	YES	YES	YES	YES	YES

Note: The dependent variable is non-core FX borrowing as a share of total FX liabilities, where non-core FX borrowing includes all short-term FX borrowing in column (1), interoffice short-term FX borrowing in column (2), arm's length short-term FX borrowing in column (3), arm's length long-term FX borrowing in column (4), and all types of FX borrowing that are subject to bank levy (all short-term plus arm's length long-term FX borrowing) in column (5). The explanatory variable is an interaction between the dummy variable for foreign bank branches and a linear time trend variable (T), reflecting a linear time trend for foreign bank branches relative to that for domestic banks. Coefficient estimates in columns (2) and (3) sum to the coefficient estimate in column (1), while coefficient estimates in columns (1) and (4) sum to the coefficient estimate in column (5). All columns include bank and time (year-month) fixed effects. The sample covers the pre-levy period from January 2007 to July 2011. Standard errors are clustered at the year-month level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Table 4: Maturity Structure of FX Borrowings Before and After the Levy (w/o FEs)

	(1)	(2)	(3)	(4)	(5)
non-core FX borrowings include:	All short-term	Interoffice short-term	Arm's length short-term	Arm's length long-term	All s.t. levy
(Foreign bank branches) _t	0.394*** (0.004)	0.361*** (0.005)	0.033*** (0.006)	-0.288*** (0.006)	0.106*** (0.006)
(Post) _t	-0.140*** (0.008)	0.003*** (0.000)	-0.142*** (0.008)	0.096*** (0.007)	-0.044*** (0.004)
(Foreign bank branches) _t X (Post) _t	-0.136*** (0.005)	-0.137*** (0.008)	0.001 (0.008)	-0.098*** (0.007)	-0.233*** (0.008)
Observations	4,702	4,702	4,702	4,702	4,702
R-squared	0.395	0.305	0.092	0.625	0.157
Bank and Time FE	NO	NO	NO	NO	NO

Note: The dependent variable is non-core FX borrowing as a share of total FX liabilities, where non-core FX borrowing includes all short-term FX borrowing in column (1), interoffice short-term FX borrowing in column (2), arm's length short-term FX borrowing in column (3), arm's length long-term short-term FX borrowing in column (4), and all types of FX borrowing that are subject to bank levy (all short-term plus arm's length long-term FX borrowing) in column (5). Explanatory variables include an indicator variable for foreign bank branches (Foreign bank branches); the period after an introduction of bank levy (Post), and their interaction terms (Foreign bank branches X Post). Coefficient estimates in columns (2) and (3) sum to the coefficient estimate in column (1), while coefficient estimates in columns (1) and (4) sum to the coefficient estimate in column (5). The sample covers the period between 2007 and 2013. Standard errors are clustered at the year-month level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Table 5: Maturity Structure of FX Borrowings Before and After the Levy (w/ FEs)

	(1)	(2)	(3)	(4)	(5)
non-core FX borrowings include:	All short-term	Interoffice short-term	Arm's length short-term	Arm's length long-term	All s.t. levy
(Foreign bank branches) _i X (Post) _t	-0.119** (0.055)	-0.119*** (0.039)	-0.000 (0.047)	-0.090** (0.038)	-0.209*** (0.045)
Observations	4,702	4,702	4,702	4,702	4,702
R-squared	0.792	0.768	0.670	0.879	0.758
Bank and Time FE	YES	YES	YES	YES	YES

Note: The dependent variable is non-core FX borrowing as a share of total FX liabilities, where non-core FX borrowing includes all short-term FX borrowing in column (1), interoffice short-term FX borrowing in column (2), arm's length short-term FX borrowing in column (3), arm's length long-term FX borrowing in column (4), and all types of FX borrowing that are subject to bank levy (all short-term plus arm's length long-term FX borrowing) in column (5). The explanatory variable is an interaction between two dummy variables for foreign bank branches and the period after an introduction of bank levy. Coefficient estimates in columns (2) and (3) sum to the coefficient estimate in column (1), while coefficient estimates in columns (1) and (4) sum to the coefficient estimate in column (5). All columns include bank and time (year-month) fixed effects. The sample covers the period between 2007 and 2013. Standard errors are clustered at the year-month level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Table 6: The Pass-through of the Levy to Lending Rates

	(1) First stage: Discrete		(3) First stage: Continuous	
FX borrowing includes:	All short-term	All s.t. levy	All short-term	All s.t. levy
(Share of FX borrowing) _{it}	0.019*** (0.004)	0.016*** (0.003)	0.026*** (0.004)	0.026*** (0.004)
<i>instrumented by</i>	<i>(Foreign bank branches)_i X (Post)_t</i>		<i>(Foreign bank branches)_i X (Time)_t</i>	
Observations	17,198	17,198	17,198	17,198
Borrower-time and borrower-lender FE	YES	YES	YES	YES

Note: The dependent variable is transaction-level domestic FX lending interest rate charged by lending bank *i* to borrower *b* at *t*. The explanatory variable is non-core FX borrowing as a share of total FX liabilities, instrumented by an interaction between foreign bank branches and time dummy variables. The first stage features discrete time dummy in columns (1) and (2) and continuous time dummy in columns (3) and (4). Non-core FX borrowing in the explanatory variable includes all short-term FX borrowing in columns (1) and (3) and all types of FX borrowing s.t. levy (all short-term FX borrowing plus arm's length long-term FX borrowing) in columns (2) and (4). All columns include borrower-time (year-month) and borrower-lender fixed effects. The sample covers the period between 2007 and 2013. Standard errors in parentheses are clustered at two levels (lender-time and borrower-lender). *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

A Appendix: Forward Position Cap

In the main text, we focused exclusively on the macroeconomic stability levy implemented in August 2011. However, as we briefly mentioned above, the authorities also introduced a leverage cap on the notional value of foreign exchange derivative contracts—including both currency swaps and forwards—that became effective earlier in October 2010. As such, this appendix addresses a potential concern that we might have incorrectly attributed the effect of the leverage cap policy to the levy.¹⁶

Specifically, the leverage cap was initially set at 250 percent of their capital for foreign bank branches, while it was set at 50 percent of their capital for domestic banks. Figures A.1. and A.2. illustrate the extent to which the leverage cap was binding in the Korean banking sector. It was particularly effective for a few foreign bank branches that used to be dominant players in the foreign currency derivatives market.

Considering that the effects of the leverage cap must have been, if anything, strongest for those foreign bank branches that had a forward position in excess of the cap prior to the introduction of the leverage cap policy, we investigated the following specifications:

$$Y_{it} = \beta_1 \text{Foreign}_i \times \text{Post}_t + \beta_2 \text{ForeignBinding}_i \times \text{Cap}_t + FE_i + FE_t + \varepsilon_{it},$$

where Y_{it} and $\text{Foreign}_i \times \text{Post}_t$ are defined as earlier, and FE_i and FE_t denote individual bank and monthly fixed effects, respectively. The additional term, $\text{ForeignBinding}_i \times \text{Cap}_t$, is supposed to separately identify the effects of the leverage, constructed as an interaction variable between the dummy variable for foreign bank branches with a forward position above the cap three months prior to the introduction of the leverage cap and the period dummy variable between the introduction of the leverage cap and that of the levy.

Table A.1. summarizes the regression results, confirming the negligible effect of the leverage cap on the maturity structure of foreign currency borrowings by foreign bank branches. First of all, the coefficient estimates of the first interaction term between foreign bank branches and the post-levy period dummies are almost identical to those reported in Table 2 across all columns. Moreover, the coefficient estimates of the second interaction term is much smaller in size and imprecisely estimated, suggesting that our main findings were unlikely to be contaminated by the effect of the cap.

¹⁶In fact, Figures 7 and 8 already suggest that the abrupt decline in the short-term foreign currency borrowings by foreign bank branches did not happen immediately after the leverage cap until the levy was introduced.

Figure A.1: Forward ratio of domestic banks and foreign bank branches

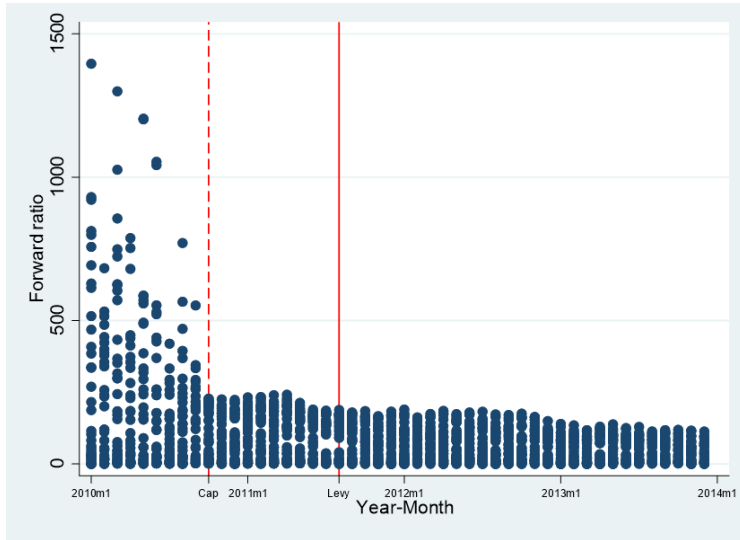


Figure A.2: Forward ratio of foreign bank branches

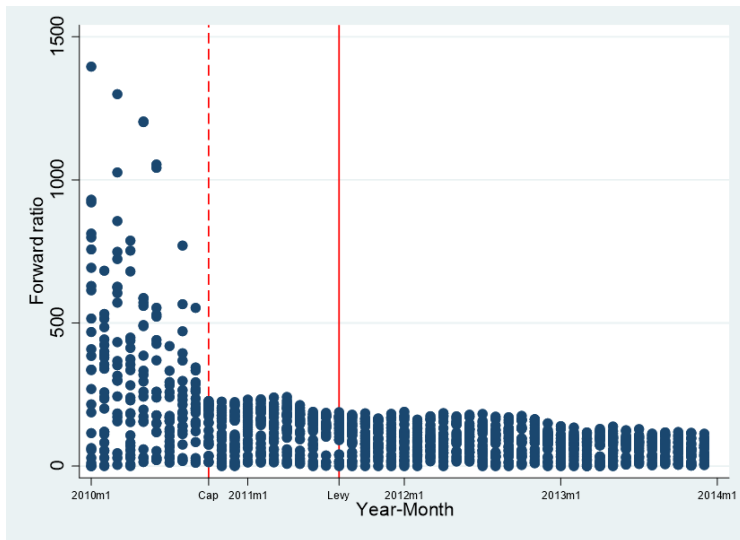


Table A.1: Effect of the Levy vs. Effect of the Leverage Cap

	(1)	(2)	(3)	(4)	(5)
non-core FX borrowings include:	All short-term	Interoffice short-term	Arm's length short-term	Arm's length long-term	All s.t. levy
(Foreign bank branches) _i X (Post) _t	-0.121** (0.056)	-0.116*** (0.040)	-0.004 (0.048)	-0.091** (0.038)	-0.212*** (0.046)
(Binding Foreign bank branches) _i X (Cap) _t	-0.030 (0.023)	0.052 (0.038)	-0.082** (0.039)	-0.026** (0.012)	-0.056** (0.024)
Observations	4,702	4,702	4,702	4,702	4,702
R-squared	0.792	0.768	0.672	0.879	0.759
Bank and Time FE	YES	YES	YES	YES	YES

Note: The dependent variable is non-core FX borrowing as a share of total FX liabilities, where non-core FX borrowing includes all short-term FX borrowing in column (1), interoffice short-term FX borrowing in column (2), arm's length short-term FX borrowing in column (3), arm's length long-term FX borrowing in column (4), and all types of FX borrowing that are subject to bank levy (all short-term plus arm's length long-term FX borrowing) in column (5). The explanatory variable is an interaction between two dummy variables for foreign bank branches and the period after an introduction of bank levy as well as the one between dummy variables for foreign bank branches and the period after an introduction of the leverage cap and before that of the levy. Coefficient estimates in columns (2) and (3) sum to the coefficient estimate in column (1), while coefficient estimates in columns (1) and (4) sum to the coefficient estimate in column (5). All columns include bank and time (year-month) fixed effects. The sample covers the period between 2007 and 2013. Standard errors are clustered at the year-month level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.