WP/21/94

IMF Working Paper

Emerging Market Securities Access to Global Plumbing

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INTERNATIONAL MONETARY FUND

 WP/21/94

IMF Working Paper

Monetary and Capital Markets Department

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Authorized for distribution by Jihad Alwazir

March 2021

Abstract

What are the constraints that have stalled EMs efforts to reuse their securities in international financial centers? We discuss the economics of collateral re-use and the present institutional structure in Asian and Latin American countries. Our empirical investigation suggests pledgeability enhances financial stability and reduces dollar funding risk. We also explain the Eurozone collateral pool to incentivize EMs, and why many securities (e.g., BTPs, Italy) are acceptable in London but not EM securities. Looking forward, EMs liaison with International Central Securities Depositories (ICSDs), and global banks' balance sheet capacity to intermediate cross-border collateral will be crucial for this market to develop.

JEL Classification Numbers: G21; G28; F33;K22;G18;G15

Keywords: EM securities, global plumbing, collateral markets, Asia, Latin America, Eurozone

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[1] The paper has been discussed at IMF's MCM Policy Forum (November 2020), and the Asian Prime Collateral Forum (December, 2020) and benefitted from comments by participants, especially Tobias Adrian, Darrell Duffie, Ulrich Bindseil, James Aitken, Bhavna Haswani, Saturo Yamadera, Federico Galizia, Josh Galper, Luc Vantomme, Kyungsoo Kim, Jun Hwan Lim, Phil Prince, Grigorios Markouizos, and colleagues at Euroclear.

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I. Introduction to Economics of Collateral Re-Use

Collateral flows lie at the heart of market liquidity, and correspondingly, are a good indicator of financial stability. While critical to the functioning of the financial system, we still lack a good understanding of many aspects of these markets. In addition, as policymakers begin to acknowledge the inadequacies of traditional theories of money and lending, collateral flows are increasingly recognised to be just as important a driver of credit creation as money itself. Despite this, a true appreciation of the importance of collateral flows is hampered by the inadequacy of the way in which they are accounted for. Collateral availability and flows are a major element of market liquidity, and hence of financial stability.

A greater part of the global economy relies on the Eurodollar system for their funding needs, and shocks from the United States almost always spills over and destabilizes emerging markets (EMs). Official liquidity facilities are only for advanced EMs with sizable Treasury holdings, and the most EMs can do during turbulent periods are transactions via FX swap markets. Looking into the balance sheets of EMs, we see sizable assets with no cross-border pledgeability, and most pledgeable assets are U.S. dollar-denominated.

The initial condition of relying only on external FX reserves (or swap lines) for financial stability needs to be re-evaluated. The low cross-border asset pledgeability of EM securities remains a key factor for the lingering financial instability in the region. With this background, it is difficult to improve financial plumbing because there is limited room for EM central banks to change the status quo. Since this is a familiar story across EMs, central banks in their respective regions need to address the issue with a coordinated effort by laying the foundation for the expanded use of eligible collateral towards cross-border transactions.

EMs need to learn from such episodes so that their securities can be re-used in the global pipes (perhaps initially in bilateral or regional pipes). Bilateral pipes may be in the works. Recently J.P. Morgan executed its first Hong Kong/China Stock Connect trade where China A shares were posted as collateral for a securities financing transaction. This is one of the first instance of an agent lender accepting this form of collateral on behalf of its beneficial owner clients (i.e., foreign investors do not interact with ChinaClear). The wider use of China-A shares marks a significant step forward in the internationalization of the Hong Kong/China Stock Connect. Similar discussion appear to be in the works for a cross-border DVP link, or a bilateral pipe, between Japan and Hong Kong where JGBs may be used as collateral for financing in HK (Bank of Japan, 2018).[1]

This section highlights the economics behind collateral re-use, the main "pipes" in the global plumbing, and questions why EMs are not yet part of these pipes. The next sections look at this theme from Asia's perspective (Section II, including a case study on South Korea); the Latin

[1] DvP (delivery versus payment) is a link between a securities transfer system and a funds transfer system that ensures that delivery occurs if, and only if, payment occurs.

America's angle (Section III, including a case study of Mexico); followed by the Eurozone's experience with collateral pooling (Section IV). We conclude by providing suggestions on what some EMs can do to graduate from the "original sin"; specifically we discuss (a) global banks that are active in the pledged collateral market can swap their excess reserves (i.e., in U.S. dollar/Euro holdings) for higher returns via haircuts on EM collateral—see Box 5; or, (b) International Central Securities Depositories (ICSDs) liaise with local authorities on regulatory issues in order to accept securities offshore or, (c) central banks' cross-border collateral pool.[2] Asset management firms (pension funds, insurance funds, sovereign wealth funds and related official sector accounts) typically demand *specific* collateral. Hedge funds are the primary suppliers of pledged collateral to this market that is largely dominated by approximately twenty dealer-banks active in peddling collateral globally; over half of this market is sourced via hedge funds.[3]

Annex 1 provides empirical support that pledgeability provides a cushion during crisis and thus contributes towards financial stability.

A. The Global Pledged Collateral Market

For overall financial lubrication, the financial system requires collateral and money for intraday debits and credits. The cross-border financial markets traditionally use "cash or cash-equivalent" collateral (i.e., money or highly liquid fungible securities) in lieu of cash to settle accounts. Financial collateral does not have to be highly rated AAA/AA: as long as the securities (which can be either debt or equity) are liquid, mark-to-market and part of a legal cross-border master agreement, they can be used as "cash equivalent". However, post-Lehman, it is more difficult to pledge lower-rated collateral and at higher haircuts. In this way, collateral underpins a wide range of secured funding and hedging (primarily with OTC derivatives) transactions. Increasingly, collateral has a regulatory value as well as being cash equivalent. Such financial collateral has not yet been quantified by regulators and is not (yet) part of official sector statistics but is a key component of financial plumbing.[4]
The term "pledged for reuse" means that the collateral taker has the right to reuse it in their own name. Its practical effect is economically equivalent to title transfer (i.e., a change in

[2] As an example, collateral must be pledgeable to the funding source via an ICSD. During crisis, unsecured U.S. dollar funding may be prohibitively expensive that banks will be willing to pay a penalty rate at a central bank swap line to get secured U.S. dollar funding (e.g., PBOC could also be a U.S. dollar funding provider in the region)—Duffie (2020, at Asia Prime Collateral Forum, December).

[3] A sset managers (except hedge funds) or their affiliates are active in the specific collateral market. For example, asset managers are instrumental in the securities-lending of German Bunds; market sources indicate 40 bps revenue for very short tenor (2-4 weeks). Similarly, Blackrock is active in reusing its sizable ETF portfolio as collateral. Also, see FSB Page 16-27 (https://www.fsb.org/wp-content/uploads/P161220.pdf discusses) OFI or "other financial intermediaries" and their collateral activities; these securities are not EM securities (e.g., footnote 52 on MMF collateral; but 90 percent are US Treasuries).

[4] Duffie (2013) defines "Plumbing" as a common metaphor for institutional elements of the financial system that are fixed in the short run and enable flows of credit, capital, and financial risk. This institutional structure includes some big "valves and pipes" that connect central banks, dealer banks, money-market funds, major institutional investors, repo clearing banks, over-the-counter (OTC) derivatives central clearing parties, and exchanges.

ownership) and is essential to the financial lubrication that makes collateral akin to cash equivalent. In the bilateral market, contracts that embrace repo, securities lending, OTC derivatives and customer margin loans generally involve title transfer. Under a title-transfer arrangement the collateral provider transfers ownership of collateral to the collateral taker. The latter acquires full title to the collateral received and, as its new owner, is completely free to utilise it. In return, the parties agree that, once the collateral provider has discharged its financial obligation to the collateral taker, the collateral taker will return equivalent collateral to the collateral provider. Note that the obligation is to return equivalent collateral, that is to say securities of the same type and value terms, but not the original security. This point about equivalence is important. After the collateral has thus changed hands via title transfer and been reused by the collateral taker, it would not be obligatory on the part of the collateral taker to return exactly the same property initially received as collateral. A simplistic example is a physical US$10 bill with serial number XYZ. If you provide that very bill as collateral to the collateral recipient, it does not matter if they give you back a different US$10 bill—any ten-dollar bill will do. Although the terms "rehypothecation" and "pledged collateral that can be reused" are often employed interchangeably, each has a specific and slightly different meaning.[5]

"Rehypothecation" means the use of financial collateral by a collateral taker as security for their own obligations to some third party (i.e., onward pledging). Reuse is broader in scope, encompassing not only repledging but also any use of the collateral compatible with ownership of the property (such as selling or lending it to a third party). Not all pledged collateral can be reused in this way. Rights of reuse are thus inherent in title-transfer financial collateral arrangements—because ownership of the property actually changes—whereas, under a pledge, the collateral taker takes a security interest only in the pledged assets and will enjoy rights of rehypothecation only if re-use is expressly granted in the pledge agreement.

Within the United States, rehypothecation rights are strictly limited. Outside the United States (i.e., outside New York-governed contracts), the prevalence of rehypothecation allows for a market clearing price for financial collateral (i.e., United Kingdom and continental Europe). Rights of reuse have a strong legal underpinning under the Financial Collateral Directive of the E.U. The E.U. legal framework for financial collateral is flexible and can accommodate the preferences of prudent and risk-averse clients and counterparties. Whether or not sophisticated market participants strike bargains that offer them appropriate protection is a matter for them alone to decide. Generally, U.K. broker-dealers operate subject to

[5] Under a pledged collateral agreement, the collateral taker, or the "pledgee", does not have automatic rights of reuse or rehypothecation in the pledge agreement unless such rights of reuse are expressly granted in the contract. The pledgee will not be able to seize or use that pledged collateral for their own purposes unless the "pledegor" defaults on their obligation to the pledgee, triggering enforcement. However, in cases where a pledgor, or collateral provider, grants a pledgee rights of rehypothecation over pledged collateral, and if the pledgee has exercised this right prior to insolvency, the pledgor's legal rights are as if they had transferred title in the property to the pledgee. The pledgor's legal remedies against an insolvent pledgee are, in practice, extremely limited.

contractually agreed reuse limits.

Some policymakers, especially in the financial stability groups (e.g., FSB, CPSS, IOSCO), perceive "rehypothecation" to be systemically important and risky (but some central banks like ECB have recently encouraged their national banks to re-use good collateral via securities lending!).[6] However, ordinary banking is not fundamentally different. In economic terms, the "reuse" or rehypothecation of a security is identical to the money creation that takes place in commercial banking through the process of accepting deposits and making loans. So why is it that a US$100-dollar deposit at a bank can be lent, but financial collateral that is mark-to-market at US$100-dollar is restricted for reuse by policymakers? A bank such as Citi has capital; so does shadow banking via haircuts and overcollateralization whenever collateral is reused. Succinctly put, securities reuse and credit creation by the banks present both risks and benefits to the financial system and the real economy.

B. Regulatory Attention to Collateral Reuse Post-Lehman

Since the Lehman Brothers bankruptcy, there has been criticism in the United States that the United Kingdom has not had rigid quantitative regulatory caps on rehypothecation equivalent to those applicable to broker-dealers regulated by the Securities and Exchange Commission (SEC) in the United States (even though many U.K. brokers agree caps in contracts). Specifically, some feel that this asymmetry is akin to regulatory arbitrage and that the United Kingdom offers a unique forum for "unlimited rehypothecation" (see Box 1).

But these criticisms risk overlooking three significant counterarguments. First, as subsequent litigation revealed, the U.K. broker Lehman Brothers International Europe (LBIE) appeared to have broken the U.K. rules on client asset segregation. In certain cases, it appears that LBIE had not been properly segregating client property. Quantitative limits on reuse do not protect clients whose brokers do not follow the rules. Second, it could be argued that Lehman clients who had voluntarily agreed to give broad rights of reuse in their prime-brokerage contracts essentially got what they bargained for when LBIE failed. Those clients (for the most part, professional and sophisticated counterparties) had misjudged the counterparty credit risk on Lehman—but they had not been cheated any more than an uninsured depositor is "cheated" by a failing bank. Third, the supposed uniqueness of the U.K. legal regime is perhaps overplayed: the types of counterparties that go to London rather than, say, Frankfurt or Paris, do so not so much for any unique features of U.K. law. In fact, the strong legal basis for title-transfer financial collateral actually has its roots in English law, which also underpins the Financial Collateral Directive of the E.U. The market is in London not because it offers unique arbitrage, but because U.K. courts are viewed with a

[6] Despite FSB's remarks on leverage and financial stability, good collateral re-use is encouraged. For e.g., ECB's securities lending now allows regional central banks (Banca d'Italia, Bundesbank, Banque de France) to swap collateral against cash since Jan 2017 (relative to collateral against collateral only)—and re-use has increased (e.g., for Bunds); this has reduced the wedge between Bund repo and ECB's minus 50 bps policy rate.

long history of contractual adjudication and legal principles.

An important distinction is interpretation of the prefix "re" in "rehypothecation". In the United States, this is normally done with a pledge with consent to reuse. So, there is a clear distinction between pledged securities and sold securities. However, in Europe a repo is a contract of sale with a promise to repurchase at an agreed future date and price. "Legally, if I sell securities, the resulting securities are no longer my securities; and, if these securities are then onward re-pledged, that is not a rehypothecation from my angle! However, is this economically different if I sell securities on the basis that you agree to sell me equivalent securities at some future time? The (present) Basel approach is on the lines that the existence of the promise to sell back means that the original sale is no longer a 'pure' sale, and therefore caught by the rehypothecation restrictions" (Singh, 2020).

C. Global "Pipes" that Move Collateral

Collateral use and reuse in financial markets is large. Before the Lehman crash, the volume of funding via pledged collateral (including title transfer) was about US$10 trillion, higher than the U.S. broad measure of money, M2. The accounting of pledged collateral suggests that many banks were (and remain) funded via collateral. In fact, Lehman's last annual balance-sheet size was US$691 billion; but, as per balance-sheet footnotes, pledged collateral received that Lehman could reuse in its own name was US$798 billion (end-2007). Also, the words "fair value of securities" entail that the securities are transferred at market prices (i.e., there is haircut or overcollateralization when collateral moves within the financial system). Lehman's last annual report said:

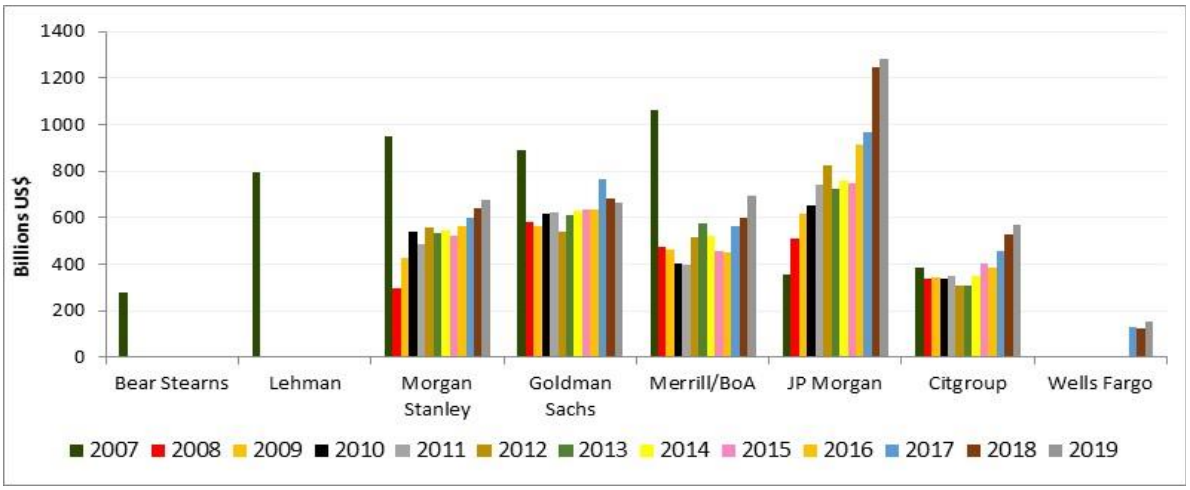
At November 30, 2007, the fair value of securities received as collateral that were permitted to sell or repledge was approximately $798 billion … The fair value of securities received as collateral that was sold or repledged was approximately $725 billion at November 30, 2007

Typically, descriptions in annual reports for pledged collateral are remarkably similar in the financial statements of both U.S. and European dealers; thus, data on pledged collateral is, at least to some extent, comparable across these institutions. For example, the Swiss bank UBS had a balance sheet of over CHF2.2 trillion as of end-2007. The off-balance-sheet collateral received that can be onward repledged was almost CHF1.5 trillion, and only a fraction shows up on the balance sheet. The latest regulatory definition of leverage allows for netting under certain conditions; so all off-balance-sheet transactions will not be picked up when calculating leverage.

The volume in this market is considerable, and not fully under- stood by everyone due to legal, accounting and related market complexities. In either case, if pledged-collateral use/reuse or market value drops—and this market crashed to about half its size, from US$10 trillion (globally) to just over US$5 trillion during 2008–9 (see Figures 1 and 2)—financial intermediation slows. Pledged collateral from bilateral, securities lending, prime

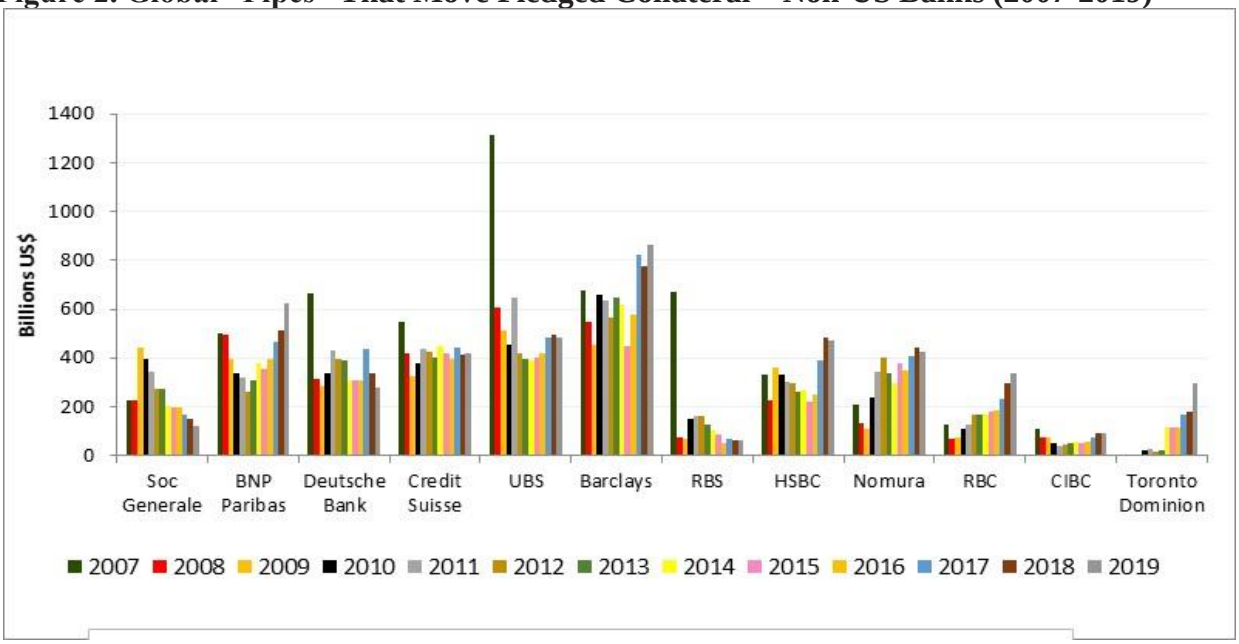
brokerage and OTC derivatives margin is hard to disentangle as it only appears as bunched up footnotes to balance sheets. Perhaps a detour, but collateral velocity, a metric based on global use/reuse of pledged collateral has declined from about 3.0 before Lehman to below 2.0 in the aftermath of Lehman and continued to remain below 2.0 during Eurozone crisis (2011/12) and the new regulatory era. Only since 2017, has the velocity rebounded about 2.0 as dealer banks (and new entrants like Canadian banks, Nomura, HSBC) find ways around the new regulations.

Figure 1. Global "Pipes" That Move Pledged Collateral–US banks (2007-2019)



Source: Singh (2020) and hand-picked data from Annual reports

Figure 2. Global "Pipes" That Move Pledged Collateral—Non-US Banks (2007-2019)



Source: Singh (2020) and hand-picked data from Annual reports

Unsurprisingly a study carried out by the Office of Financial Research at the OFR, U.S. Treasury, (Baklanova, et al, 2019) only provides a range for the bilateral repo market of around US$1–2 trillion (and only for the U.S. market, not globally). Such a slowing in collateral usage—and hence in secured lending as a whole—is exactly analogous to a drying-up of interbank markets. Under such circumstances, the distinction between "good" and "bad" collateral becomes crucial. [7]

From regulatory and accounting perspective, there is a wedge between off-balance-sheet footnotes on pledged collateral (via repo, sec-lending, OTC derivatives in the money and prime-broker loans), and on-balance-sheet entries (which may pick up only a slice of the off-balance-sheet funding). The wedge is not identical across the key banks. Some, such as Lehman, significantly funded themselves off balance-sheet. However, due to recent regulatory proposals such as leverage ratio and the Liquidity Coverage Ratio (LCR), banks' business models are changing. For example, all global regulators, including in the United States, European Union, implemented the LCR with a phased-in timetable between 2015 and 2020. There may still be difference in reporting under International Financial Reporting Standards (IFRS) and Generally Accepted Accounting Principles (GAAP), but the off-balance-sheet entries are similar, to make relevant comparisons. Box 1 summarizes rehypothecation rules in the United Kingdom relative to the United States.[8]

Bilateral Collateral vs Triparty Repo market—a useful detour: Think of the bilateral repo market as analogous with the old-clothing trade: typically, merchants in developed countries shrink-wrap old clothes in shipping-container sized bundles and send the plastic-wrapped blocks to poorer countries. There, a clothing broker buys it and resells it by weight to jobbers. Buyers pay to gather around the jobber, those who are in close pay more for the prime spots compared with those on the outside. Then the jobber pops the bundle open with a knife and the shrink-wrap literally explodes; everyone gathered around jumps for the best pieces. Collateral desks are a bit like those jobbers. Big lots come in from hedge funds and security lenders, and the collateral desks at large banks will paw through it, searching for gems. Those gems go out bilateral to customers who will pay a premium. The remainder goes to the guys in the back of the line: triparty repo. Banks will generally use securities first in the bilateral market, as it offers a better price, and what does not get used in the bilateral then goes to the triparty market.

[7] In general, the underlying economics is that good collateral should not be silo-ed as UST, Bunds, JGBs etc. are needed for market plumbing (see Singh and Stella, 2012).

[8] To the best of our understanding, there is still no E.U. law which sets a cap on rehypothecation like the U.S. The E.U. approach has been one of disclosure and consent, plus prohibition as regards retail customers (broadly speaking). Despite the noise about Brexit, in the U.K. laws are still in line with the E.U.'s, at least on this issue.

Box 1. Rehypothecation in the United States and in the United Kingdom

In the United States, the SEC's Rule 15c3-3 prevents a broker-dealer from using its customer's securities to finance its proprietary activities. Under this rule, the broker-dealer may use/rehypothecate an amount up to 140 percent of the customer's debit balance (i.e., borrowing from the broker-dealer). As an example, assume a customer has US$500 in pledged securities and a debit balance of US$200, resulting in net equity of US$300. The broker-dealer can rehypothecate up to US$280 of the client's assets (140 percent x US$200). Doing so would create other regulatory complications under Rule 15c3-3, so the efficiency of that rehypothecation would depend on the rest of the dealer's customers. Created by the Securities Investor Protection Act (SIPA), the Securities Investor Protection Corporation (SIPC) is an important part of the overall system of investor protection in the United States. SIPC's focus is very specific: restoring securities (rather than cash) to investors with assets in the hands of bankrupt brokerage firms (e.g., Lehman).

A key reason why hedge funds may have previously opted for funding in Europe is that leverage is not capped as in the United States via the 140 percent rule under Rule 15c3-3. Leverage levels at many U.K. hedge funds, banks and financial affiliates have been higher, as both the United Kingdom and continental Europe do not have a direct parallel to SIPA. Brokers and banks would rehypothecate their clients' assets along with their own proprietary assets. Some recent proposed regulations seem to be at odds with "title transfer". If I transfer title, then the recipient of collateral is able to use that asset in any way they deem fit. This is not compatible with regulations that treat the asset as "client property" and limit rehypothecation, or segregate for the client. In fact, insisting on segregation undermines the legal construction under which title was transferred.

Despite Brexit, there is still no E.U. law which sets a cap on rehypothecation like the U.S. The E.U. approach has been one of disclosure and consent, plus prohibition as regards retail customers (broadly speaking). The U.K. laws are still in line with the E.U.'s, at least on this.

Market practice suggests that rehypothecation of assets has historically been a cheaper way of financing the prime business than turning to the repo market. Empirical work to test this hypothesis has been absent or very limited but may be very relevant if rehypothecation loses ground in the near future. Both prime business and repo financing are key elements whereby collateral lubricates financial plumbing. Lately, even when there is a glut of collateral supply (e.g., in the United States), relative to money, the need to understand the money-to-collateral transactions (or vice versa) that are intermediated via dealer-banks' balance sheets is even more crucial.

II. Asian Collateral Markets and Related Plumbing Constraints

Since a greater part of the global economy relies on the Eurodollar system for their funding needs and the shocks from the United States almost always disrupt the stability in emerging economies, focusing on how to improve the global plumbing using the Asian collateral gives a new perspective to the Asian collateral is needed. Succinctly put, bottlenecks include (i) U.S. wholesale funding market remains unsettled with spillovers to EMs; (ii) exclusive collateral framework with G-SIBs is one of the issues that inhibits plumbing with the Eurodollar system; (iii) fixing the "pipes and valves" of modern finance with something new leads to the introduction of the "rewiring" for better financial plumbing. Because of the reserve-currency status of U.S. dollars, the global stability depends on global access to the emergency secured loans of last resort in dollars. Since securities in Asia have limited pledgeability as collateral, EMs have no other choice but to secure dollar funding.

Official liquidity facilities, e.g., FIMA (Foreign and International Monetary Authorities) repo facility, are primarily for advanced EMs with sizable Treasury holdings, and the most EMs

can do during turbulent periods are transactions via FX swap markets. Federal Reserve Act's section 23A exceptions now require FDIC to agree; thus, it is possible to exempt EM securities (similar to some EMs that have favorable access to FX swap lines).[9]

One of the frictions in the U.S. dollar funding market is that the Fed repo facilities are not inclusive but centralized among the primary dealers. These insiders are heavily regulated and have limited balance sheet space; moreover, they cannot always engage in providing stable dollar credit to non-U.S. clients. Situation in the United States basically dictates the global funding market and spillover effects to EM are especially non-negligible.10 FX swap market (with the lack of cross-currency repo) is vulnerable to persistent, external shocks. The Fed repo and the FX swap arrangement involves risks that cannot be recognized and controlled: G-SIB regulation, reserve-draining intermediation by G-SIBs.

A. Current Situation of Asia's Prime Collateral Market

Asia's responses have been passive and limited. Asia has become more dependent and more vulnerable against external shocks: access to global plumbing is still restricted and has become more challenging. Asia's limited collateral capacity hinders market liquidity, risk management, and profitability. Initial conditions and exigencies skew incumbent's mindset toward status quo: most banks still prefer traditional FX swaps (especially U.S. dollar). Dominance of dollar assets and liabilities is striking in non-U.S. banks' balance sheets. Non-U.S. banks are borrowing large scale to ease currency mismatch on balance sheets. Since the global financial crisis, the dollar swap turnover and outstanding dollar denominated debt securities in Asia are exponentially growing. On the other hand, only a few local currency denominated bonds are eligible as cross-border financing. Notice that outstanding local currency bonds include issuance from the central bank and the government.

In Asia, majority of government bonds (excluding Japan) are not eligible as collateral in cross-border securitized financing. According to the ASIFMA repo survey, Asian collaterals in repo and reverse repo market constitute of only 7.1 percent and 0.5 percent, respectively. Compared to Europe, EM, especially Asia, lacks properly defined eligible collateral framework. Compared with Europe, Asia's collateral fluidity is limited and not yet in sync with global trends; their fragmented markets, coupled with limited pledgeability, results in

[9] Fed's Section 23A, by its terms, exempts certain transactions from its requirements and authorizes the Fed to grant additional exemptions. For example, the statute exempts transactions between sister banks and transactions fully secured by U.S. government securities from most of section 23A's requirements. For certain EMs like Korea, Mexico, a pledged collateral market can be useful during crisis, and may have access to Fed's 13.3 facilities during crisis, akin to U.S. corporate bonds. For other highly rated EMs with liquid collateral, market-based access to U.S. dollar funding during crisis would reduce pressure on US dollar and US Treasuries.

[10] LTCM failure may be reminiscent of Russian collateral (GKOs or Government bonds) losing value in August 1998. However, it was also Salomon Smith Barney liquidating its dollar interest arbitrage positions a month earlier, the divergence between off the run/on the run U.S. Treasuries, widening of credit spread on mortgage products (e.g., Danish)—all going against LTCM positions. However, the bigger picture was LTCM's excessive leverage, (including off balance sheet netting of derivatives), zero haircuts and lax rehypothecation under its prime brokerage contracts etc., that made LTCM vulnerable.

dollar dependent system, which leads to frictions in the Eurodollar system and financial instability.

B. Frictions in Cross-border Collateral Transactions

Frictions in cross-border collateral transactions can be divided into two sections: direct and indirect. Direct frictions include, capital controls, hedging limitations, and inconsistent eligibility criterion. Indirect frictions include poor market infrastructure (e.g., regulatory transparency, price transparency, creditor protection, clearing, and settlement service) and asymmetric legal systems across the region.

Constraints to cross-border collateral transactions in emerging markets include macro conditions and policy mandates for growth and stability, and the legal and regulatory framework should be assessed. Given widely divergent market conditions and backgrounds, it is challenging to synchronize governing laws and regulations across the region.

However, regional central banks can agree on the eligibility criteria for collaterals, organize pool of collaterals accordingly, and disclose them to the market. Collaboration with ICSD, OTC platform on a collateral pool can serve as a viable option. close coordination between ICSD and CSD is essential for effective and interoperable market infrastructure in cross-border transactions. In practice, EM securities are most commonly accessed and held by asset managers via global custodians who normally use local sub-custodians that are direct CSD participants in the local (emerging) market. In Europe one of the biggest providers of such services are the ICSDs which also offer sophisticated tri-party collateral management services for repos or securities lending. According to sources, ICSDs provide access for their customers to around 50-60 domestic securities markets in a similar number of currencies. In addition, the well-known major global custodians (e.g., BONY, JPM, Euroclear, Clearstream, Citi, etc.) usually cover more than a hundred markets. They all offer tri-party collateral management for securities financing transactions, which still remains a different story in EMs where plumbing is still a problem.

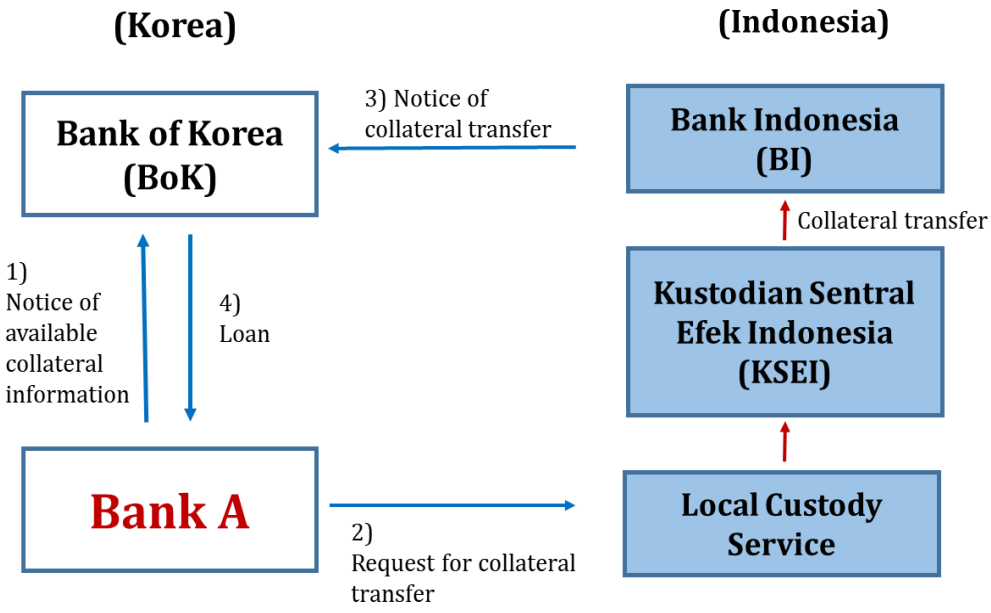
C. Central Bank Collateral Arrangement (CBCA)

In Asia, there are real demands for trade financing, development financing, etc. A tiered collateral pool based on CBCA criteria can allow better market access for periphery countries. Collateralized, and pledgeable assets are “information insensitive” cross-border tool for financial plumbing. Inclusive financial plumbing may also overcome persistent clogging problems in the Eurodollar system. Cross-border Collateral Arrangement (CBCA) allows regional central banks to accept collateral denominated in foreign currency or located in a foreign jurisdiction to support funding to financial institution. There are different practices of how CBCAs are conducted. Box 2 illustrates the correspondent central banking model (Asia) model with an example between Korea and Indonesia. The example is not simple a payments’ swap between the two currencies but includes securities as collateral and a local CSD/custodian.

Box 2. The Correspondent Central Banking Model (CCBM)

This box illustrates a CCBM between two countries, Korea and Indonesia. Bank A in Korea plans to acquire KRW funding via Bank of Korea (BoK) by collateralizing Indonesian securities.

- Bank A files a notice to BoK that specifies information of the available collateral.
- Bank A requests Indonesian local custody service to transfer stored asset (collateral) to the central securities depository of Indonesia (KSEI).
- KSEI transfers received collateral to the central bank of Indonesia (BI).
- Confirming the transfer, BoK provides loans to bank A.



Box 3 is a case study on Korea and highlights the typical constraints faced locally in EMs. Asia, unlike Eurozone with a unified currency, needs cross-currency collateral market and regional central banks are best placed to initiate this.[11] [Nordic collateral pool is another example but hinges on interoperability of all central banks]. Even if a small step, CBCA with relevant market infrastructure can kickstart the plumbing by promoting the use of local currency bonds as eligible pledged collateral.

[11] Eurozone is moving to ECMS—Eurosystem Collateral Management System. Communication will be enhanced, but not the legal issues that have undermined the CCBM model (variant of CBCA) in Eurozone.

Box 3. The Case of Korea

This section investigates Korea's laws and regulations that apply to cross-border transfers and collateral use, expand the scope of analysis to ASEAN+3 countries, and draw parallels on barriers to developing cross-border collateral markets (China and Japan).

Limitations of current Korean law on collateral: In theory, rehypothecation of collateral may be employed by i) fiduciary transfer of title for security purposes, ii) repo (sale and repurchase agreement), and iii) loan for consumption under the current Korean The question is to ask why the fiduciary transfer of title must be used as a solution to facilitate cross-border collateral transactions. In the repo and loan for consumption, collateral ownership is transferred to the purchaser or the borrower to rehypothecate (or re-use) the collateral. When the borrower declares bankruptcy, the lender may not transfer their bankrupt borrowers' assets as the lender lacks ownership. However, in the fiduciary transfer of title, a secured creditor rehypothecates the requested collateral. Under the incumbent Korean law, 'the right of pledge' does not involve the transfer of title, and thus, one cannot dispose of collateral at will. With 'the transfer of security,' the collateral ownership is acknowledged, but rehypothecation of collateral is restricted. According to the 'Entrusted Transfer of Title' hypothesis, the collateral holder may dispose it to a third party, but according to 'the limited real right' hypothesis, the collateral holder may not do so.

Limitations to Using Fiduciary Transfer of Title in Korea: Fiduciary transfer of title involves the transfer of ownership for security purposes until the debt dissolves. Several financial regulations in Korea currently constrain fiduciary transfer of title; the secured creditor pays the income tax proportion to the holding period of bonds. Moreover, it is illegal for any foreign company to transfer listed securities outside the securities exchange market. Along with repo and loan for consumption, exceptions from financial regulations apply to the title's fiduciary transfer.

KSD monopoly and ICSDs: underutilized third-party platform: In Korea, the Korea Securities Depository (KSD) monopolizes national custodian services. Securities firms need to deposit FX securities at institutions designated by the KSD. The Euroclear and Clearstream offer omnibus accounts so that users can freely make securities transactions wherever ICSD has a presence. Thus, they serve as a gateway to the market by streamlining the transaction process. The Korean government permitted opening an omnibus account with Euroclear and Clearstream to trade government bonds and monetary stabilization bonds, but their use has been negligible Currently, foreign investors can open an omnibus account at domestic financial institutions or KSD. Still, they are not allowed to go through ICSD for securities settlement due to the difficulty of tracking non-residents' transaction records for tax purposes.

The ASEAN Chiang Mai's Initiative, which was established in 2000 following the Asian financial crisis of 1997 to prop up weakening currencies by letting countries exchange local money for the U.S. dollar to prevent capital flight, has opened the doors to China, Thailand, and Indonesia for an alternative to greenback while emphasizing the need to uphold the rules-based multilateral trading system and open regionalism.[12] Since Chiang Mai's backstop is secured, normal operations need to utilize cross-border collateral transactions. Cross-border collateral

[12] The Chiang Mai Initiative (CMI) is the first regional currency swap arrangement launched by the ASEAN+3 countries in May 2000 at an annual meeting of the Asian Development Bank to address the short-term liquidity difficulties in the region and to supplement the existing international financial arrangements. CMI is composed of: (a) the ASEAN Swap Arrangement (ASA) among ASEAN countries, and (b) a network of bilateral swap arrangements (BSAs) among the ASEAN+3 countries (Source: ADB).

arrangements by central banks can boost market-based support in addition to emergency swap arrangements. LATAM also has similar thinking with Mexico, Brazil, and Colombia in the lead.

Succinctly put, plumbing failure starts from the links made on dollar collateral, but underlying mismatches in EM introduce frictions for greater volatility. Asia, in general, needs to upgrade the current FX funding system for better plumbing to overcome its vulnerability. For that, we need collateral capacity-building (both capacity and infrastructure) initiative as well as institution-building with eligible collateral pool.

We also substantiate our paper via empirical work using a "pledgeabilty index", (Annex 1 is self-contained—literature review, methodology and results—and updates Choi 2020); we find that: asset pledgeability contributes toward financial stability via three channels:
(a) capital market development by recognizing the role of collateral, (b) increased shock absorption capacity via collateral management, and (c) the newly activated safe asset provision.

III. Latin America's Experience to Access Global Plumbing

Historically Latin America has been a region with economic struggles, however in past years there have been efforts to put the region in the map for foreign investors and in order to have access to liquidity. A viable securities finance market can significantly increase the vibrancy and profitability of emerging markets. It can help grow the local market, increase foreign investment, and add liquidity. The main idea should be to develop a "global model" that can work for all: local regulators, exchanges and market participants (local and international). México has achieved the most in the region, but the questions remains whether LATAM countries have graduated from the "original sin".

Latin America remains a key investment target for foreigners with local economies eager to grow. With a GDP of US$1.2 trillion, México is the second largest economy in the region behind Brazil with a GDP of US$1.8 trillion according to the World Bank. Other countries of the region such as Argentina, Colombia, Chile, and Peru are also actively trying to boost their financial markets. However, this is not enough and the whole region stills trails vis-a-vis other EMs.

The political instability and currency crisis suffered in the 90´s in Latin America explains, in large part, the slower development of the region. Other countries like Korea have sorted similar crisis and have succeeded in stablishing a flourishing securities finance market, which gives access to liquidity. Therefore, LATAM will need to establish securities finance, and encourage the pipes to access liquidity; this will be the key component to enhance investor confidence.

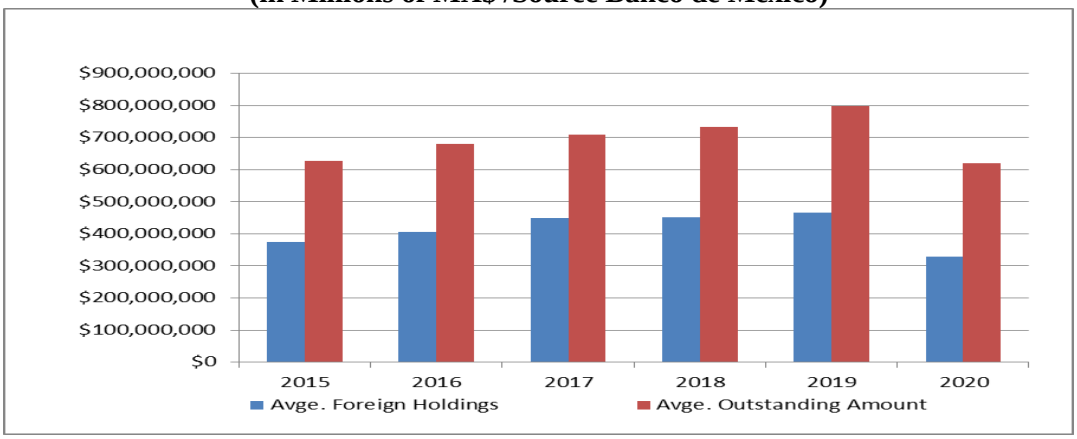
However, it is encourging to see collateral pledgeability come to the forefront in the region; local and foreign investors are in continuous dialogue with local regulators. There are efforts in several Latin American countries: Argentina, reintroduced securities lending in 2017, and has

made efforts to integrate the existing exchanges in order to improve efficiency and facilitate access to the market; Brazil is continuously improving its securities finance model, based on a CCP model (B3); Chile with the introduction of Blockchain in 2018, is one of the most recent countries with Colombia to engage in development of their securities finance market, with Colombia also tending to move to a CCP model; Peru has been engaging in securities finance since 2016 and has been making efforts in looking for new ways to boost their market.

A. The Case of Mexico

Mexico has been a leader in the LATAM region, in large part due to the depth and size of its local debt and equity market and the proximity to the United States. For the past five years, on average 60 percent of the Government bonds have been on foreign hands, reflecting the appeal of investor for México (Figure 3).

Figure 3. Foreigners Demand for Mexican Securities
(in Millions of MX$ /Source Banco de México)



Source: Banco de Mexico

It may come as a surprise, but México has had a domestic securities lending market in place since the ‘90s. So, the question remains why Mexican Assets are not pledgeable offshore? Mexico has adopted regulations in accordance with international standards and there two ways to access the market:

- Through local bilateral agreements
- Through two Electronic platforms: VALPRE (From INDEVAL, local DTC) and MEIPresval (From Grupo CENCOR, private firm).

Regulation allows other competing platforms with previous authorization from the CNBV.

International Agreements such as the Master Securities Loan Agreement (“MSLA”) Global Master Securities Loan Agreement (“GMSLA”) are recognized and allowed by regulation to be signed. MSLA and GMSLA agreements have been signed in the past between Mexican broker dealers and foreign Counterparties allowing Mexican securities to be pledged as

collateral. It is logical to assume that this collateral was reused, so if this has already been done in the past, why cannot we move forward?

Under the current model Mexico has some issues to address as well as some challenges, such as:

- Loans can be booked for same day settlement, T+1 or T+2
- Collateral must be Mexican denominated securities or pesos
- Collateral is transferred "DVP"
- Collateral is held in Indeval in the name of the lending local broker; In the event of a default by either party, Indeval will execute the un-wind process.
- Mexican collateral is not an acceptable form of collateral for many of the large foreign lenders.
- The loan requires the intervention of a foreign broker who can:
- Provide acceptable collateral (U.S. dollars) to foreign lenders.
- Accept Mexican denominated securities or pesos from the local borrower.

Without direct access to Indeval, the intervening foreign broker has no recourse to the local Mexican counter party, thereby creating an inherent risk to the foreign counterpart. Under this current model some interesting proposals arises that could help move forward to a more developed securities finance market (*Banco de México, "México 2018 and Beyond")*:

- Loans may need to be pre-collateralized
- Explore with the Authorities the possibility of including collateral denominated in other currencies (e.g., U.S. dollars)
- Propose to the Authorities the possibility of including Tri-Party Custodians as an approved "sub-custodian" to hold collateral
- May require a country specific addendum to the GMSLA
- Authorities consider allowing foreign dealers access to Valpre/ MEIPresval which would result in direct access to the collateral
- Indeval could consider moving to a full CCP-type model

Potential Advantages:

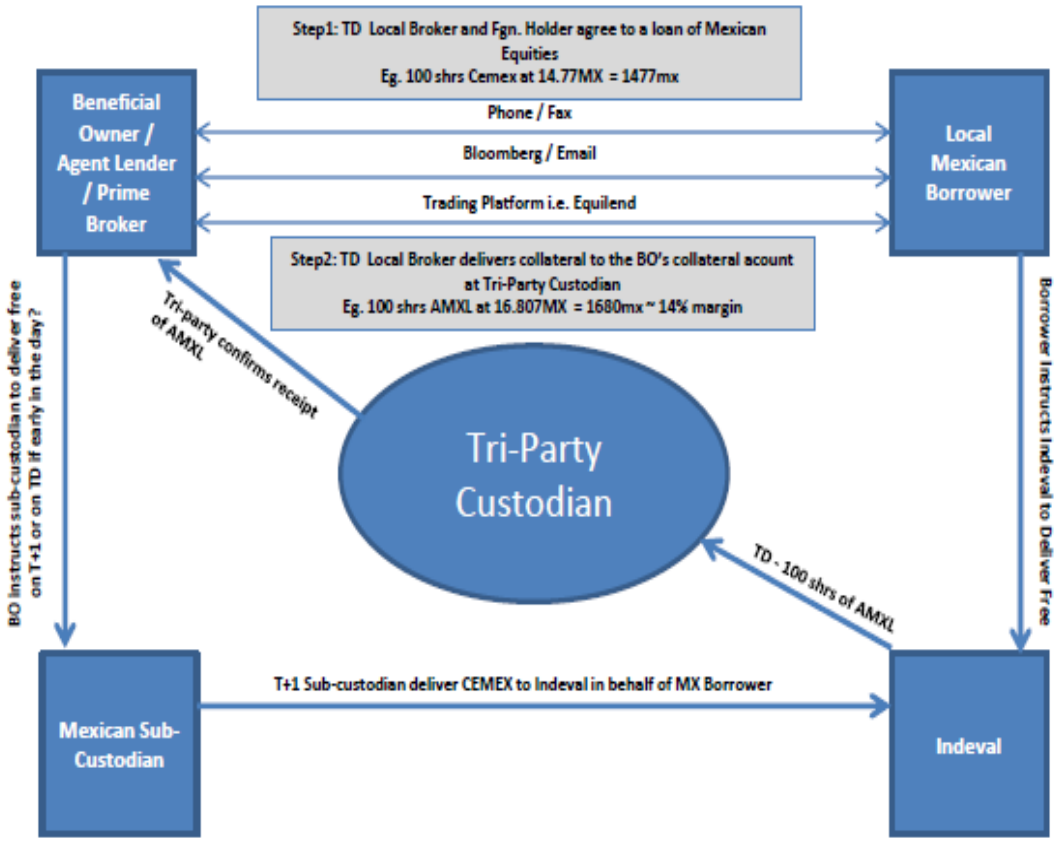
–Direct access to market allows ALL participants to benefit from potential increased economics
–Introduction of Tri-Party provides foreign participants a higher level of comfort and transparency over the pledged collateral
- Allows for "customized" collateral margins (i.e., 102 percent vs. 105 percent vs.120 percent) based on collateral composition and counterparty credit.
– Proposed flows mimic many of the processes utilized in other markets
– Central Bank already familiar with Tri-Party through non-Mexican activity

Potential Disadvantages:

–Adds a level of operational complexity to existing local SBL process
–Requires foreign lenders to take direct credit risk to local borrowers (may limit the universe)
–Would likely require formal regulatory and processing changes within Indeval
- Would they be willing to release control of collateral to a tri-party collateral agent?
–Will require review and/or possible changes to MXN tax regulations with the use of free-of-payment ("FOP") transactions by foreign lenders

As a result, the following model was proposed, in order to help the securities lending market and access to global plumbing (Figure 4).

Figure 4. Proposed Securities Lending Model for Mexico



Source: Risk Management Association

Mexico faces competition against what are denominated "safe assets", "good credit ratings", "U.S. dollar denominated securities". There remain challenges, as mentioned before; however, if Mexican securities is seen as a good form of investment why can they not be acceptable form of collateral? Mexican securities move already across borders, so we need to forget the past and move on and make the pipes flow. If local regulations are attractive and interest from offshore custodians (e.g., BNY Mellon, JP Morgan) or foreign banks in the region (e.g., Scotia Bank) , even if the plumbing is not available, "pipes" will come.This not only applies for Mexico, it can be applied to the LATAM region, and efforts should not be isolated by country; the whole region should stablish a common front and start building those missing pipes to access the global plumbing.[13] Liquidity is of most importance to all

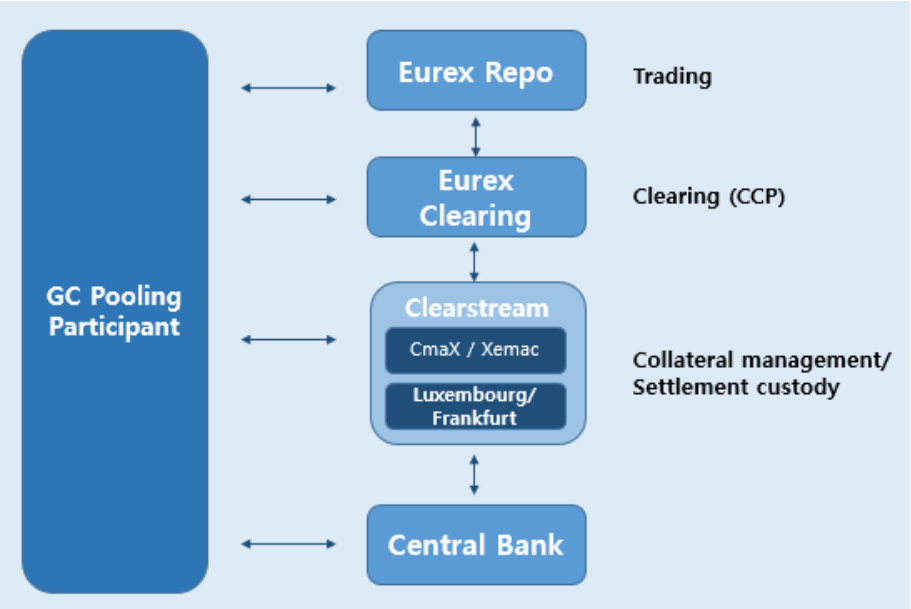
[13] An omnibus structure is different from a "forced segregated structure", as the latter breaks down the collateral into silos, due to tax structures or local CSD (central security depository) rules; example of such segregation has been an issue in S. Korea, Indonesia, Philippines, Malaysia, Brazil and Colombia.

investors globally and is fundamental to the stability in financial markets; thus, the need to graduate from "the original sin" so that liquidity does not bypass LATAM in favor of other EM regions.

IV. EUROZONE GENERAL COLLATERAL POOL

BTPs (Italian bonds) have access to the Eurozone plumbing as Italy is part of the Eurozone. This is very useful in times of crisis for countries to have their collateral accepted at the ECB matrix often at accommodative haircuts (relative to market haircuts).[14] In general, ample liquidity available globally due to QE measures in advanced economies have reduced their liquidity problems as their collateral is pledgeable (with markets or with central banks). Europe's OTC marketplace platform for secured funding and financing, called the Eurex Repo system, offers a general collateral pool in transactions[15]. An available collateral pool (GC pool) refers to a set or *basket* of securities tradable in repos. Securities in the GC pool are interchangeable for one another, without significantly changing the repo rate[16]. The repo transaction's potential cash lender is (except during crisis) indifferent to the securities in a GC basket he will receive. Figure 5 shows the general collateral financing (GCF) trading system of Europe.

Figure 5. European GC (General Collateral) Pooling Market: Eurex Repo



Source: Eurex and Staff estimate

[14] See Turing (forthcoming JFMI) on LCH haircuts vs. ECB haircuts "Clearing away after Brexit"—see references.

[15] Eurex Repo offers the following markets: GC Pooling market, repo market, HQLA^x, and eTriParty Repo. Also see Bank of England collateral framework (Rule, 2012).

[16] Too much scarcity (e.g., German Bunds) will create wedges between policy rate, repo rate and GC pool rate. Also, cash lender (or security buyer) trade the basket of securities, not the individual securities itself.

There are 5 GC Pooling Baskets[17] in the Eurex repo, but we focus on the basket that consists of ECB's eligible securities (Box 4).

Box 4. ECB General Collateral Pooling Baskets

Basket Type		Assets	Credit Requirement	Required Location of Bond Issuance
ECB Basket	•	• Central Banks • Central Govt • Regional / Locational Govt • Supranational Traditional and Jumbo Pfandbriefe style instruments of: • Credit Institutions • Agency Credit Institutions ***Current basket covers 3,000 ECB eligible securities***	• Minimum A- (S&P) / A3 (Moody/s) • For covered bonds: minimum AA- (S&P) and fulfil the LCR HQLA requirements	In the European Economic Area (EEA) or one of the non-EEA G10 countries (i.e., US, Canada, Japan, or Switzerland) ***Current basket contains bonds issued from 9 countries***
ECB EXTended Basket		Instruments of ECB Basket in addition to instruments of: • Credit Institutions • Agency Credit Institutions • Agency-Non Credit Institutions • Corporate and other Issuers ***Current basket covers 14,000 ECB eligible securities***	• Minimum BBB- (S&P) /Baa3 (Moody/s)	In the European Economic Area (EEA) or one of the non-EEA G10 countries (i.e., United States, Canada, Japan, or Switzerland) ***Current basket contains bonds issued from 13 countries***

Source: ECB

Looking at the Eurex GC pool case, EMs countries should collaborate on implementing a unified collateral pool containing central banks' eligible assets that are tiered against its credit ratings (e.g., baskets that range from AAA, A-, etc.).[18] Such a collateral pool would make it available for highly liquid bonds of various regional countries to be freely traded/pledgeable cross-border (global banks' balance sheet constraints matter—see Box 5).

[17] The 5 pooling baskets include ECB Basket, ECB EXTended Basket, INT MXQ Basket, Equity Basket, and CTD Basket.

[18] The AMF (Arab Monetary Fund) is pursuing a cross-border payment system in the region through BUNA, a multi-currency payment platform.

Global bank's balance sheets are constrained post Basel III especially on liquidity ratios, capital and cross-border risk limits. However, there will be trade-offs between financial stability from the prism of bank safety and soundness, relative to a fully functioning financial system with effective plumbing and robust financing flows that support global growth and stability. The optimal balance may not be a fixed equilibrium, but flexible, and will depend on the financial conditions at any given time.

Furthermore, EMs collateral framework will need to adapt if situation warrants. For example, ECB has made changes to its securities-lending program and now allows cash-for-collateral swaps also—the goal is to keep good collateral in the market domain.[19]

Box 5. Global Banks Balance Sheet Capacity: Returns vs. Reserves Trade-off

The difficulty in using EM collateral in global financial centers is that there is little or no liquidity in that collateral, along with the full convertibility issue; thus, it has not been possible for EM securities to be pledged on a cross-border basis.

However, the international market is positioned favorably at present. Currently, EM central bank typically access the FX swap market for U.S. dollars. If the EM assets could be pledged offshore, then EMs would effectively access U.S. dollars in exchange for non-US dollar collateral. The pledged collateral would not be at SOFR, (the opportunity cost), as the collateral is not US Treasuries; however, some of the inducement to a global bank of doing this transaction would be via the higher haircut on the EM collateral.

Presently, there is excess liquidity (i.e., dollar reserve balances) at major international banks. If the bank is simply substituting the EM collateral loan for excess reserve deposit at the Fed, then it maybe to the advantage of the bank and relative cheaper than the alternative. The alternative is if the bank had no excess reserve deposit at the Fed, then it will first have to raise the U.S. dollars (with its own UST at SOFR and with the EM's collateral at some higher rate, in the unsecured market). The global banks will not take the additional risk for free as balance sheet capacity is constrained in a post Basel III era.

Basically, the ímpetus to intermediate EM collateral depends on the risk appetite of the global banks that are active in peddling pledged collateral globally—see section 1. There is a trade-off for global Banks between the level of excess return vs. their excess deposit at central banks. The large haircut on EM collateral will be an incentive; however, there will be a cap, as the market has only a finite number of EM participants, and limited depth. If liquidity increases, more EMs (and quasi sovereigns) will join, and that in turn will improve liquidity further. G7 central banks may have a vested interest too, as this could help jump-start the higher rated EM collateral market. Otherwise, the status quo remains: EMs with swap lines with an advanced economy central bank during crisis will face limited downside; but not for EMs without swap lines.

[19] https://www.ecb.europa.eu/mopo/implement/app/lending/html/index.en.html

V. CONCLUSION

As a backstop for financial stability, the central bank collateral arrangement (and liaison with ICSDs) is the first step to reach consensus about the use of eligible collateral for funding and risk management practices in EMs. Unless EMs make better use of their collateral to enhance their financial stability and diversify from the focus on FX reserve and swap lines, the current global plumbing will continue to bypass EM securities. Therefore, the legacy institutions need to take a more proactive approach towards expanding their collateral pool, including the potential from digital transformation. Fragmented collateral resources and infrastructures interfere with global financial plumbing via creating endogenous frictions, especially during the periods of market stress. For EMs with on/off dollar funding facilities, improving the cross-border collateral pledgeability is the first step to secure sustainable financial stability.[20]

In summary, to overcome constraints for collateral pledgeability, EMs need extensive re-wiring of their present plumbing to connect existing institutions to allow movement across the border without incurring serious prudential implications for financial stability. This requires EMs to formulate new governance, including a tiered collateral framework to expedite cross-border financial plumbing in collaboration with the ICSD and CSDs; or induce global banks to substitute their excess reserves for higher returns (via haircuts on EM securities), or create central banks' cross-border collateral pool.

The recent trend is very positive and suggests that EMs are "waking up" to become part of the global plumbing—although in small bilateral steps (e.g., China-A shares where foreigner investors do not have to face ChinaClear etc.).21 Other dimensions that accelerate the desire for cross-border collateral reuse includes digital fintech (e.g., payments system coordination –Singapore/Thailand/Hong Kong)—see Copic and Franke (2020) and Singh and Long (2020).22 Also, a bilateral pipe, between Japan and Hong Kong where JGBs may be used as collateral for financing in Hong Kong, may be another small step in EMs collateral accessing global plumbing (Bank of Japan, 2018).

[20]Many EMs interest rate policies move in tandem with major advanced economies interest rate policies; however with the latter's expansion of central bank balance sheets, EMs need new policy tools when (and if) these balance sheets unwind; pledgeability of EM collateral (along with macro-prudential and capital controls) may be the way forward—see Singh and Wang, 2019.

[21]Also, in January, 2021, Citibank execute the first EM securities-lending transaction that involved Romanian securities.

[22] Technology-driven alternative may be useful to mobilize collateral resources via introducing digital tokens on blockchain platform. There are numerous examples on the use of distributed ledger technology (DLT) in the area of collateral management, payment and settlement. "In principle, DLT is capable of delivering further benefits in terms of the velocity and usability of collateral" (Bundesbank, 2020).

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Also forthcoming Journal of Financial Markets Infrastructure

Annex 1. Asset Pledgeability: An Empirical Investigation

Our empirical results are supportive of the hypothesis that asset pledgeability matters for financial vulnerability in situations when the sample contains crisis episodes. Asset pledgeability contributes toward financial stability via three channels: (a) capital market development by recognizing the role of collateral, (b) increased shock absorption capacity via collateral management, (c) and the newly activated safe asset provision.

Literature Review:

The unfortunate initial condition of relying only on external FX reserves (or swap lines) for financial stability needs to be re-thought; literature is limited on examining the correlation between cross-border asset pledgeability as measured by the market perception gap and the financial vulnerability as measured by changes in exchange rates. Two aspects of the issues touch on either the *potential availability* of pledgeable assets or the *actual pledgeability* in times of stress. Indeed, the consequences of ignoring eligible assets as cross-border pledgeable are far-reaching and massive.

In recognition of the fact that collateral grease the wheels of global finance, lack of collateral in response to shocks has placed additional pressure on the global financial system (see Section I of this paper). On the other hand, if cross-border collateral is better utilized, it can significantly moderate the impact of various shocks on a specific region or country. It is a rather unexpected development in the highly integrated financial markets that the use of EM collateral is minimal under jurisdictional practices. Limited transactions during non-crisis times can result in precarious situations that cannot deal with usual market adjustment and results in spillovers (Corradin et al., 2017). Panel data analyses allow you to control for pledgeability that is unobservable; or variables that change over time but not across entities (i.e., supervisory guidelines or international agreements). That is, it allows individual heterogeneity in terms of asset pledgeability.

The importance of asset pledgeability as a de facto market indicator of liquidity, financial stability, and bond market development is measurable with the empirical findings. The underperformance of these underlying factors is identified as a contribution toward recurrent instability because other vital indicators have served as policy targets and have shown little anomaly before the crises. This observation also raises a fundamental question about the policy recommendations of IFIs for EMs which resulted in the “indicator becoming target problem”. In an ex-post sense, this sensitivity cannot be overcome ex-ante with conventional macro measures for stability, e.g., FX reserves and swap arrangement, and pre-emptive policy responses. Given that it is the operational freeze of the system under stress, not the stability during regular times, a more in-depth approach is in order.

In a similar setting, there are various studies with some bearings on asset pledgeability. For instance, there is a link between asset pledgeability and asset price in a specific setting.

Ignoring information from collateral transactions is equivalent to missing out market functioning for price discovery. For instance, the equilibrium price of an asset not only depends on its fundamentals but also on its pledgeability as shown by Chen et al. (2019), whose insight rigged on the fact that difference in the price of the same product with different regulatory settings reflects the impact of asset pledgeability on asset valuation. Likewise, the interplay between various characteristics of pledgeable assets is reflected in most market transactions because asset pledgeability carries lots of information that reflect changes in complex activities.4 In a related context, these haircut-implied funding costs have also been used by Chen, Cui, He, and Milbradt (2018) indigenize the holding costs and, in turn, the liquidity discounts of illiquid assets. Likewise, asset pledgeability is a vital channel to look into this interplay between markets and participants.

Further, Caballero's safe asset mechanism (SAM) has some bearings on the pledgeability issue since the extra demand for safe assets in the region has roots in the limited pledgeability of its assets. By emphasizing the underpinnings of collateral in capital flow and asset choices, Caballero and Farhi (2013) highlighted the role of safe assets with full pledgeability in the international financial system.

Their focus is mainly on the availability of safe assets supplied as compared with demand, yet the underlying feature of pledgeability still plays a vital role in greasing the wheels of international finance. If there is a growing gap between the supply and demand for safe assets, especially in emerging economies where there are little safe vehicles for long-term savings with safety features, it plays out as a depressed global interest rate. Notably, near-zero interest rates, abundant liquidity, and continued instability stand out as some of the symptoms for the shortage of safe assets (Caballero, Farhi, and Gourinchas, 2017). Specifically, this approach toward *nomina*l supply and demand factor for safe assets is incomplete, since it tends to gloss over more important underlying cross-border pledgeability, which has a different dimension (i.e., *effective* supply is nominal supply times reuse rate or the pledgability factor).

Ignoring the pledgeability aspect of assets contribute to the inherent bias among EM bonds. Especially in times of stress, when pledgeability matters, and the gap between the asset holdings and pledgeable asset holdings remains the underlying causes for financial lockup that paralyzes financial markets. This sudden stop is a salient feature of emerging economies and has a close connection with the limited asset pledgeability of Asian bonds. The sharp distinction among assets in terms of pledgeability especially matters for emerging economies where FX liquidity dictates the creditworthiness of debtor nations.

Lack of pledgeability is the critical reason for Asian asset underpricing, if not a lack of re-use. Some would argue that FX volatility and limited hedging capacity remain the overriding constraints of Asian assets over pledgeability (Caruana, 2011). Yet, it is mostly an empirical issue of sizing up convertibility vs. pledgeability as determinants of the asset price. Given our

preliminary understanding of the cross-border asset pledgeability, it is still necessary whether the data support our claim about its importance. The interplay among eligibility, pledgeability, and credit-ratings needs in-depth analysis. Therefore, it is crucial to examine the relative contribution of various factors that determine asset pledgeability: the limited pool of pledgeable assets or lack of market infrastructure to support transactions

Lou (2016) develops a complementary parametric haircut model to conduct sensitivity tests, capture market liquidity risk, allow idiosyncratic risk adjustments, and incorporate relevant market information.[1] Computational results show potential uses in designing collateral haircuts for collateral agreements, such as credit support annexes. Collateral-related information (via derivatives, repo, sec-lending and prime brokerage agreements) remains a critical piece for any risk assessment

Data and Modeling Strategy

Regulatory haircuts of BIS, which are essentially PIC3 subsequently used in empirical analyses of this paper, are divided into five parts: AAA to AA-/A-1, A+ to BBB-/A-2/A-3/P-3, BB+ to BB–, main index equities and gold, other equities and convertible (See Table 2). This study deals with haircuts of residual maturity with 10 or more years. Accordingly, the applicable haircut is 12 percent, 20 percent, not eligible, 20 percent, 30 percent, respectively. Credit ratings are grouped into three levels, with credit rating 1 corresponds to BB+ to BB–, credit rating 2 tags BB+ to BB–, and credit rating 3 refers to AAA to AA-/A-1, respectively. However, third grade is recognized as not eligible, so we took the haircuts of other equities and convertible bonds, which is 30 percent, i.e., credit rating 1 = haircut 30 percent, credit rating 2 = haircut 20 percent, credit rating 3 = haircut 12 percent. (Table 2)

Some central banks publish their haircut schedules. For instance, the ECB schedule serves as the main categories. The CCP also publish haircut schedules for the much narrower range of collateral that they accept. The Basel Accord has prescribed a schedule of haircuts as Standard Supervisory Haircuts for institutions that calculate the credit risk mitigation provided by eligible financial collateral under the Standardized Supervisory Approach. The use of these haircuts is limited to revalued transactions and margined daily (assuming a 10-day holding period). There is an additional 8 percent haircut for cross-currency repos and securities lending transactions. On the other hand, there is provision for national supervisors to carve out repos and securities lending transactions and apply a zero haircut, where the counterparty is “core market participants” and the collateral is a security issued by a government qualifying for a zero right weight under the Standardized Approach and certain other conditions apply.

[1] Lou (2016) uses explanatory factors to determine the value of assets, instead of data-driven approach that typically uses jump-diffusion model to see credit rating impact on haircuts (Table 1). The same illiquid asset (especially during crisis) have a range of haircuts—and the wedge between market rates and a central bank matrix can be very large (recall GIIPS crisis in the Eurozone and haircuts at LCH, U.K. vs haircuts at the ECB matrix).

We chose the panel regression as a benchmark model to investigate the statistical significance of asset pledgeability on financial vulnerability as measured by log-differences of nominal exchange rate.[2] Using the panel data on 19 countries8 panel regression results show that some aspects of the market perception gap have a significant impact on vulnerability against various shocks.[3] In the subsequent empirical investigations, the above three aspects related to limited asset pledgeability have particular meanings: lower market efficiency, extra demand for safe assets, and limited usability of FX holdings in times of stress.

In this Annex the first indicator for financial stability, exchange rate volatility as measured by nominal exchange rate changes,[4] is related to various indicators of cross-border asset pledgeability and other control variables (Park, Shin, and Tian, 2018). Specifically, the study reveals the impact of asset pledgeability on a narrowly defined measure of financial vulnerability in emerging economies. Building on studies by Park, Shin, and Tian (2018), the separate impact of asset pledgeability is measured using a set of panel regression. Given the lack of haircut data, we construct proxy variables as follows:[5] PI Index represents cross-border pledgeability by classifying as non-pledgeable = 1, narrowly pledgeable = 2, pledgeable = 3.

Similarly, credit ratings under BBB+ = 1, credit rating A = 2, credit rating over AA = 3. Based on this classification, PIC Index (Total pledgeability) = PI*Credit rating, and PIC2 Index (Gap Indicator) = Credit rating/PI, respectively. Also, PIC3 = supervisory haircuts, PIC4 = 1/PIC3 - country risk premium. In reality, the asset pledgeability remains fixed in most EMs as they do not recognize LCY (local currency) bonds beyond national borders as accepted collaterals. PIC2 asset pledgeability is measured over time as the gap between standings in credit ratings and given pledgeability in a cross-border setting. It is difficult to construct empirical measures for cross-border asset pledgeability, and the empirical studies largely reflect the link between pledgeability and a measure of financial vulnerability as measured by changes in the nominal exchange rate. With crisis dummies, pledgeability measures could prove to be insignificant with the existence of other control variables, yet the influence would be greater when crises episodes are controllable. Extra explanatory power of cross-border asset pledgeability during crisis times as measured by interaction variables shows its significance in the context of financial stability. The interaction between a

[2] Log of nominal exchange rate has been taken as the dependent variable as exchange rate volatility adversely affects real and financial sectors (Agenor and Silva, 2013). Gourinchas and Obstfeld also explain that abrupt swings in exchange rate entail defaults and currency crises (2012).

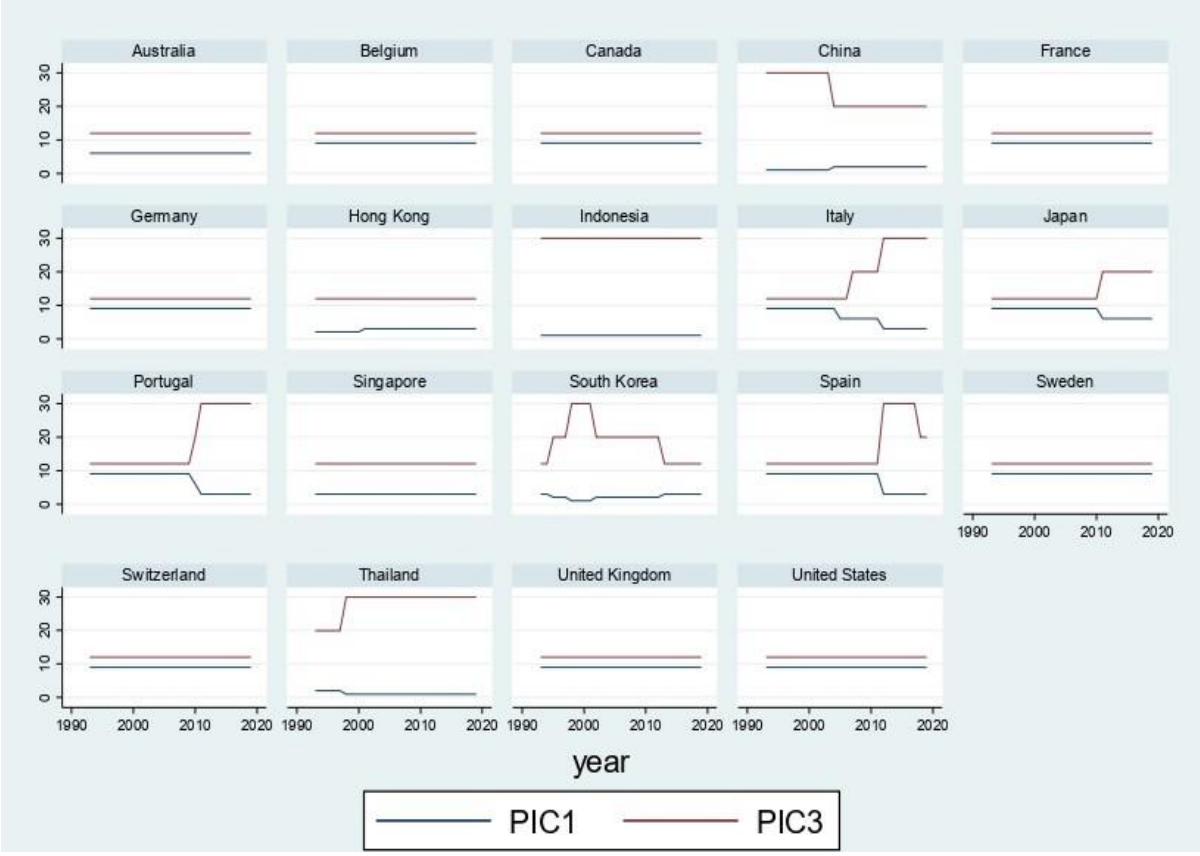
[3] Australia, Belgium, France, Germany, Italy, Portugal, Sweden, Switzerland, Spain, United Kingdom, Canada, United States, China, Hong Kong, Indonesia, Japan, Singapore, South Korea, and Thailand.

[4] Exchange market pressure variables are chosen as the dependent variable in panel regressions to reflect the reality where emerging economies often intervene to stabilize the exchange rate. Further, alternative variables of asset pledgeability include the proportion of pledgeable assets as compared with the total holdings of assets among central banks.

[5] A useful perspective on the composition of repo collateral is also available from the survey of the main tri-party repo agents in Europe included in the ICMA (International Capital Market Association)'s semi-annual European repo market survey.

particular aspect of asset pledgeability and crisis episode is most pronounced in case of PIC3, which largely reflects market assessment of asset pledgeability. Compared with the overall pledgeability capacity that takes account of credit ratings and actual usability (PIC1), and the gap between de jure and de facto pledgeability (PIC2), financial instability as measured by exchange rate changes are better explained by the haircut adjustments that are responsive to market assessment of actual pledgeability during the crisis (PIC3). Even for emerging market assets that are rarely used for cross-border collateral, OTC transactions that involve adjustable haircuts reflect the importance of asset pledgeability during difficult times.

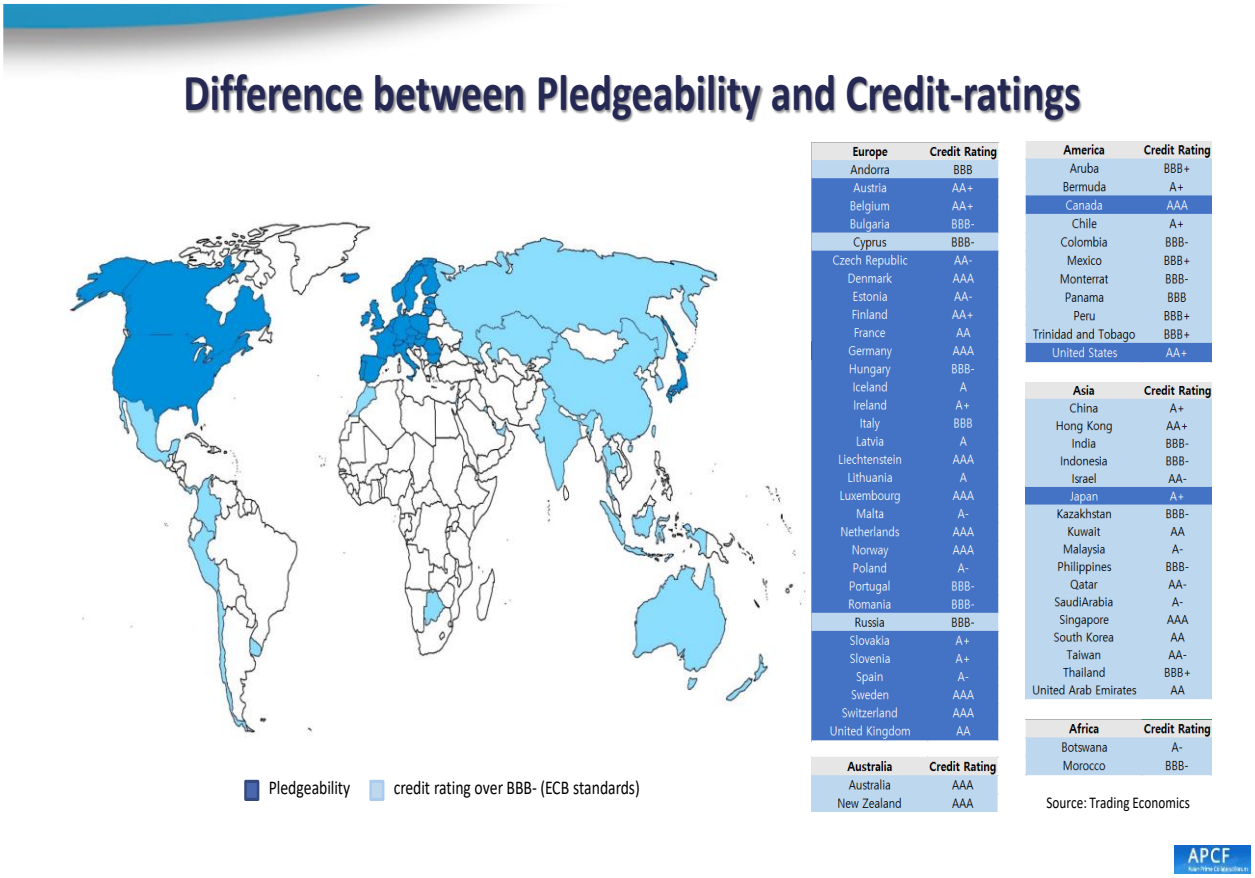
Figure 1. PIC 1 vs. PIC 3



Additionally, it remains to be seen whether the jurisdictional classification is more important than economic evaluations for gauging financial vulnerability. The current econometric specification cannot measure that aspect as the dummy remains insignificant. Yet, the crisis episodes are all global nature and cannot capture interactions in jurisdictional influence on cross-border asset pledgeability. In fact, economic zone classification based on monetary union matters for financial stability, as evidenced by the Euro example. If that is the overriding factor for financial stability, Asia needs to follow a similar strategy to go forward. If the cross-border asset pledgeability is the ultimate protection against financial instability, it is more important to foster a market-friendly ecosystem to secure the critical factor for a sustainable environment.

The contrasting picture of favorable credit ratings and unfavorable asset pledgeability in Asia (Figure 2), is a clear reflection that there has been a lack of collaboration among member countries to secure critical elements for financial stability.

Figure 2. Difference between Pledgeability and Credit Ratings



Europe	Credit Rating
Andorra	BBB
Austria	AA+
Belgium	AA+
Bulgaria	BBB-
Cyprus	BBB-
Czech Republic	AA-
Denmark	AAA
Estonia	AA-
Finland	AA+
France	AA
Germany	AAA
Hungary	BBB-
Iceland	A
Ireland	A+
Italy	BBB
Latvia	A
Liechtenstein	AAA
Lithuania	A
Luxembourg	AAA
Malta	A-
Netherlands	AAA
Norway	AAA
Poland	A-
Portugal	BBB-
Romania	BBB-
Russia	BBB-
Slovakia	A+
Slovenia	A+
Spain	A-
Sweden	AAA
Switzerland	AAA
United Kingdom	AA

Australia	Credit Rating
Australia	AAA
New Zealand	AAA

America	Credit Rating
Aruba	BBB+
Bermuda	A+
Canada	AAA
Chile	A+
Colombia	BBB-
Mexico	BBB+
Monterrat	BBB-
Panama	BBB
Peru	BBB+
Trinidad and Tobago	BBB+
United States	AA+

Asia	Credit Rating
China	A+
Hong Kong	AA+
India	BBB-
Indonesia	BBB-
Israel	AA-
Japan	A+
Kazakhstan	BBB-
Kuwait	AA
Malaysia	A-
Philippines	BBB-
Qatar	AA-
SaudiArabia	A-
Singapore	AAA
South Korea	AA
Taiwan	AA-
Thailand	BBB+
United Arab Emirates	AA

Africa	Credit Rating
Botswana	A-
Morocco	BBB-

Source: ACPF

Empirical Results

Overall empirical results suggest that the asset pledgeability measures demonstrated marginally significant power in explaining changes in the nominal exchange rate when crises episodes are controlled, especially with PIC3. With the general lack of available data using OTC transactions for the cross-border, PIC3 and its times series equivalent PIC4 showed limited success in explaining changes in the nominal exchange rate. With crisis episodes dominating the explanatory power over changes in the nominal exchange rate, PIC2, which shows the gap between credit ratings and pledgeability, exercises extra power when all macro variables are controlled (Table 4 (1)). This difference is because extra dynamics that limit cross-border asset pledgeability kick in during the episodes of market stress compared with regular times. In contrast, another proxy for cross-border asset pledgeability, especially PIC3 of regulatory haircut, shows statistically significant extra influence (Table 5 (2)-(5)) during the crises, possibly due to its pro-cyclical adjustments.

Table 1. Definitions of Variables and Data Sources

Variables	***Description and Construction***	***Data Source***
Percent change in nominal exchange rate, 1993-2019.	Log difference in nominal exchange rate (National Currency per US dollar) from 1993 to 2019.	IMF International Financial Statistics
Increase in current account deficit (percent of GDP), 1994-2019	Difference in current account deficit from 1994 to 2019.	World Bank World Development Indicators
Increase in credit-to-GDP ratio, 1994-2019	Increase in domestic credit to the private sector (percent of GDP) from 1994 to 2019	World Bank World Development Indicators
Log of portfolio liability, 1994-2017	Sum of portfolio equity and portfolio debt security 1994 to 2017	Lane and Milesi-Ferretti dataset that extends Land and Milesi-Ferretti (2007)
Reserves/M2, 1993 to 2019	Inverse of money and quasi money(M2) to total reserves ratio 1993-2019	World Bank World Development Indicators
Inflation(CPI), 1993 to 2019	Inflation, consumer prices (annual percent) 1993 to 2019	World Bank World Development Indicators
Exchange rate regime (Annual fine classification in IIzetzki, Reinhart, and Rogoff (2017), 1993 to 2017	Exchange rate regime Annual fine classification in IIzetzki, Reinhart, and Rogoff (2017), 1993 to 2017	IIzetzki, Reinhart, and Rogoff (2017)
Foreign Direct Investment net flows, 1994-2017	Foreign Direct Investment net inflows (percent of GDP), 1994 to 2017	IMF International Financial Statistics
DSGDP, 1997-2019	Log difference in Local Currency Bond Market and GDP,1997-2019	BIS Debt Securities database
Asia	A dummy of Asia countries	Author's calculation
Country risk premium, 1993-2019	Yield of sovereign bond (mid yield to convention) – Yield of US treasury, 1993-2019	Bloomberg
Developed	Dummy variables of Developed vs emerging countries (Developed=1, Developing=0)	Author's calculation
Haircut	Application of haircuts according to credit ratings	Bank for International Settlements
Crisis	Dummy variables of global crisis Asia: 1997-1998=1, 2007-2008=1, others=0 Other countries: 2007-2008=1, others=0	Bloomberg

Source: Staff estimates

Table 2. Supervisory Haircuts for PIC3

Issue rating for debt securities	*Residual Maturity*	*Sovereigns*	*Other Issuers*	*Securitization Exposures*
AAA to AA-/A-1	≤ 1 year	0.5	1	2
	>1 year, ≤ 3 years	2	3	8
	>3 years, ≤ 5 years		4	
	>5 years, ≤ 10 year	4	6	16
	> 10 years		12	
A+ to BBB-/ A-2/A-3/P-3 and unrated bank securities	≤ 1 year	1	2	4
	>1 year, ≤ 3 years	3	4	12
	>3 years, ≤ 5 years		6	
	>5 years, ≤ 10 years	6	12	24
	> 10 years		20	
BB+ to BB-	All	15	Not Eligible	Not Eligible
Main index equities			20	
Other equities			30	
UCITS/mutual funds			Highest haircut applicable to any security in which the fund can invest, unless the bank can apply the look-through approach (LTA) for equity investments in funds, in which case the bank may use a weighted average of haircuts applicable to instruments held by the fund.	
Cash in the same currency			0	

Source: BIS (2017).

Table 3. Summary of Statistics

Variables	*Obs*	*Mean*	*Std.Dev*	*Min*	*Max*
Pledgeability index	513	2.315789	0.921575	1	3
Credit rating	513	2.536062	0.772555	1	3
PIC	513	6.222222	3.28368	1	9
PIC2	513	1.281027	0.687834	0.333333	3
PIC3	513	15.90253	6.878284	12	30
PIC4	443	0.162881	1.469047	-8.83037	4.338033
Percent change in NEER	469	0.001219	0.076312	-0.57935	0.273628
Increase in current account deficit (percent of GDP)	475	0.129211	2.222729	-11.5802	14.54069
Increase in credit-to-GDP ratio	425	1.402935	8.865643	-64.8959	79.79653
Log of portfolio liability	509	26.76859	1.586817	22.17424	30.45951
Reserves/M2	337	0.208741	0.206787	0.012528	0.969346
Inflation	337	0.208741	0.206787	0.012528	0.969346
Exchange rate regime	513	6.001949	2.993156	1	12
DSGDP	392	0.008592	0.3640452	-2.031409	1.184393
Share of FDI (percent of GDP)	482	4.684437	7.695408	-10.8093	58.51875
Asia	513	0.368421	0.482847	0	1
Country risk premium	450	0.091327	1.841975	-4.2547	9.3225
Developing country dummies	513	0.736842	0.440777	0	1
Haircut	513	15.90253	6.878284	12	30
Crisis	513	0.101365	0.302105	0	1

CPI = consumer price index, GDP = gross domestic product, LCBM = local currency bond market. Notes: The dependent variable is monthly exchange rate depreciation. Exchange rate regime is annual fine classification in Ilzetzki, Reinhart, and Rogoff (2017). Asia is a dummy variable for seven Asian countries: Hong Kong, Indonesia, Japan, China, Republic of Korea, Singapore and Thailand. Source: Author's calculation.

Table 4. PIC2 Index and Exchange Rate Depreciation

Variables	*Percent Change in Nominal Exchange Rate*								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
PIC2 Index	-0.0246* (-1.72)	0.0151** (2.06)	0.0012 (0.57)	0.0249 (1.3)	0.0176* (1.92)	0.0011 (0.07)	0.0159* (1.8)	0.013 (1.32)	0.0011 (0.08)
PIC2 Index for crises (1997-8, 2007-8)	-0.0113 (-0.65)	0.0024 (0.16)	0.0164*** (4.84)	0.0013 (0.09)	0.0031 (0.2)	0.0102 (0.53)	0.0026 (0.18)	0.0024 (0.15)	0.0115 (0.58)
Increase in current account deficit (percent of GDP)	0.0012 (0.61)			-0.0023 (-1.28)					-0.0021 (-0.84)
Increase in credit-to-GDP ratio	-0.0004 (-0.79)				-0.0005 (-1.08)			-0.0006 (-1.18)	-0.0006 (-0.96)
Log of portfolio liability	0.0119** (2.33)			0.0017 (0.25)	0.0015 (0.35)				0.0072 (1.24)
Reserves/M2	0.1422** (2.51)					0.0813 (1.42)			0.0921* (1.65)
Inflation (CPI)	0.0061** (2.04)					0.0054 (1.2)		0.0047 (1.47)	0.0057 (1.3)
Exchange rate regime	0.0027 (0.76)						-0.0008 (-0.55)		-0.0017 (-0.48)
Share of FDI (percent of GDP)	0.0003 (0.27)						0.0002 (0.29)	0.0003 (0.36)	-0.0005 (-0.34)
Crisis	-0.0516* (-1.71)	-0.0474** (-2.14)	-0.1491*** (-6.12)	-0.0462** (-2.02)	-0.0477** (-2.06)	-0.0842*** (-2.62)	-0.0484** (-2.17)	-0.0526** (-2.25)	-0.0867*** (-2.62)
DSGDP		0.0427*** (3.73)	0.0295** (2.28)	0.0518** (2.20)	0.0387** (2.37)	0.0507** (2.5)	0.0427*** (3.35)	0.0388*** (2.8)	0.0411** (1.98)
Asia			0.0198 (1.35)	-	-0.0042 (-0.3)	-0.0083 (-0.39)	-0.0034 (-0.3)	-0.0026 (-0.2)	-0.0018 (-0.11)

Note 1: The dependent variable is monthly exchange rate depreciation. Exchange rate regime is annual fine classification in Ilzetzki, Reinhart, and Rogoff (2017). Asia is a dummy variable for seven Asian countries: Hong Kong, Indonesia, Japan, China, Republic of Korea, Singapore and Thailand. Numbers in parentheses are z-score. ***, **, and * denotes the significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis is a dummy variable that indicates Financial Crises in 1997-8, and 2007-8.

Note 2: $\boldsymbol{Y_{it} = \alpha_i + A(X_{it}) + \mu_{it}}$: Y_{it} is the vector of the dependent variable, log nominal exchange rate. α_i (i=1…n) is the unknown intercept for each entity (n entity: specific intercepts), X_{it} depicts time-varying entities of independent variables, and $\mu_{i,t}$ is the error term. A panel VAR model is estimated. As predicted, the influence of PIC2 on NEER becomes more pronounced when incorporated with the crisis dummy. Source: Author's calculation based on the Bank for International Settlements Debt Securities Statistics and the Asian Bonds Online.

Table 5. PIC3 Index and Exchange Rate Depreciation

Variables	*Percent Change in Nominal Exchange Rate*								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
PIC3 Index	0.0003 (0.27)	-0.0003 (-0.50)	-0.0007 (-1.03)	-0.0007 (-1.00)	-0.0008 (-1.12)	-0.0007 (-0.58)	-0.0007 (-1.03)	-0.0007 (-0.92)	-0.0028 (-0.98)
PIC3 Index for crises (1997-8, 2007-8)	-0.0044** (-2.20)	-0.0094*** (-5.66)	-0.0095*** (-5.71)	-0.0094*** (-5.61)	-0.0095*** (-5.49)	-0.0092*** (-4.29)	-0.0094*** (-5.60)	-0.0095*** (-5.53)	-0.0088*** (-3.94)
Increase in current account deficit (percent of GDP)	0.0025 (1.20)			-0.0012 (-0.70)					-0.0015 (-0.63)
Increase in credit-to-GDP ratio	-0.0005 (-0.91)				-0.0006 (-1.27)			-0.0007 (-1.46)	-0.0006 (-1.11)
Log of portfolio liability	0.0083* (1.69)			-0.0002 (-0.04)	-0.0009 (-0.21)				0.0066 (0.66)
Reserves/M2	0.0687* (1.87)					0.0499 (1.30)			0.0949 (0.97)
Inflation (CPI)	0.0067** (2.47)					0.0063* (1.66)		0.0058** (1.96)	0.0039 (0.78)
Exchange rate regime	0.0023 (0.81)						-0.0007 (-0.44)		-0.0016 (-0.28)
Share of FDI (percent of GDP)	-0.0003 (-0.42)						0.0002 (0.31)	0.0002 (0.25)	-0.0008 (-0.38)
Crisis	0.0073 (0.19)	0.1021*** (3.63)	0.1023*** (3.64)	0.101*** (3.52)	0.1033*** (3.51)	0.0793** (2.01)	0.1006*** (3.52)	0.0971*** (3.28)	0.0769* (1.89)
DSGDP		0.0192 (1.59)	0.0254** (2.01)	0.0248* (1.76)	0.026* (1.67)	0.0273 (1.48)	0.0268** (2.07)	0.0211 (1.55)	0.0255 (0.87)
Asia			0.0166 (1.49)	0.0157 (1.49)	0.0159 (1.31)	0.0082 (0.46)	0.0173 (1.50)	0.0154 (1.36)	-

Notes: The dependent variable is monthly exchange rate depreciation. Exchange rate regime is annual fine classification in Ilzetzki, Reinhart, and Rogoff (2017). Asia is a dummy variable for seven Asian countries: Hong Kong, Indonesia, Japan, China, Republic of Korea, Singapore and Thailand. Numbers in parentheses are z-score. ***, **, and * denotes the significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis is a dummy variable that indicates Financial Crises in 1997-8 and 2007-8. Results may have interpretational limitations as data were retrieved on an annual basis. Source: Author's calculation based on the Bank for International Settlements Debt Securities Statistics and the Asian Bonds Online.