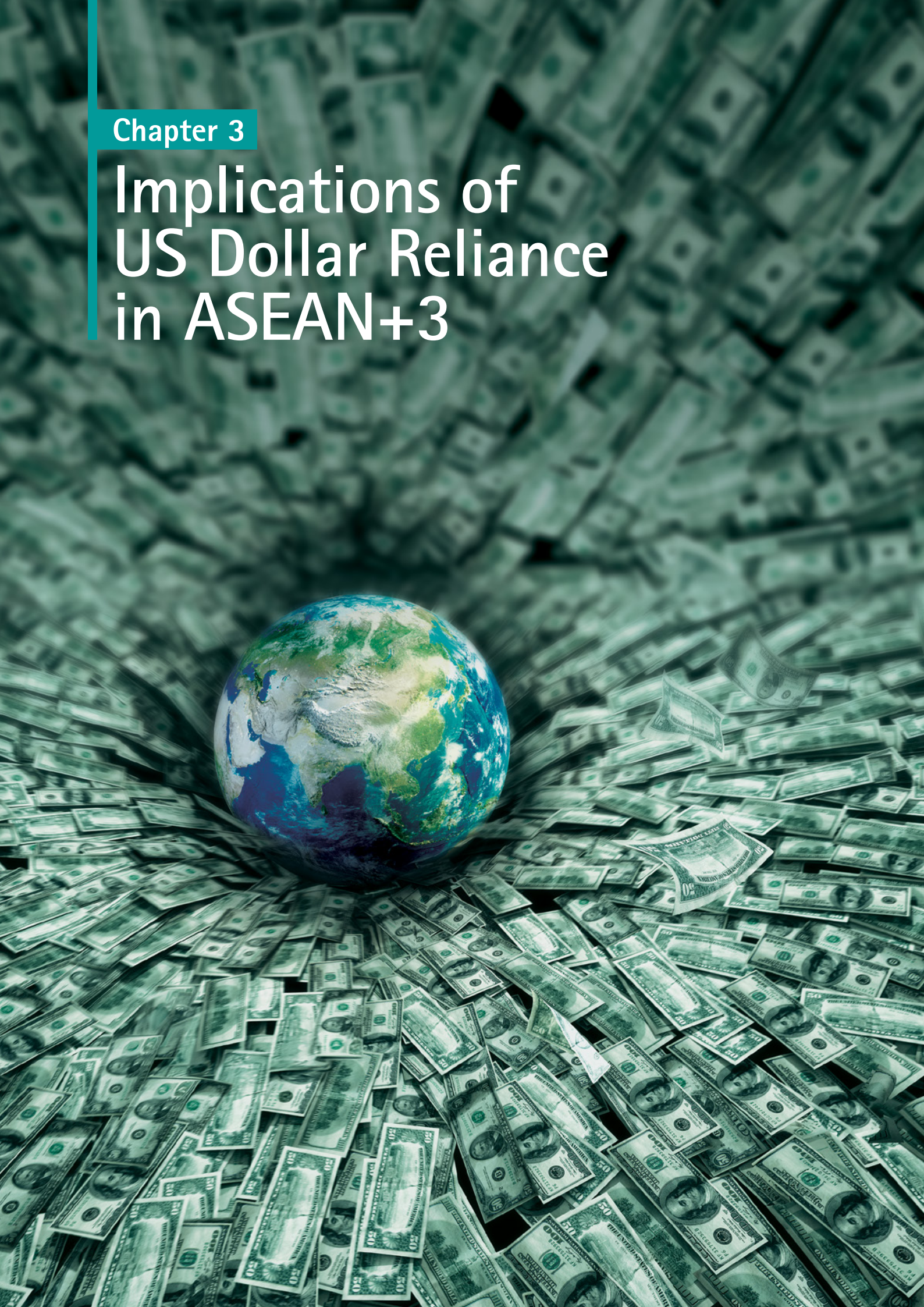
Chapter 3

Implications of US Dollar Reliance in ASEAN+3



Highlights

- The United States (US) dollar has a significant role in the ASEAN+3 macro-financial system as a vehicle currency for trade invoicing and the preferred currency for cross-border financial transactions. Though ASEAN+3's reliance on the US dollar has declined in the past decade, the pace has been slow. Heavy reliance on US dollars can only be partly attributed to direct linkages to the United States and is a result of several different factors.

- The ASEAN+3 US dollar supply chain is complex as a variety of players interact through different roles. Exporters of goods and services and bond issuers are the main sources of US dollar foreign exchange whereas imports and debt repayments are the main uses of the foreign exchange. Banks and a wide range of nonbank financial institutions (such as securities companies, asset managers, and other market intermediaries) facilitate the flow of funds and risk management. However, this supply chain also results in some currency and maturity mismatches which could pose risks during adverse market conditions.

- The region's reliance on the US dollar creates two important risks for the ASEAN+3 financial system. First, a shortage in availability of US dollars can increase stability risks for financial markets and intermediaries. Second, the US dollar acts as a transmission channel for shocks arising from US monetary policy, geopolitical tensions and other global developments.

- Surprisingly, Federal Reserve policy tightening in 2022 and 2023 did not create a US dollar liquidity squeeze in the region even as capital outflows occurred and exchange rates came under depreciation pressure. While the strong external position of ASEAN+3 economies was among the underlying reasons for the robust US dollar liquidity situation, many micro-market developments also supported US dollar availability. These include an increase in US dollar deposits from domestic investors, reduced US dollar borrowing and negative carry costs from leveraged investments.

- Authorities may adopt a two-pronged approach to deal with the risks. In the near term, they can build economic resilience against global spillovers while strengthening financial sector surveillance and risk management strategies. In the long term, the authorities can diversify from the dominant use of US dollars to a wider range of other currencies, including local currencies within the ASEAN+3 region while adopting technological solutions. Regional cooperation and strengthening the regional financial safety net are also of utmost importance for improving the financial stability.

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I. Overview

Role of the US dollar in the ASEAN+3 financial system

The United States dollar has been the cornerstone of the international financial system for decades. Its significance is well documented and demonstrated by its disproportionate share in foreign reserves, foreign exchange trading, invoicing, cross-border payments, and cross-border loans (Maronoti 2022). Factors reinforcing the US dollar's pivotal role in the international financial system are equally well known. They include the size of the US economy and its share in global trade, policy credibility of US authorities, characteristics associated with the US dollar such as its perception as a safe, liquid and convertible currency, as well as the deep and liquid markets for US dollar financial assets. Historical agreements, such as the Bretton Woods agreement in 1944, and the US-Saudi agreement in 1974, have played crucial roles in its dominance. Lack of a credible alternative (CGFS 2020), strong inertia, network effect, along with the US dollar's "Imperial Circle" further entrench its global role.[1]

As in the rest of the world, the US dollar plays a significant role in the ASEAN+3 financial system as a vehicle currency for trade invoicing and payments, and the preferred currency for cross-border financial investment and borrowing. The disproportionate share of the US dollar is also evident in ASEAN+3 as the share in external financing in US dollars far exceeds the direct trade or financial linkages with the US (Figure 3.1).[2] The US dollar remains the most used foreign currency in the ASEAN+3's cross-border financial system (Figures 3.2 to 3.4) and generally is used more in the region than the global averages.[3] Specifically, the US dollar is widely used in the following two areas:

- As the vehicle currency for trade invoicing and payment: The US has long been a key market of regional exports (Figure 3.5). The deep integration of ASEAN+3 economies into the global production supply chain contributes to the extensive use of US dollar (Mercado, Jacildo, and Das 2022), which is the vehicle currency for trade with many countries (Boz and others 2020) within and outside ASEAN+3. Over 80 percent of trade invoicing across the ASEAN+3 region is in US dollars (Figure 3.6).

- As the currency of denomination for banks' holdings of cross-border assets and liabilities: Following the global financial crisis (2008–2009), low interest rates made US dollars attractive for emerging market nonbank borrowers. At the same time, the European debt crisis (2010) led European banks to scale back their US dollar lending activities. The rising demand from emerging market borrowers and constrained supply from European lenders created an opportunity for Asian banks to increase their US dollar lending. By 2016, Asia held the highest share of cross-border US dollar assets (loans made and debt securities held) by non-US banks.[4] This also created a demand from Asian banks for US dollar liquidity to finance the assets, through cross-currency swaps (CCS) and short-term debt. The share of US dollars in ASEAN+3 banks' cross-border assets and liabilities remains above 50 percent (Figure 3.7).

Over the past decade, ASEAN+3 trade and investment exposures to the US have diversified with lower FDI inflows from the US (Figure 3.1) and with China overtaking the US as the most important export destination for most ASEAN+3 countries (Figure 3.5). At the same time, the share of US dollars in cross-border activities, such as trade invoicing and cross-border investment and borrowing of the domestic banks, has reduced slightly—although some activities have seen a rise in the share of US dollars (such as FX trading of ASEAN+3 currencies (Figure 3.4)).[5] Overall, the region remains reliant on US dollars for cross-border activities, although reliance is declining at a very slow pace.

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1 The dollar's "Imperial Circle" is a confluence of structural, international and US-specific elements, creating a self-reinforcing pro-cyclical force that keeps the US dollar strong even during economic slowdowns. The dollar's dominance in trade invoicing and credit-intensive trade makes it crucial to the global manufacturing cycle. A strong dollar weakens the global manufacturing sector, but since the US economy is more service-oriented and less dependent on manufacturing, the dollar benefits relative to US trading partners that are more exposed to the manufacturing cycle. (Akinci and others 2022)

2 External financing is defined as the cross-border claims on domestic banks, nonbank financial intermediaries (NBFIs) and non-financial institutions.

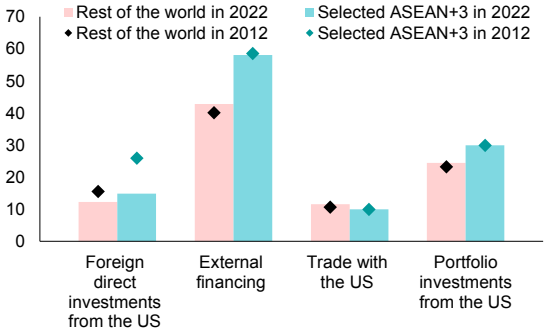
3 That said, the global averages are skewed due to the inclusion of data for European economies, where the euro has displaced the US dollar as the most used currency. On the other hand, Latin America is much closely integrated to the US due to its proximity and has a higher share of US dollar usage.

4 Includes ASEAN+3, Australia, India, and Taiwan Province of China (Park and others 2020).

5 The data for trade invoicing from Boz and others (2020) is available as of 2019. In ASEAN+3, Indonesia, Japan, Korea and Thailand publish regular data for currency shares in trade invoicing. The data shows that the average share of US dollars in import invoicing for these economies was at 82 percent in 2023 while that for exports was at 76 percent. These shares are on the lower side of the range seen since 2010.

Figure 3.1. World and ASEAN+3: Share of US Dollar in External Financing, and Fundamental Linkage with the US
(Percent)

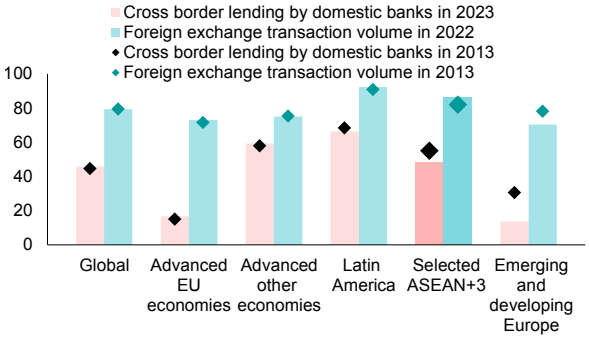
The use of the US dollar in external financing far exceeds the direct trade or financial linkages with the US.



Source: International Monetary Fund (IMF); Bank for International Settlements (BIS). AMRO staff calculations.
Note: The calculated value of each of the variables shown in the chart are simple averages. Selected ASEAN+3 includes China, Hong Kong, Indonesia, Japan, Korea, Malaysia, The Philippines, Singapore, and Thailand. Portfolio investments and FDI are adjusted using location-based methodology. See Annex 3.1 for detail.

Figure 3.2. World and Selected Regions: Share of US Dollar in Key Cross-Border Functions by Region
(Percent)

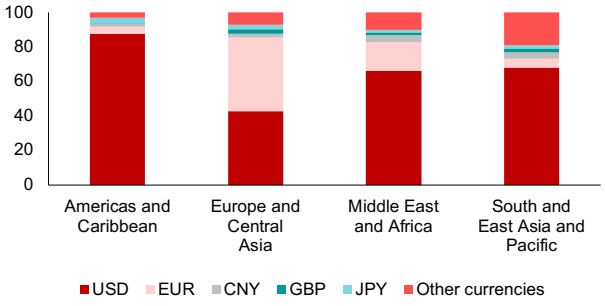
The US dollar is the most used foreign currency in ASEAN+3's financial system, …



Source: Bank for International Settlements (BIS) via Haver Analytics; AMRO staff calculations.
Note: Selected ASEAN+3 economies for foreign exchange transactions include China, Hong Kong, Japan, Korea, and Singapore. For the calculations of cross border lending, we also include Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand and Vietnam.

Figure 3.3. Selected Regions: Currency Distribution of Reserves by Region, 2023
(Percent)

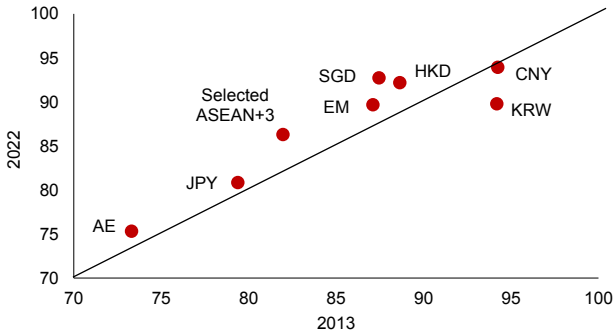
… foreign exchange reserves, …



Source: The World Bank Ramp Report (2023).
Note: The granular data for ASEAN+3 economies are unavailable. ASEAN+3 economies are included in the South and East Asia and Pacific region, as along with other major Asia Pacific region economies such as Australia, India, and New Zealand. CNY = Chinese renminbi; EUR = Euro; GBP = Pound sterling; JPY = Japanese yen; USD = US dollar.

Figure 3.4. Selected Regions: Share of US Dollar in Trading Against Regional Currencies
(Percent)

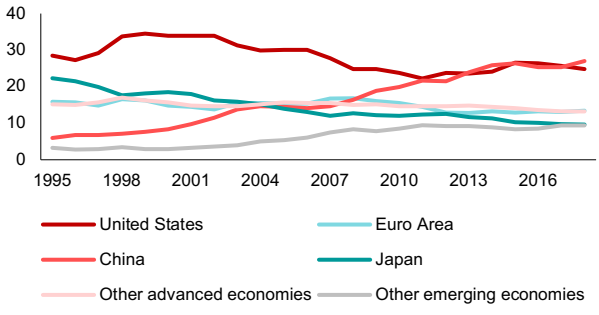
… and foreign exchange trading.



Source: BIS Triennial Central Bank Survey (2022); AMRO staff calculations.
Note: AE = Advanced economies; EM = Emerging economies; CNY = Chinese renminbi; HKD = Hong Kong dollar; JPY = Japanese yen; KRW = Korean won; SGD = Singapore dollar; Advanced economy currencies include EUR, GBP, AUD, CAD, CHF, SEK, NOK, and NZD. Emerging economy currencies include INR, MXN, TWD, ZAR, PLN, AED, and TRY. Selected ASEAN+3 currencies include JPY, CNY, HKD, SGD, and KRW.

Figure 3.5. ASEAN+3: Share of Exports by Destination
(Percent)

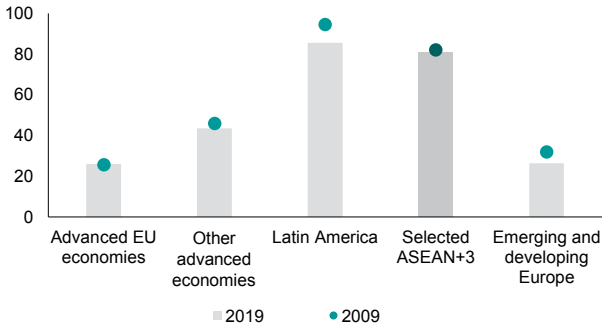
The US remains one of the most important export destinations for ASEAN+3 economies.



Source: OECD via Haver Analytics; OECD TiVA; AMRO staff calculations.
Note: The lines of the chart indicate the share of total exports to the respective final destinations represented by each line in the chart. Latest available data are as of 2018.

Figure 3.6. Selected Regions: Share of US Dollar in Trade as the Invoicing Currency
(Percent)

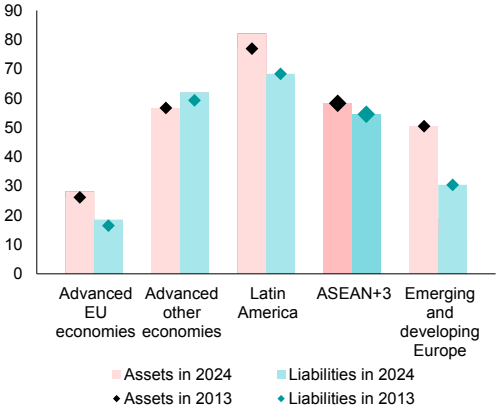
The US dollar is the most preferred vehicle currency for trade invoicing in ASEAN+3.



Source: Boz and others (2020); AMRO staff calculations.
Note: Simple averages of exports and imports of the countries in the region are calculated. Selected ASEAN+3 includes Cambodia, Indonesia, Japan, Korea, Malaysia, and Thailand.

Figure 3.7. Selected Regions: Share of US Dollar in Bank Cross-Border Assets and Liabilities
(Percent)

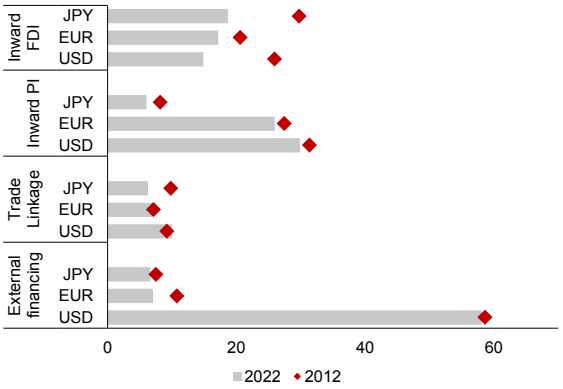
More than 50 percent cross-border assets and liabilities for ASEAN+3 are denominated in the US dollars.



Source: Bank for International Settlements (BIS); AMRO staff calculations.
Note: Simple averages are calculated for both assets and liabilities for 2013 and 2023 respectively across the region. ASEAN+3 countries include Brunei, China, Cambodia, Hong Kong, Indonesia, Japan, Korea, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. Data as of Q1-2024.

Figure 3.8. ASEAN+3: Share of Currency in External Financing, and Trade and Investment Linkage by Currency
(Percent)

The use of US dollar in external financing far exceeds that of other currencies with similar trade and investment linkages.



Source: International Monetary Fund (IMF); Bank for International Settlements (BIS); AMRO staff estimation.
Note: FDI = Foreign direct investment; PI = Portfolio investment; EUR = Euro; JPY = Japanese yen; USD = US dollar. Simple averages of ASEAN+3 region in 2022 and 2012. External financing shows the share of external bank borrowing denominated in each currency. Other variables are the share of the corresponding economy in various external activities, including trade (exports and imports), inward portfolio investment, and inward FDI. Portfolio investments and FDI are adjusted using location-based methodology. See Annex 3.1 for detail.

What factors are behind the prevalence of the US dollar in external financing?

The importance of the US dollar in ASEAN+3's external financing far exceeds the economic linkage of the region with the US. A dynamic panel regression (Annex 3.2) is used to analyze the factors influencing the share of a currency in external bank borrowings (Figure 3.8). The dependent variable is the share of currencies (US dollar, euro, and yen), while the independent variables include the share of the US, the euro area and Japan in ASEAN+3's exports, imports, and both inward and outward portfolio and direct investments.[6] The results show that:

- The share of a currency in external financing is heavily dependent on the existing share, thus indicating the role of inertia in the choice of currency.

- For ASEAN+3 economies, the source of inward portfolio investment and export destination significantly influences the choice of currency used in external financing. The choice of currency for Plus-3 economies depends more on the source of portfolio investment whereas for ASEAN-5 it depends more on the export destination.

The rest of the chapter focuses on the US dollar reliance in ASEAN+3, identifying vulnerabilities and potential policy actions. The US dollar's central role in the international monetary system facilitates the transmission of shocks from global financial markets to the ASEAN+3's financial system. Funding squeezes amplify these effects, whereas easy financial conditions can fuel asset bubbles and leverage. Over reliance on the US dollar makes ASEAN+3 economies more vulnerable to spillovers from global, and more specifically US macro financial developments. The chapter examines the entities involved in the ASEAN+3's dollar supply chain and the risks from their operations and interconnectedness, and it presents policies to manage and reduce dollar dependence. Due to limited publicly available data, the study heavily relies on inputs from market participants, supplemented by analysis where data are available.

[6] The methodology follows Iancu and others (2022), and the model is estimated using the Arellano-Bond 2-step robust GMM.

II. The Landscape of the ASEAN+3's US Dollar Supply Chain

Roles of key private participants

The US dollar supply chain in the region comprises various players performing different roles. They can be broadly classified into three categories:

- Corporates: The foreign exchange management practices of exporters, importers and firms issuing US dollar debt securities have a material impact on the US dollar supply chain in ASEAN+3. Exporters and importers are primary sources and users of US dollars in the region. Many firms borrow or issue debt securities in US dollars while debt repayments lead to the outflows of US dollars. They are also involved in investments (largely direct, but also portfolio in certain cases) which, depending on the location of the investing corporate, can constitute an inward or outward flow of the US dollars.[7]

- Nonbank financial intermediaries (NBFIs): Aramonte, Schrimpf, and Shin (2022) classify NBFIs into three categories (1) institutional investors and asset managers, which include pension funds, insurance companies, sovereign wealth funds, hedge funds, family offices, exchange traded funds, mutual funds, and securities firms, (2) market intermediaries which include broker-dealers and principal trading firms, and (3) financial market infrastructures i.e. exchange, electronic trading platforms and central counterparties. The NBFIs, along with banks, facilitate the flow of funds and trading activities. They provide clients with currency, maturity and credit risk transformation services.

- Banks: They are the largest counterparties for companies and NBFIs and provide a wide range of US dollar services such as loans and deposit facilities, and liquidity and foreign exchange risk management services. The banks may retain residual currency and maturity risk exposures from their client activities.

These players are interlinked through transactions and business needs. The transactions may vary across economies due to differences in sectoral compositions, risk preferences, instruments, and access to onshore and offshore US dollar products. Table 3.1 summarizes the major market participants in the private sector, their roles, preferred tools, and influencing factors. Figure 3.9 provides a simplified schematic of interlinkages between various entities in ASEAN+3.

US dollar liquidity management by institutions and related risks

The preferences of companies in the trade sector can impact domestic US dollar liquidity conditions. Exporters typically convert foreign currency proceeds to domestic currency, but they may delay doing so in periods of higher US interest rates and expected dollar strength, thus exacerbating domestic currency weakness. The US dollar deposits of domestic companies, when held in financial institutions within the country, improve domestic dollar financing conditions. However, if for regulatory reasons or because of exporter preferences the deposits are placed with offshore banks, this can cut off a key source of US dollars for domestic banks. Importers generally convert domestic currency into US dollars (in spot or derivative markets) to meet their obligations.

Institutional investors and asset managers ("investors") are providers of liquidity for the markets and their investment practices greatly influence the supply and demand of the US dollar. These investors channel funds from their clients into multiple assets across geographies. The ones relevant for US dollar supply chains in ASEAN+3 are foreign investors investing in ASEAN+3 assets and domestic investors from within the ASEAN+3 region who invest abroad.

[7] Some large corporations may even employ dedicated treasury desks to deploy their foreign currency proceeds into liquid assets which can provide better returns over deposit rates.

Table 3.1. Private Participants in US Dollar Supply Chains

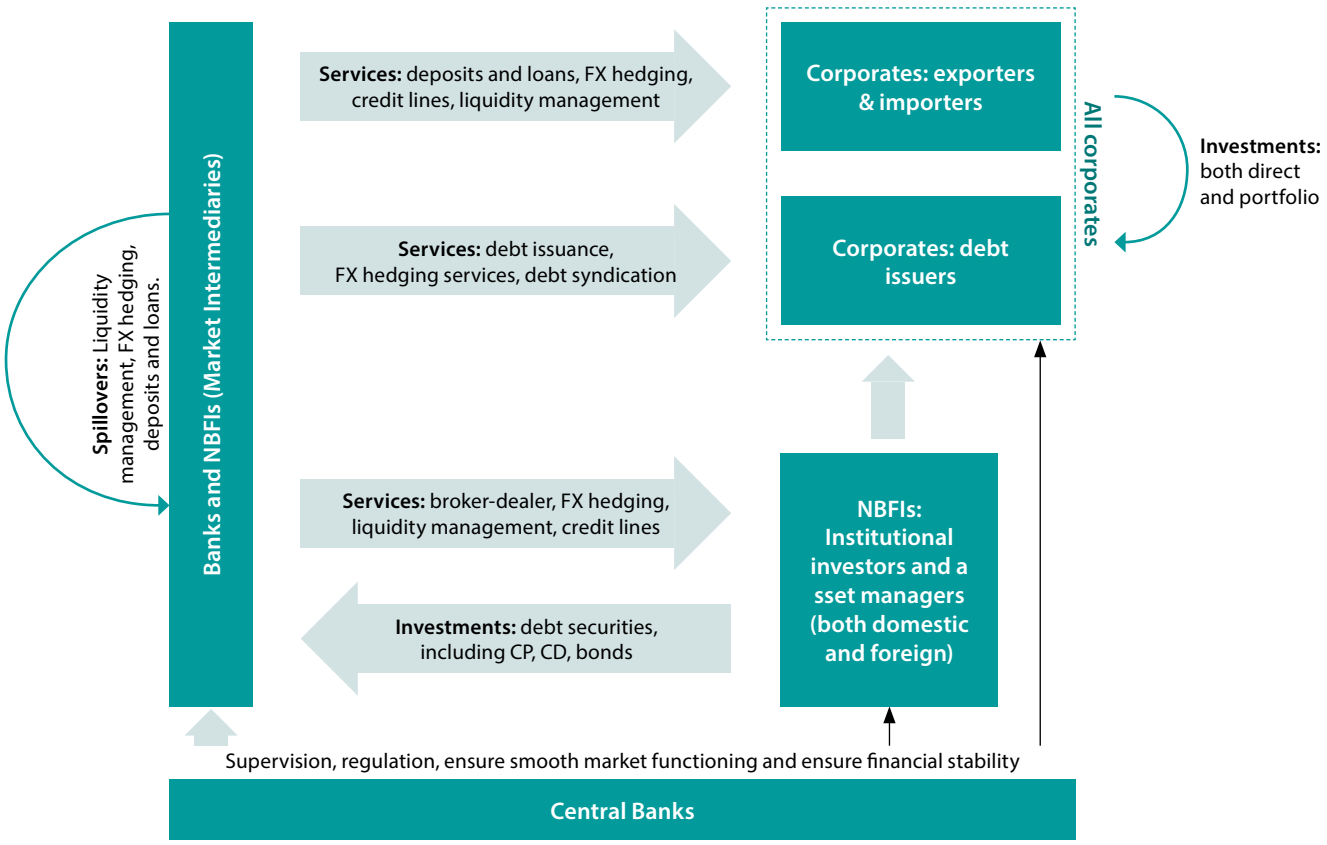
The private players use different tools to meet their foreign exchange requirements...

Participant	Tools used	Typical foreign exchange hedging practices	Factors considered
Corporates (Exporters and importers)	Deposits, spot conversions, derivatives	Discretionary	View on exchange rate, interest rate differentials, liquidity and hedging instruments, regulations
Corporates (Foreign currency debt issuers)	Syndicated loans, bonds, foreign exchange hedging instruments	Largely hedged for bonds, to the extent possible using available instruments	Cost of borrowing, synthetic yields, and hedging instruments
Investors (Both foreign and domestic)	Derivatives, deposits, onshore and offshore foreign exchange products	Generally, debt and short-horizon investments are hedged, equity and long-horizon investments are unhedged; Extent of hedging is discretionary	Interest rate differential, price of derivatives used, investment mandate or risk appetite, investment horizon, regulations
Financial intermediaries (Banks, NBFIs)	Short term instruments for liquidity management, provide products based on client requirements.	Banks typically strive to minimize currency and maturity mismatches; NBFIs may retain some exposure based on their mandate and risk-return profile.	Risk management (regulatory or prudential), instruments available, linkages with other intermediaries

Source: AMRO staff compilation, based on discussions with market participants.
Note: The tools, hedging practices and the factors considered are not all encompassing as they depend a lot on market conditions and preference of individual institutions. The table paints a generic landscape based on inputs received from private sector meetings. NBFI = nonbank financial intermediary.

Figure 3.9. Stylized US Dollar Supply Chain

… and in the process, create various interlinkages within the US dollar supply chains.



Source: AMRO staff compilation, based on discussions with market participants.
Note: The diagram is a simplified and stylized presentation of a complex network and is not all encompassing. Arrows represent services provided by the entity at the base of arrows to the entity at the tip. The participants and services provided are based on AMRO's understanding through discussions with market participants. CD = certificate of deposit; CP = commercial paper; FX = foreign exchange; NBFI = nonbank financial intermediary.

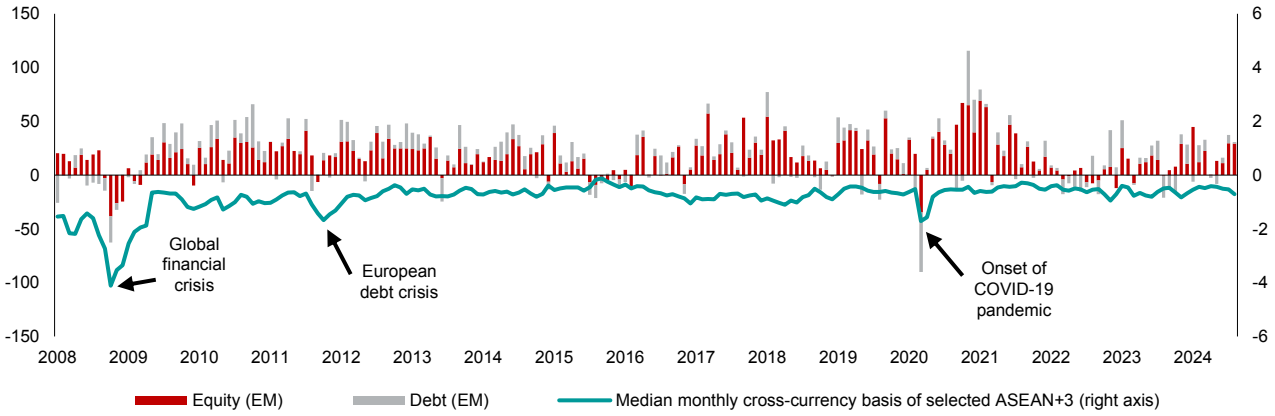
- Foreign investors: Foreign portfolio investments into emerging market assets (including ASEAN+3) have increased steadily since 2010, despite occasional outflows during episodes of market stress.[8] Tighter US dollar funding conditions accompanied outflows during the global financial crisis in August–November 2008, the deepening of the European debt crisis in 2011, and the onset of the COVID-19 pandemic in March 2020 (Figure 3.10). Foreign investors in most ASEAN+3 respond to stress episodes in the same way: they retreat from riskier assets to safe havens, and the resultant portfolio outflows worsen the US dollar funding environment.

- Domestic investors: Demand for foreign equity and debt instruments by ASEAN+3 portfolio investors have seen a marked increase (Figure 3.11) (McGuire and others 2021).

The behavior of domestic investors tends to be more diverse than that of foreign investors. Some investors (such as pension funds, hedge funds, family offices), driven by mandate or need for portfolio reallocation, will move to safe assets (such as US Treasuries) during market weaknesses and worsen US dollar availability in risk-off environments. Other investors are countercyclical, improving funding conditions during market stress by unwinding foreign investments and repatriating the proceeds. Asset managers and mutual funds with balanced portfolio allocations across asset classes and geographies will buy during domestic asset weakness. Investment funds and securities companies that mobilize domestic funds for investments abroad face redemption pressure from clients who retain a strong "home bias" during periods of markets stress.[9]

Figure 3.10. Emerging Markets: Equity, Debt Securities and Median Estimated Cross-Currency Basis
(Billions of US dollar; percent)

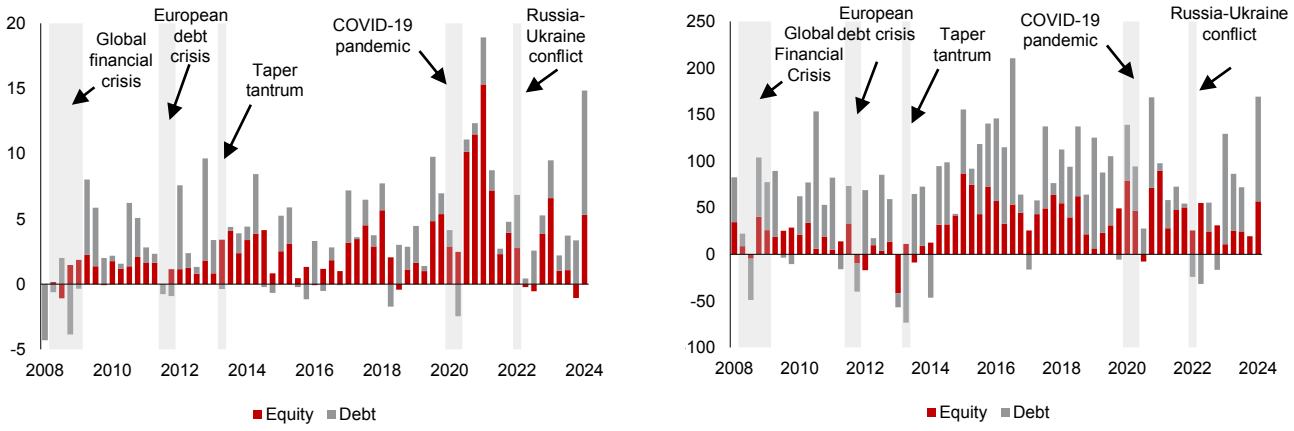
Tighter US dollar funding conditions have accompanied foreign portfolio outflows during episodes of markets stress.



Source: National authorities via Haver Analytics; Bloomberg Finance L.P.; AMRO staff calculations.
Note: EM = emerging markets. Data as of August 2024.

Figure 3.11. Selected ASEAN+3: Portfolio Investments in Foreign Securities by Domestic Investors
(Billions of US dollar)

Domestic demand for foreign equity and debt investments has increased over the past fifteen years.



Source: IMF via Haver analytics; AMRO staff calculation.
Note: Selected ASEAN economies include Indonesia, Malaysia, Singapore, Philippines, and Thailand. Selected Plus-3 economies include China and Korea. Data for China only starts in 2014. Data are updated as of Q1 2024.

[8] Direct investments may also be important for funding conditions, but they are structural and hence more stable. Portfolio investments are dependent on market sentiment, thereby exhibiting a high degree of volatility (FSB 2022; Wagas, Hashmi, and Nazir 2015). We, therefore, focus on portfolio investments in this chapter.

[9] Home bias is the tendency for investors to over-invest in domestic assets despite the benefits of diversifying into foreign assets.

Apart from foreign investors, other NBFIs outside the region may influence the dollar liquidity conditions in ASEAN+3.

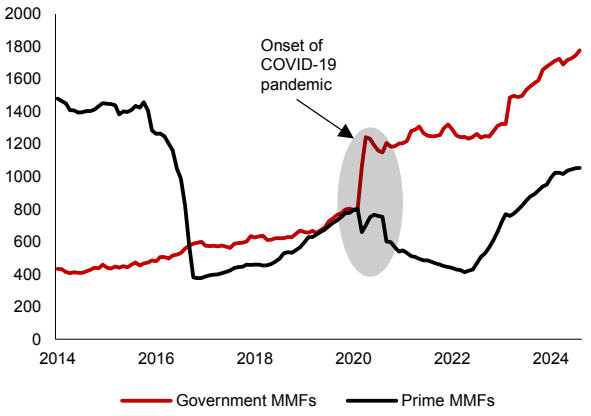
- Money Market Funds (MMFs): Prime MMFs provide short-term financing for non-US banks, corporations, and governments by investing in commercial papers, certificates of deposits, and repo markets. They may be forced to sell assets during times of stress to meet redemption demands (FSB 2021). The reallocation of investments from prime MMFs to government MMFs (which invest in US Treasury bonds) was a significant factor behind the funding stress in March 2020 (Figure 3.12), thus reducing the liquidity available for non-US banks.

- Central Counterparties (CCPs): During periods of severe market weakness, such as in March 2020, CCPs accumulate liquid assets through margin calls. Non-US CCPs place secured deposits with US banks, while US CCPs place them with the Fed, reducing access to US dollars for the ASEAN+3 financial system (Aldasoro, Eren, and Huang 2021).

Banks use a multi-layered system to manage residual liquidity risks and leverage on their cross-border relationships to manage liquidity efficiently. The interbank market allows them to address liquidity (and maturity) mismatches through instruments like repos, forwards, swaps, cross-currency swaps, commercial papers, and certificates of deposit. To manage these risks, many banks operate internationally, leveraging their branches and affiliates in financial centers in Hong Kong, Singapore, Tokyo, the US, and Europe (Figure 3.13). They rely on prime MMFs and other global banks to finance foreign currency liquidity deficits and park surplus liquidity. Notably, non-US banks (including large ASEAN+3 banks) use their branches to obtain liquidity from prime MMFs, customer deposits, and currency swaps. This extensive network gives banks access to US dollar sources and destinations for more optimal liquidity management. During stress episodes, liquidity obtained through central bank swap lines with the Fed is channeled to domestic banks in ASEAN+3 through affiliates or correspondent banks in the US (Figure 3.14).

Figure 3.12. US: Net Assets of Government and Prime Money Market Funds
(Billions of US dollar)

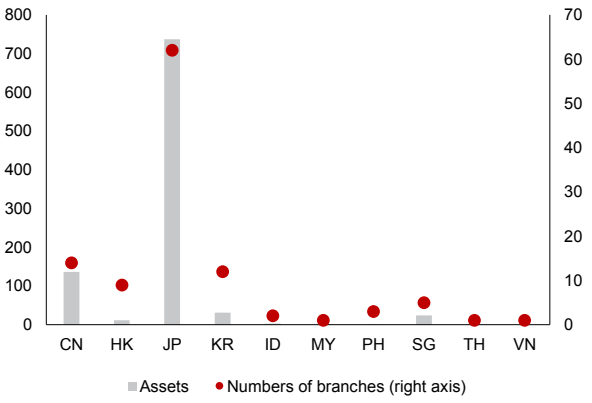
The investments from prime MMF were reallocated to government MMF in March 2020, during the onset of COVID-19 pandemic.



Source: Bloomberg Finance L.P; AMRO staff calculations.
Note: MMFs = money market funds. Data as of August 2024.

Figure 3.13. Selected ASEAN+3: Number of Bank Branches in US and Their Assets, 2023
(Billions of US dollar; number)

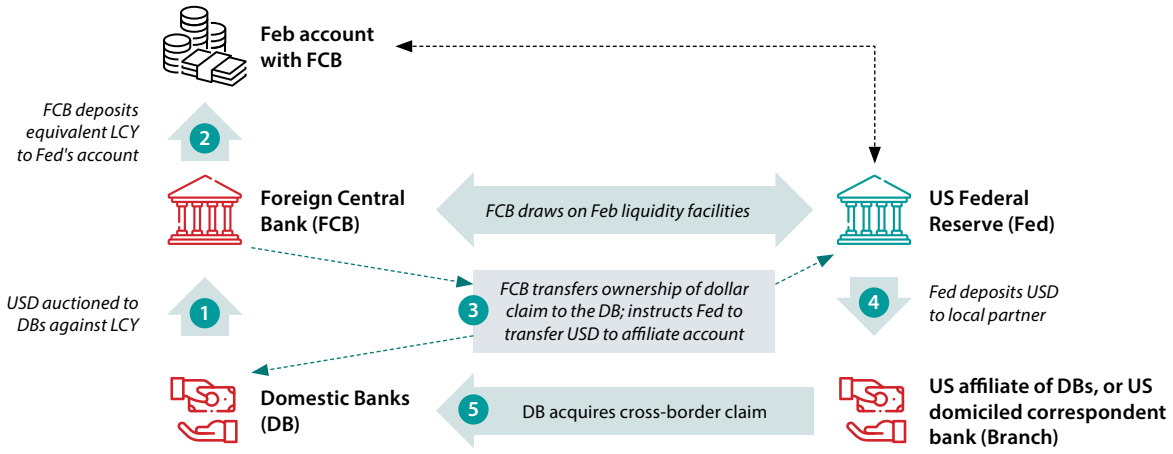
US branches of ASEAN+3 banks play an important role in the management of US dollar liquidity…



Source: The Federal Reserve.
Note: CN = China; HK = Hong Kong; JP = Japan; KR = Korea; ID = Indonesia; MY = Malaysia; PH = The Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Data as of March 2024.

Figure 3.14. Role of US Branches and Affiliates of ASEAN+3 Banks in Tapping Fed's Liquidity Facilities

… especially in channeling liquidity obtained through central bank swap lines during periods of market stress.



Source: Adopted from Aldasoro and others 2020.

Firms in ASEAN+3 issue foreign currency bonds to meet financing and liquidity management requirements. Typically, companies issue US dollar corporate bonds to satisfy business needs (such as paying for US dollar liabilities), diversify financing sources, or for more attractive terms of issuance (such as lower interest rates, lower cost of swapping US dollars to domestic currency). Accessibility to US dollar issuance markets and related costs are an important consideration, and ratings from international rating agencies allow firms to issue bonds at lower costs (tighter credit spreads). Banks and NBFIs may issue US dollar-denominated debt instruments to meet their short-term funding needs.

Foreign exchange hedging needs and practices in ASEAN+3

Foreign exchange hedging practices among ASEAN+3 entities depend primarily on business needs and the availability of hedging instruments. Business needs drive the demand for exchange rate hedging and the availability of instruments determines the sophistication of hedging practices. The demand for hedging practices varies across institutions.

- Corporates (trade sector): Across ASEAN+3, exporters and importers use spot and derivative markets to manage their foreign exchange exposure. Firms in advanced markets may employ complex structured products, including derivatives of up to two-year maturity. The choice of hedging tenors is driven by the extent of clarity of the firm's cash flow and liquidity of derivatives, which typically reduces for longer tenors and can make hedging expensive. The structure of the hedging instruments used can present risks for the currency and for the firms (Box 3.1).

- Debt issuers: Firms issuing long-term US dollar debt may choose to hedge the currency exposure on their liabilities through foreign exchange forwards (up to one year) and cross-currency swaps for longer tenors.[10] Unhedged debt exposes the firms to repayment risks due to currency depreciation, increasing the likelihood of a default (Bruno and Shin 2018). Firms face rollover risks due to changes in foreign currency interest rates, though this can be managed by switching currencies.

- Investors: According to market participants, investors tend to hedge more of their investments in debt securities, shorter-tenor investments, and portfolio investments, relative to equity securities, longer-tenor investments, and direct investments. Hedging instruments help offset the foreign exchange exposure of both foreign and domestic entities (investors and their counterparts). The unwinding of unhedged investments by foreign investors leads to outflows of US dollars creating a shortage of US dollars in the domestic financial system and further weakens the domestic currency. Some large domestic investors (such as pension funds) intentionally leave foreign investments unhedged to avoid high hedging costs, rely on domestic currency characteristics as a natural hedge, to prevent market disruptions from large hedging volumes and to diversify their currency risks. The hedging practices and business models of investors can aggravate US dollar shortages as seen during the onset of COVID-19 pandemic.[11]

- Banks: The residual exchange rate and maturity risks from the activities of businesses and investors end up in the banking system. Banks rely on the depth, liquidity and diversity of markets to minimize these risks but may not be able to mitigate them completely. For instance, banks may provide hedging services to longer tenor bond issuers through cross-currency swaps, but the lack of liquidity for longer tenor instruments limits their ability to find counterparties and offload the resultant duration mismatches.

[10] FX forward is an instrument used to fix the exchange rate for a particular date in the future. Cross-currency swap is an agreement between two entities to exchange interest and principal payments in one currency with those in a different currency. Both FX forwards and Cross-currency swap are over the counter derivatives and are typically provided by banks as part of their FX hedging services to their clients.

[11] The activities of NBFIs and their hedging practices was a key source of aggravated US dollar shortage in Korea in March 2020. As noted by McGuire and others 2021, the key factors behind the stress were the requirement to roll FX hedges by insurance companies, large margin calls in equity-linked securities (ELS) which asset managers and securities companies sold to their clients (AMRO 2021), and the sale of local currency assets by foreign investors. The lack of diversity in ELS products and lack of sufficient dollar credit lines of NBFIs with banks were identified as the key sources of vulnerabilities. In January 2021, authorities announced measures to address these weaknesses.

Recent developments during the Fed's hiking cycle

Surprisingly, the increases in the Fed's policy rate over the past two years have helped improve US dollar liquidity in the ASEAN+3 banking system. Fears of US dollar shortage due to rapid Fed rate hikes and resultant capital outflows did not materialize. While the strong external position of ASEAN+3 economies was an important underlying factor, many micro-market developments also helped support the US dollar liquidity situation. Domestic markets that allowed residents to hold US dollars saw an increase in dollar availability. The Fed's rate hikes largely outpaced interest rate increases by ASEAN+3 central banks. Three developments contributed to the improvement in US dollar financing conditions in the region.

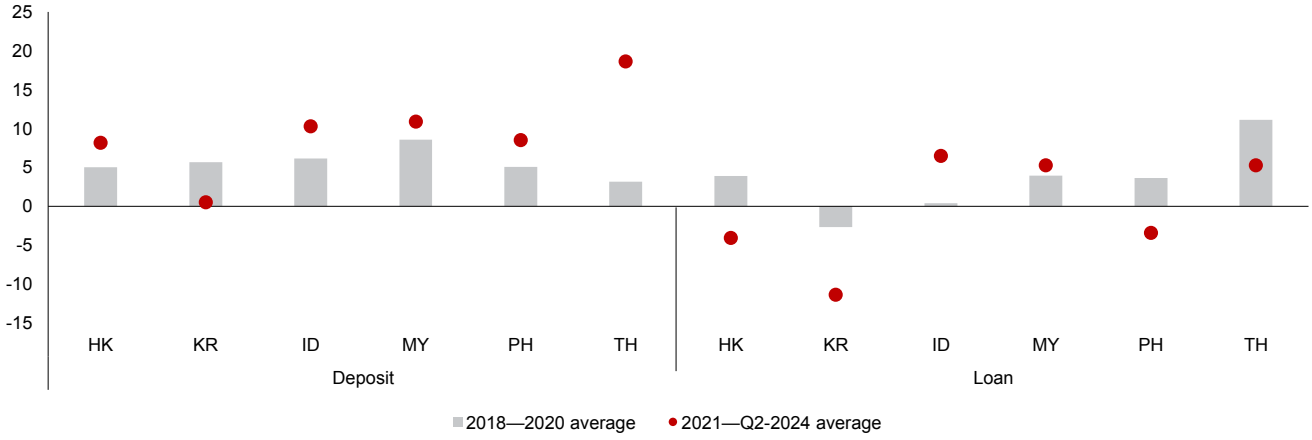
- Higher interest rates and expectations of US dollar appreciation made US dollar deposits attractive. The US dollar deposits held by residents increased due to attractive returns compared with domestic currency deposits, which helped the domestic banking system receive US dollar financing. Notably, exporters in a few economies delayed converting their export proceeds to domestic currencies. That said, the rise in resident US dollar deposits added to the depreciation pressures on domestic currencies. Authorities in some jurisdictions took measures to discourage exporters from hoarding dollars (Box 3.2).

- Higher interest rates reduced the attractiveness of US dollar borrowing. The growth in foreign currency deposits outpaced the foreign currency loan growth in ASEAN+3 economies (Figure 3.15). Elevated interest rates globally led to a slowdown in foreign currency bond issuances in 2023. The share of bonds denominated in US dollars declined as issuers preferred to raise bonds in other currencies (Figure 3.16). An uptick in US dollar bond sales in 2024 has been driven by ASEAN+3 banks. There is still much fewer issuance by nonfinancial companies than before Fed's hiking cycle started.[12]

- The Fed's hiking cycle led to an inverted yield curve which happens when short-term US dollar interest rates are higher than long-term bond yields. This made it less attractive for investors such as hedge funds and insurance companies to borrow US dollars to fund long-term investments, as they would incur a negative carry cost.[13] It also discouraged banks from borrow-and-buy strategies for US Treasuries.[14] The reduced short-term US dollar borrowing also contributed to easy financing conditions.

Figure 3.15. Selected ASEAN+3: Average Foreign Currency Deposit and Loan Growth
(Percent)

The foreign currency deposit growth has outpaced foreign currency loan growth in ASEAN+3 banking systems since the commencement of Fed's hiking cycle.



Source: National authorities via Haver Analytics: AMRO staff calculations.

[12] Though the lower issuance reduced the potential US dollar inflows, it also ensured that US dollar liquidity available from rising deposits was deployed in highly liquid securities instead of lower rated corporate debt. The decrease in issuance also reduced the price pressures on USD financing.

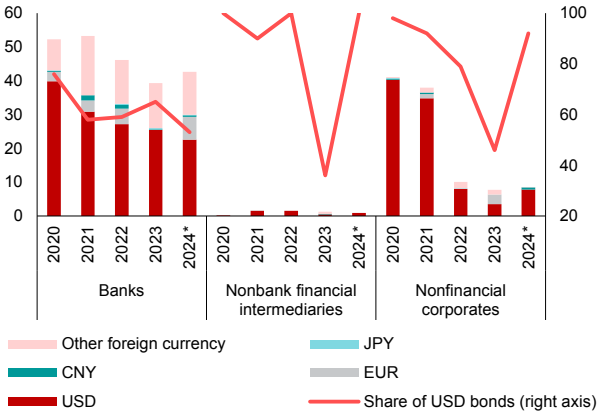
[13] Negative carry is a condition where cost of holding an investment is more than the income it generates. In the stated example, the investor will pay more for borrowing US dollars than the income it receives from holding the investment.

[14] A typical borrow-and-buy structure is used to secure funding and buy US dollar repo-able assets by banks that do not have US operations or partners. They would approach banks who have US branches to help facilitate these structures. The structure consists of two legs 1) purchase of US dollar assets and 2) secure funding by repo-ing out these assets. As the two legs are intertwined, these are done with a single counterparty. The banks entering these structures expect the US dollar asset return to be greater than the funding cost while the counterparty gains from earning the fees and interest on the funding it provides. An inverted yield curve leads to a higher funding cost than the yield on the long-term asset, thus making the structure less attractive. Such structures against US Treasuries have been unwound due to negative carry but those involving US MBS are attractive due to higher MBS yields. It is likely that the US treasury structures become attractive again when funding costs fall.

Figure 3.16. Selected ASEAN+3: Bonds Issued in US Dollar and Other Foreign Currencies
(Billions in US dollar; percent of total foreign currency bonds)

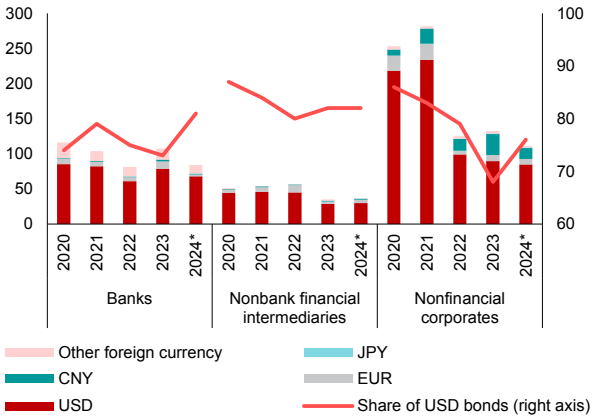
The share of US dollar denominated bonds in new issuances reduced after the Fed rate hikes started.

Selected ASEAN



Source: Cbonds; AMRO staff calculations.
Note: Economies included in the analysis are Malaysia, Singapore, Thailand, Indonesia, the Philippines, and Vietnam. CNY = Chinese renminbi; EUR = Euro; JPY = Japanese yen; USD = US dollar. Data for 2024 is as of 9 September 2024.

Plus-3



Source: Cbonds; AMRO staff calculations.
Notes: CNY = Chinese renminbi; EUR = Euro; JPY = Japanese yen; USD = US dollar. Data for 2024 is as of 9 September 2024.

Box 3.1:

Market Implications of Hedging Structures

Hedging structures used by Japanese importers may have exacerbated the sharp depreciation in the Japanese yen against the US dollar in 2022. In Japan, importers typically hedge against a stronger US dollar and would normally purchase knock-out options at much higher levels to reduce hedging costs.[1] Unprecedented yen weakness in 2022 triggered these knockouts, inflicting losses and prompting firms to rebuild the hedges at even weaker levels of the yen, which in turn drove exchange rate volatility and amplified the spillover from the US dollar to the yen. Likewise, prior to the global financial crisis, Korea's small and medium sized enterprise (SME) exporters had used knock-in and knock-out (KIKO) structures to manage exchange rate risks at a time when the won was appreciating. At the onset of the crisis in 2008, when the won depreciated and fell beyond the range defined by the KIKO structures, exporters incurred huge losses due to their options positions. Many SMEs, including shipbuilders, went bankrupt. The banks that sold the options suffered minimal losses initially, but the ripples from the crisis led to corporate defaults, which in turn impacted bank earnings. The US dollar stress increased as investors were concerned that Korean companies could not repay maturing short-term debt. In both the instances, companies used the same kind of hedging structures and so, were exposed to the same risks in unexpected market movements. This homogeneity exacerbated the pressures on the domestic currency and, in case of Korea, added to US dollar funding stress.

The author of this box is Chiang Yong (Edmond) Choo.

[1] A knockout option is an option with a built-in mechanism to expire worthless if a specified price level in the underlying asset is reached. A cap is set on the level the price can reach in the option holder's favour. As knockout options limit the profit potential for the buyer, the premium is typically lower than an equivalent vanilla option.

Box 3.2:

Exchange Rate Implications of Corporate US Dollar Deposits

The foreign currency deposits of companies based in Indonesia and Malaysia increased significantly during 2020–2023. The Fed's tightening cycle enhanced the yield on US dollars and fueled expectations of an even stronger US dollar, while rising geopolitical tensions and a slowdown in trade earnings may encourage exporters to keep high precautionary balance in uncertain times. A similar trend was reported among Chinese exporters. The expectations of a weaker yuan amid diverging monetary policies between the US and China encouraged exporters to hold on to high-yielding US dollars deposits and use currency swaps (i.e. swapping US dollars for yuan for a short period, say 3 months) to meet local currency business needs. These actions exerted depreciation pressures on domestic currencies. To alleviate pressures on domestic currencies, the authorities have taken measures such as offering better interest rates for dollar deposits through domestic banks (Indonesia) and conducting active engagement with corporates to encourage repatriation of foreign investment income (Malaysia).

The author of this box is Chiang Yong (Edmond) Choo.

Risks due to linkages between entities

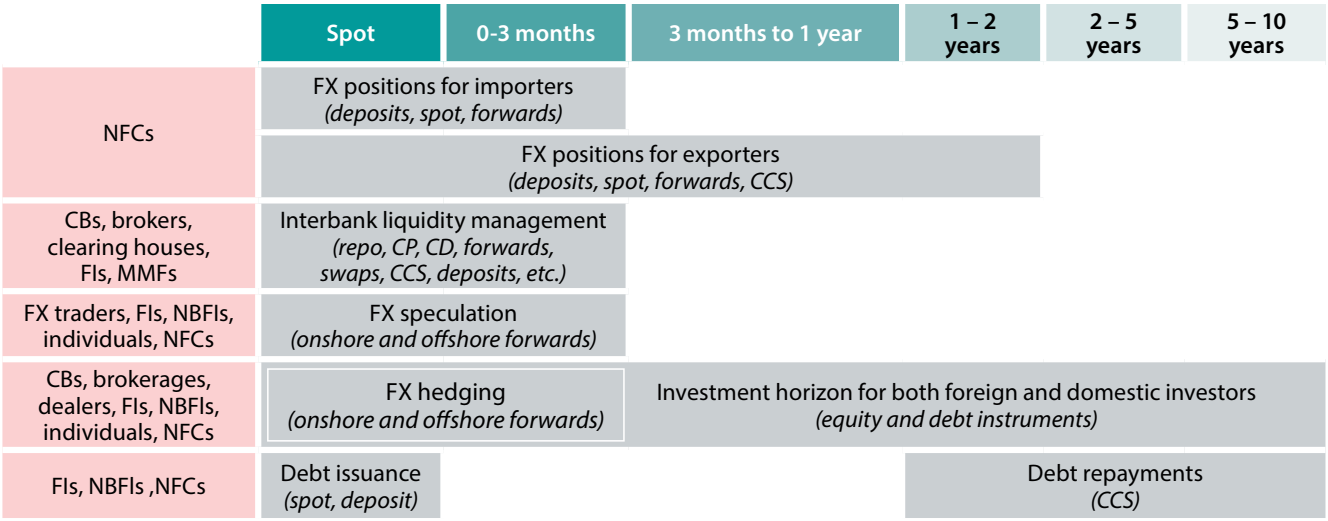
The US dollar supply chain in ASEAN+3 economies appear robust, but not without pockets of risk. Under normal conditions, regional entities do not face US dollar liquidity shortages. The primary concerns are managing currency and maturity mismatches, often leaving financial systems with these risks.

- Currency mismatches: The ASEAN+3 financial system historically holds more US dollar assets than liabilities. The resultant currency and maturity mismatches need to be managed frequently to account for changes in exchange rates by using tools such as cross-currency swaps, repos, and other market financing tools (IMF 2019), but these tools add to costs and expose institutions to rollover risks during market stress.
- Duration mismatches: Participants in the US dollar supply chain operate in different maturity buckets (Figure 3.17). Financial institutions tend to hold less-liquid positions themselves to meet client needs, contributing to duration mismatches in the financial system.

Banks and other financial institutions, even highly regulated ones, are exposed to amplified currency and duration mismatches in times of stress. NBFIs subject to less stringent prudential regulation may take on such risks willingly if the risk-to-reward ratios are favorable. These institutions could face stress even in mildly adverse market conditions, with resultant spillovers to the wider financial system.

Figure 3.17. Interaction of Various Entities in US Dollar Supply Chain and Resultant Maturity Mismatches

The participants in the US dollar supply chain operate in different maturities and may create duration mismatches in the financial system.



Source: AMRO staff's representation based on inputs from market participants.
Note: The diagram is a simplified and stylized representation of a complex network and is not all encompassing. CCS = cross-currency basis swap; CB = central bank; CD = certificate of deposit; CP = commercial paper; FI = financial institution; FX = foreign exchange; MMF = money market fund; NBFI = nonbank financial intermediary; NFC = nonfinancial corporate.

III. Issues Arising from US Dollar Reliance in ASEAN+3's Financial Systems

US dollar funding stress and risks for financial intermediaries

The global financial system has faced persistent US dollar shortages since the global financial crisis. The cross-currency basis ("basis", Box 3.3) for most major currencies has turned negative since 2008, which means borrowing US dollar through foreign exchange swaps carries a premium (i.e. more costly) over US dollar interbank borrowing. The basis has turned negative as domestic investors have swapped local currency for dollars, and banks have reduced their hedging services to clients due to low interest rates and tighter regulations (Avdjiev, Eren, and McGuire 2020). Regulatory limits on arbitrage activities have kept the basis negative. The negative basis indicates a persistent US dollar shortage in the global financial system (Borio and others 2016).

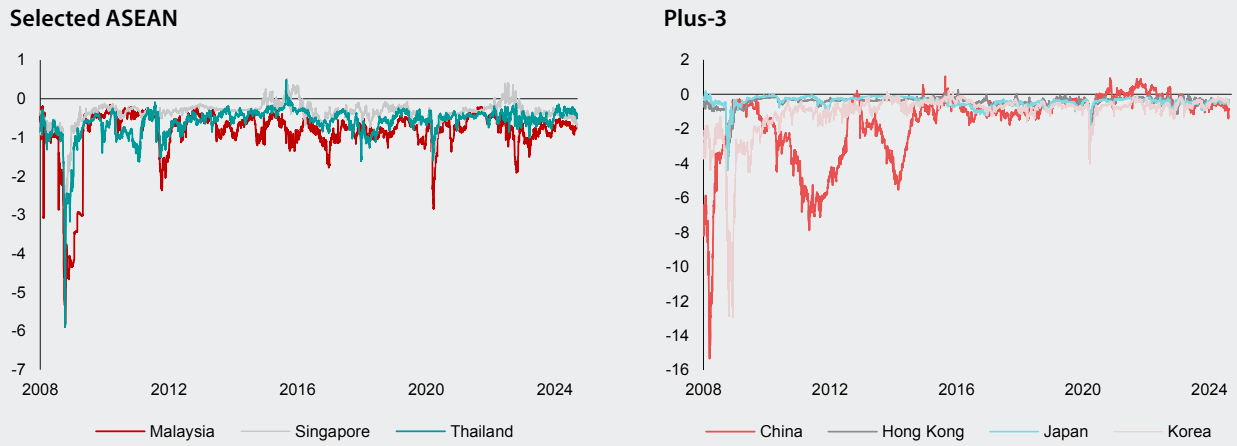
US dollar funding acts as a risk transmission channel and risk magnifier rather than a source of shock for financial markets. Major funding stress episodes in the past 15 years, such as the global financial crisis, European debt crisis, COVID-19 pandemic (del Rosario and Pande 2020), and the US regional banks crisis (2023), were triggered by global economic and financial shocks and accompanied by a rise in volatility (Figure 3.18). Although technical factors occasionally cause short-lived US dollar funding squeezes, like in September 2019, the spillover effects are less severe. The greater risk lies in a confluence of shocks stemming from both fundamental and technical factors causing a funding squeeze, which could magnify the original shock with significant consequences for global financial markets.

Box 3.3:

Why and How Is the Cross-Currency Basis Estimated?

The cross-currency basis is the difference between the cost of directly borrowing one currency in the cash market and the interest paid to borrow this currency by swapping it with another. If the covered interest rate parity holds, the basis should be zero. The basis for less- developed markets has two issues: lack of liquidity in less-developed markets makes price aggregator quotes unreliable, and the transition from Interbank Offered Rates (IBORs) disrupts time series data. To address this, the basis using foreign exchange spot and forward exchange rates, and interest rates is constructed for various ASEAN+3 markets.[1] The difference between the US dollar interest rate and the equivalent interest rate of borrowing in domestic currency and swapping them to US dollars using foreign exchange spot and forwards is calculated. Figure 3.3.1 show the estimated basis for selected ASEAN+3 economies.[2]

Figure 3.3.1. Selected ASEAN+3: Cross-Currency Basis Swap Estimates
(Percent)



Source: Bloomberg Finance L.P; AMRO staff calculations.
Notes: Data as of 9 September.

The author of this box is Prashant Pande.

[1] The following interest rates in the 3-month tenor are used: US (SOFR OIS), China (SHIBOR), Hong Kong (HIBOR), Japan (JPY OIS), Korea (KORIBOR), Malaysia (KLIBOR), Singapore (SIBOR), and Thailand (BIBOR). There is a possibility that some deviations in the estimates are due to the difference in the ways the forward and the basis markets operate. The forward markets can be influenced by factors other than US dollar funding, which can create some distortions.

[2] The basis estimated for Indonesia and Philippines were dropped because these markets do not have relevant interest rate derivatives. Secondly, the forwards for IDR and PHP were used by investors to hedge their domestic currency exposures. They did this by buying US dollars through forward transactions. Thus, the forward implied rates are not a true reflection of the interest rate differentials between these markets and the US.

What drives the US dollar funding stress in ASEAN+3?

A panel pooled regression model is used to explore the relationship between the basis and potential drivers such as liquidity, volatility, and expectations of the domestic exchange rate (against the US dollar), financial market volatility, and credit spreads. A quantile regression analyzes the change in drivers during extreme dollar funding stress episodes. Annex 3.3 lists the variables used and describes the methodology. The key findings are:

- Higher Libor-OIS spread, financial market volatility, a stronger US dollar and the widening of term spread differentials are associated with US dollar funding stress.[15] These results are intuitive and indicate that a spike in the perceived credit risk, risk-off investor sentiments, US dollar strength and more attractive returns on US dollar assets could lead to stress in the dollar funding market.

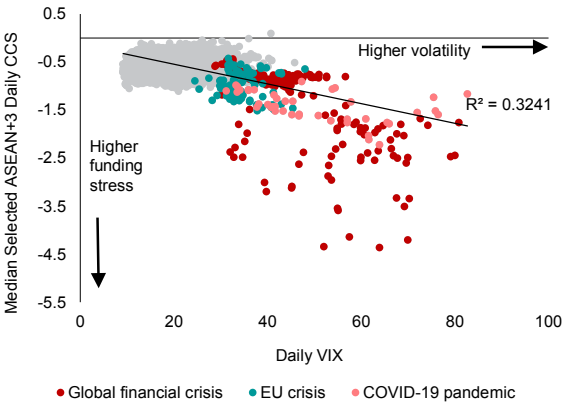
- The basis for ASEAN+3 international financial centers (IFCs) is less dependent on term spread differentials, whereas that for advanced economies shows a strong relationship with exchange rate volatility.

- The quantile regressions show that in periods of extreme funding stress, the volatility and expectations of the exchange rate (against the US dollar) are the most significant factors. Meanwhile the importance of US dollar strength, financial market volatility, and term spread differential, drops in comparison to the baseline model.

Financial intermediaries in ASEAN+3 face pressures on multiple fronts during stress situations. There is structural demand for US dollar funding in ASEAN+3 financial system from financial institutions having accumulated more US dollar assets, mostly in the form of loans to corporates, than liabilities, which are mostly in form of deposits and shorter term borrowings (Figure 3.19). This demand is met by tapping into global and intra-regional pools of liquidity through US dollar denominated debt instruments, foreign exchange swaps and cross-currency swaps. This cost rises as funding conditions tighten, and in extreme situations the funding may dry up, increasing liquidity risks for financial intermediaries. The situation may be worsened by the response of foreign NBFIs during stress scenarios, including: (1) foreign asset managers and institutional investors selling ASEAN+3 assets, (2) CCPs making margin calls on foreign investments of domestic investors, and (3) reduced liquidity from prime-MMFs as they face redemption pressures. During such periods, ASEAN+3 banks find it difficult to secure funding from banks in the US, Europe and other economies. The funding stress causes banks to scale down exchange rate hedging services to their clients who themselves may face drawdowns on corporate credit lines, and thus exposing nonfinancial companies to liquidity stress.

Figure 3.18. Selected ASEAN+3: Volatility Index versus Daily Median Cross-Currency Basis
(Index; percent)

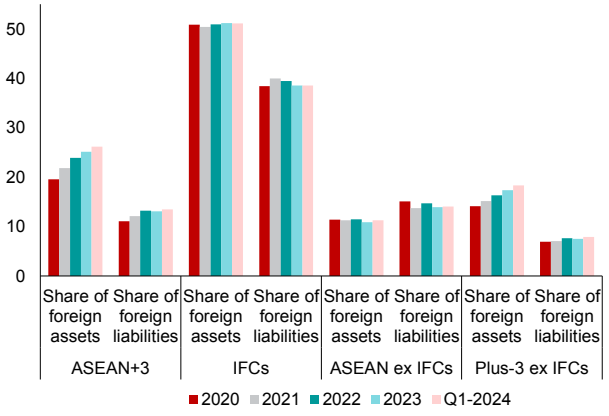
Funding stress tends to be higher in periods of higher market volatility.



Source: Bloomberg Finance L.P.; NUS Credit Research Initiative (NUS-CRI); AMRO staff estimates.
Note: The volatility index used is the index of expected volatility in S&P 50 Index (VIX Index) derived from option bid and ask quotes. Sample is for ASEAN+3 economies which includes China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand. Data as of 9 September 2024.

Figure 3.19. Selected ASEAN+3: Foreign Assets and Liabilities in the Financial System
(Percent of total assets and liabilities)

The ASEAN+3 financial system has more US dollar denominated assets than liabilities.



Source: Bank for International Settlements (BIS).
Note: ASEAN+3 includes Brunei, Cambodia, China, Hong Kong, Indonesia, Japan, Korea, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. IFCs include Hong Kong and Singapore. ASEAN ex IFCs include Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. Plus-3 ex IFCs include China, Japan, and Korea. Data for 2024 is as of Q1.

[15] The Libor-OIS spread is the difference between the London interbank offer rate (Libor) and the overnight indexed swap (OIS). The Libor is the rate at which banks indicate their willingness to lend to other banks while the OIS is the rate on a derivative contract of the same tenor on the effective federal funds rate. The analysis used the 3-month tenor of these rates.

Does stress in US dollar funding conditions affect cross-border bank lending?

Tighter funding conditions can lead to sharper reductions in cross-border lending. Panel regressions (Annex 3.4) investigate if the lending behavior of banks in 20 advanced economies to recipient ASEAN+3 economies depend on dollar funding conditions. The key findings are:

- The reduction in lending to ASEAN+3 economies from advanced economy banks is larger than the reduction seen for rest of the world, possibly due to higher banking exposure to and greater reliance on US dollars from advanced economy banks (see Feature 1, Section II). Thus, the ASEAN+3 region is more vulnerable to credit rationing from foreign banks during episodes of funding stress.

- Sharper pullbacks in lending from the banks in the advanced economies to ASEAN+3 IFCs and advanced economies are observed compared to their lending to ASEAN+3 emerging market economies.

Does US dollar funding stress impact domestic banking sector stability?

ASEAN+3 banks are generally well capitalized and have strong domestic balance sheets. US dollar funding stress alone may not pose a significant direct risk to domestic financial stability. However, the spillover effects may not be negligible. A panel regression is employed to investigate the relationship between tighter dollar funding conditions and the probability of default of domestic banking systems in selected ASEAN+3 economies (Annex 3.5). A visual inspection of Figure 3.20 suggests some co-movement between the basis and the average probability of default in ASEAN+3, and the results of the panel regression confirm this observation. The results of the regression show that:

- Funding stress leads to a rise in the probability of bank defaults.[16]

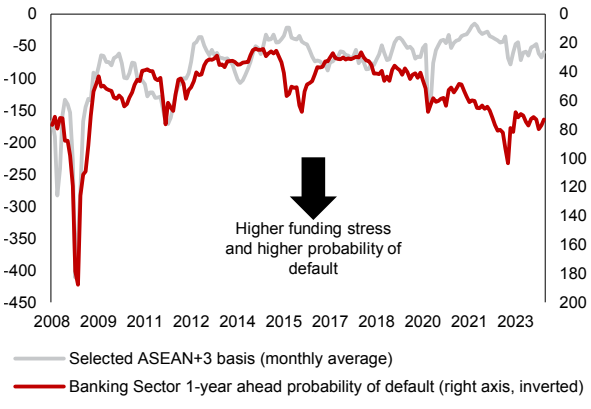
- The correlation is strongest in ASEAN+3's IFCs and advanced economies, possibly due to larger US dollar intermediation activities and cross-border exposure by banks in these economies.

- During major crises over the past 15 years (such as the global financial crisis and the onset of the COVID-19 pandemic), the link between funding stress and banking sector instability heightens for all ASEAN+3 economies in the sample. The magnitude of the change in probability of defaults is modest outside of crisis periods.

- The probability of default for ASEAN+3 IFCs is the most sensitive to funding conditions: an event like the global financial crisis (with the basis widening by 400 basis points) will increase the 1-year ahead probability of default by 1.5 percentage points.

Figure 3.20. Selected ASEAN+3: Average Cross-Currency Basis and Banking Sector 1-Year Ahead Probability of Default
(Basis points; basis points)

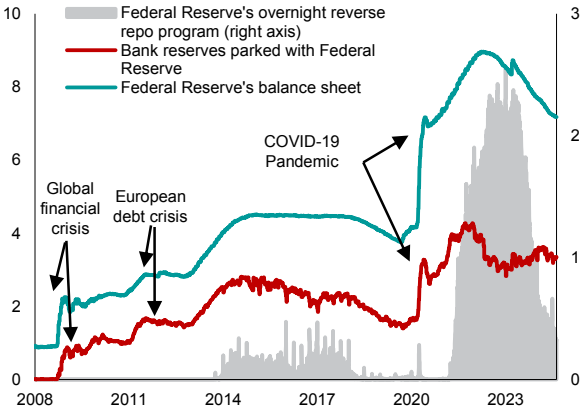
The probability of default for banking sector tends to rise when the US dollar funding stress.



Source: AMRO staff estimates; NUS Credit Research Initiative (NUS-CRI).
Note: Sample is for ASEAN+3 economies which includes China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand. The latest available data for probability of default is as of February 2024.

Figure 3.21. US: Proxies for Surplus US Dollar Liquidity
(Trillions of US dollar)

Stable bank reserves show that the liquidity remains surplus in the US banking system.



Source: Bloomberg Finance L.P.; AMRO staff calculations.
Note: Data for Federal Reserve's overnight reverse repo program begins in September 2013. Latest data as of 9 September 2024.

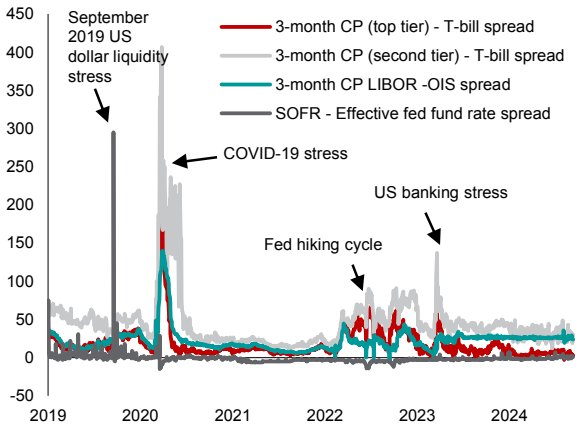
[16] The relationship strengthens significantly when year-effects are added to the model. This indicates that the relationship may not to be static and changes with financial market or macroeconomic conditions.

The funding landscape in the US has stabilized since the regional banking crisis in March 2023. Bank reserves have stabilized (Figure 3.21), indicating a liquidity surplus. Reserves remain "abundant", and the Fed aims for "ample" reserves.[17] Funds in the Fed's overnight reverse repo (ON RRP) facilities, an indicator of surplus liquidity, have continued to fall as MMFs prefer higher repo rates with banks and brokers over the ON RRP rate. This shift in ON RRP usage reflects a redistribution, not a decline in liquidity. With the Fed's balance sheet shrinking steadily, quantitative tightening may end by 2025, alleviating a key drag on US dollar liquidity. Credit spreads have remained stable even amid elevated interest rates (Figure 3.22), indicating benign funding conditions.

US dollar funding for ASEAN+3 appears stable but remains vulnerable to significant global growth shocks. As of September 2024, the basis is stable, spreads are narrow, and the trend of dollar assets versus liabilities in the banking system is favorable due to stronger US dollar deposit growth and slower US dollar loan growth, indicating no major stress. US dollar stress tends to spike during massive negative shocks to the global economy, as indicated by sharp declines in breakeven yields (Figure 3.23), increased financial market volatility, and poor returns on equities and emerging market currencies.[18] A major global economic shock can impact investor sentiment and banking flows and lead to a US dollar shortage. Geopolitical developments also pose risks, potentially disrupting US dollar supply chains and creating vulnerabilities. In extreme cases, loss of access to US dollars due to sanctions, technological failures, or cyber-attacks could have significant spillover effects on the region's US dollar funding.

Figure 3.22. US: Selected Interest Rate Spreads
(Basis points)

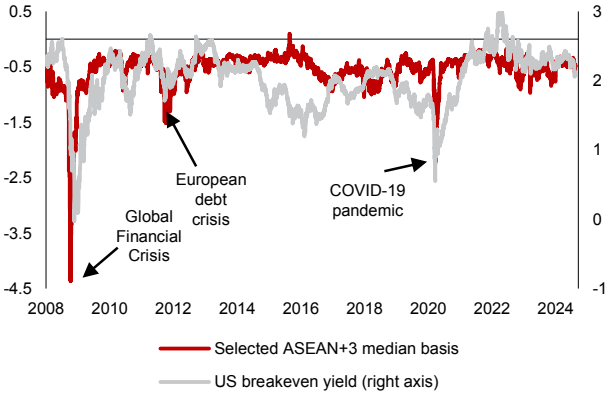
The credit rate spreads remain stable indicating benign funding conditions.



Source: Bloomberg Finance L.P.; AMRO staff calculations.
Note: CP = commercial paper; LIBOR = London interbank offer rate; SOFR = Secured overnight financing rate; T-bill = treasury bill. Latest data as of 9 September 2024.

Figure 3.23. Selected ASEAN+3: Median Cross-Currency Basis and US Breakeven Yields
(Percent)

The funding stress spikes in periods of negative shocks to the global economy.



Source: Bloomberg Finance L.P; NUS Credit Research Initiative (NUS-CRI); AMRO staff calculations.
Note: Due to data unavailability, economies in selected ASEAN+3 only includes China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand. Latest data as of 9 September 2024.

US dollar as a channel of spillovers from US policies and other global shocks

US monetary policy has spillover effects on the global economy and financial system through various macro-financial channels. Changes in US monetary policy (both conventional and unconventional) affect cross-border capital flows, asset prices, and economic growth through several channels. These include (1) portfolio rebalancing driven by the search for yield, (2) the Fed signaling a reduction of the expected risk-neutral domestic interest rates prompts capital flows to emerging economies, (3) exchange rate changes due to portfolio flows and interest rate differentials, and (4) trade-flow alterations due to effect on US domestic demand (Lavigne, Sarker, and Vasishtha 2014). These channels are not independent and often operate simultaneously. The reliance on the US dollar amplifies the spillovers through portfolio rebalancing and exchange rate channels. Over the past 15 years, the markets experienced a prolonged period of easy US monetary conditions, followed by a relatively short period of sharp monetary tightening in 2022 and 2023. In both periods, US monetary policy conditions affected financial conditions in ASEAN+3 financial markets.

[17] Harris, Alex. 2024. "Powell Says It'll Soon Be Appropriate to Slow Pace of QT." Bloomberg, 21 March.
[18] Breakeven yield is defined as the difference between nominal and real yield of the same tenor. It is perceived as a market implied measure of inflation expectations.

US monetary policy affects asset valuations in ASEAN+3. The long period of quantitative easing and near-zero US interest rates flooded global markets with dollar liquidity, encouraged investors to take risks, and led to a massive buildup of leverage due to cheap and ample availability of credits. A prolonged period of easy financing conditions can lead to formation of asset bubbles (Powell 2013). Valuations of emerging market equities and bonds have tended to be richer during periods of zero-lower bound Fed policy and quantitative easing (Chari, Stedman, and Lundblad 2017). Though rich valuations may not be categorized as a bubble, overvalued assets are susceptible to a sharper correction when market conditions switch to risk-off. ASEAN+3 asset prices over the past two years have seen weaknesses and episodes of elevated volatility during periods of rapid change in Fed interest rates and expectations.

How do US dollar financial conditions affect portfolio flows?

US dollar financing conditions can alter ASEAN+3 portfolio flows. Foreign investors typically buy ASEAN+3 equity and debt instruments in times of easy financial conditions and sell them when conditions tighten. Although the financing environment is not the sole determinant of portfolio flows, the analysis shows that financing conditions have a material influence on foreign appetite for regional assets. A panel regression (Annex 3.6) on the relationships between the basis, and equity or debt flows in various ASEAN+3 markets, suggests that:

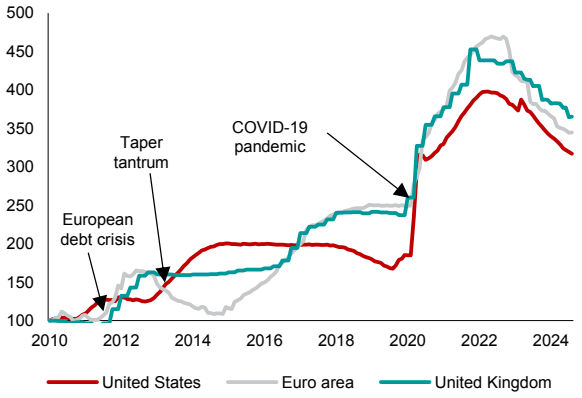
- The basis has a positive coefficient against various country-asset class combinations—i.e., a lower or more negative basis (tighter funding conditions) is associated with portfolio outflows from debt and equity markets in ASEAN+3.
- The relationship is most stable in Malaysia's debt and equity markets, and somewhat stable for equity flows in Korea and Thailand, and debt flows in China.
- The relationship between the basis and portfolio flows strengthens during times of financial stress. Outflows during funding stress could be severe while inflows during easier financing conditions would be slower.

The Fed's easy monetary policy and balance sheet expansion contributed to a rise in ASEAN+3 external debt. Fed balance sheet expansion (Figure 3.24) created large bank reserves (Wessel 2024) which found their way to offshore markets (Bhattarai, Chatterjee, and Park 2018). The increase in ASEAN+3 external debt (Figure 3.25) in ASEAN+3 economies made the economies more vulnerable to the risk of capital outflows and currency depreciation. Particularly for entities with liabilities denominated in US dollars but a revenue stream in local currency, a depreciation of the domestic currency during elevated interest rates could pose difficulties for debt servicing.

ASEAN+3's monetary policies often react to mitigate spillovers from US monetary policy changes. Domestic monetary policies in ASEAN+3 economies respond to the changes in domestic economic conditions and outlooks as well as to changes in the Fed's policy. Some ASEAN+3 central banks hike interest rates in periods of tighter Fed policy to ease depreciation pressures on their currencies, and vice versa. Spillovers from US monetary policy, while having more immediate impact for capital flows and exchange rates, may alter the medium-term trajectory for growth and inflation trajectory in the region.

Figure 3.24. Selected Advanced Economies: Balance Sheets of Major Central Banks
(Basis points)

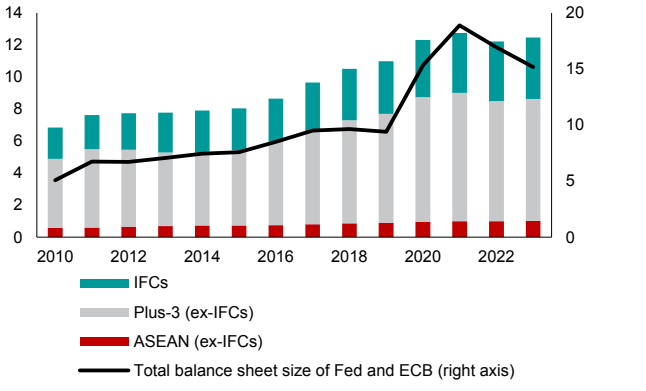
Major central bank balance sheets have expanded significantly since 2010…



Source: Haver Analytics; AMRO staff calculations.
Note: Data as of August 2024.

Figure 3.25. Selected ASEAN+3: Change in External Debt
(Percent of GDP; trillions of US dollar)

… and have been one of the drivers of the rise of external debt in ASEAN+3.



Source: International Monetary Fund (IMF); AMRO staff calculation.
Notes: ASEAN includes Cambodia, Indonesia, Malaysia, Philippines, and Thailand; IFC includes Hong Kong and Singapore; Plus-3 includes China, Japan, and Korea. Due to data unavailability, Brunei, Lao PDR, Myanmar and Vietnam are not included in the grouping. For Cambodia, China and Malaysia, the data are available starting 2015, 2015 and 2012 respectively. The data is backfilled with the first available data point. Fed = Federal Reserve; ECB = European Central Bank.

The US dollar can transmit global shocks to ASEAN+3 due to its safe asset status. The US dollar tends to strengthen during periods of stress (such as the onset of the COVID-19 pandemic or the March 2023 banking system stress) and increased market uncertainty, when investors turn to safe assets. Such episodes can be more disruptive to financial stability and generally require that authorities, either in the US or in domestic economies, take remedial measures to alleviate market stress. On the other hand, financial market volatility may also rise when markets rapidly adjust their expectations around Fed policy. Once the adjustment is complete, volatility eases back to normal levels. The US dollar safe asset channel may be a more potent transmitter of risk than that the channel of US monetary policy spillovers.

Reliance on the US dollar makes ASEAN+3 susceptible to US policy decisions that (rightly) serve US domestic economic and financial interests. Although the US Fed has helped to alleviate liquidity stress in global markets, its role as the global lender of last resort should not be taken for granted (Annex 3.7):

- During the global financial crisis, European debt crisis, and onset of COVID-19, the Fed announced swap lines to many advanced economy central banks to provide liquidity to meet exceptional demand for US dollar. The measures were effective in containing the stress in global markets and curbed spillovers including those to the US economy and financial markets.

- The allocation of swap lines is at the Fed's discretion. The US dollar swap facility is available only to some ASEAN+3 central banks during times of stress. The Fed considers various economic and political factors when allocating swap lines. Countries with strong economic ties to the US, substantial holdings of US assets (particularly treasury securities), and significant geopolitical interests are more likely to be given access. The Fed converted FIMA from a temporary facility to a standing facility in July 2021, allowing foreign central banks to repo US Treasuries with the Fed for liquidity. Using the FIMA facility as a dollar financing backstop incentivizes central banks to maintain or increase their holdings of repo-able US Treasuries, further entrenching the role of US dollars in the international financial system.

Regulatory actions by the US authorities can inadvertently impact US dollar financing conditions. For example, structural and operational reforms for US money market funds (MMFs) adopted in 2014 had significant spillover effects. These reforms aimed to prevent runs on prime MMFs (Cipriani, La Spada, and Mulder 2017), like those in 2008. However, the reforms led many prime MMFs to convert to government MMFs, which were exempt from the new rules, resulting in a USD 1 trillion outflow from prime MMFs. Since prime MMFs were major sources of short-term financing through commercial papers for many non-US banks, their shrinkage increased dollar financing costs (Penn Mutual, 2016). Many non-US banks compensated by raising dollar deposits outside the US and drawing down excess reserves with the Fed, which helped fill the gap created by the loss of MMF liquidity (Aldasoro and others 2017).

The international financial system depends not only on the US dollar as a currency, but also on the infrastructure and services that the US-based financial system provides. US commercial banks may hold deposits and act as the custodian of US dollar assets held by non-US entities, such as institutional investors, asset managers, sovereign wealth funds and central banks. Many non-US entities also depend on US counterparties for trading and settlement services for US dollar assets. The payment systems like CHIPS and messaging systems like SWIFT also form a part of the US dollar ecosystem. In a scenario where access to these financial services is cut-off, ASEAN+3 banks, NBFIs and companies could find it very difficult to conduct their cross-border business.

IV. Policy Discussion

The ASEAN+3 financial system's dependence on the US dollar is deeply entrenched, and resolving the resulting structural vulnerabilities requires both short-term and long-term strategies. In the short term, efforts should focus on improving resilience within the dollar-reliant environment. In the long term, authorities should work together to reduce the structural dependence on the US dollar.

Short-term policy direction—Boosting immunity to shocks

Policy considerations over the short term, to increase ASEAN+3 resilience in a US dollar-reliant international financial system, can focus on: (1) improving economic fundamentals to mitigate spillovers from external shocks, (2) strengthening surveillance and risk management strategies, and (3) enhancing regional financial safety nets to withstand liquidity shocks. These policies aim not to replace the US dollar but to strengthen the domestic financial system to mitigate spillover risks from global developments and exogenous shocks.

- Improving economic resilience to withstand external shocks: The 2022–2023 Fed hiking cycle demonstrated that robust domestic macro-financial fundamentals—strong economic growth, well-anchored inflation expectations, sound fiscal policies, well-capitalized banking systems with ample liquidity buffers, manageable levels of public debt, and ample foreign exchange reserves—have helped ASEAN+3 economies withstand external shocks and maintain financial stability. Specifically, while the Fed's action influenced ASEAN+3 monetary policy decisions, the required tightening was much smaller than in the US, thanks to well-anchored inflation expectations and clear central bank communications (Ahmed, Akinci, and Queralto 2021 2021). Financial spillovers were managed through selective FX interventions to control market volatility and minimize impacts on the real sector (Mohanty 2013). Robust foreign exchange reserves and a prudent intervention strategy enhanced domestic currency credibility.

- Strengthening surveillance framework and risk management strategies: Ongoing monitoring of US dollar financial conditions and cross-border capital flows is an essential component of this strategy. Regulatory authorities should monitor foreign exchange liquidity risks, conduct stress tests (to simulate sudden capital outflows), and enhance the macroprudential policy framework for banks and NBFIs. Improved risk monitoring should address vulnerabilities arising from crowded positions caused by uniform hedging practices or speculative activities, which can exacerbate market stress. The growing role of domestic investors in the US dollar financing landscape warrants closer scrutiny of investment and foreign exchange hedging strategies to understand if they could destabilize markets during stress periods. The domestic financial system must be robust enough for exporters, importers, and investors to manage foreign exchange risks effectively. Authorities should monitor foreign investments in domestic assets as high foreign positioning can increase vulnerabilities to external shocks. For assets with high foreign participation, facilitating smoother exits for foreign investors to normalize the positioning, can be done by deepening the domestic investor base. Stress periods may require intervention from authorities to support markets during selloffs by foreign investors.

- Enhancing regional financial safety net in times of localized funding stress. Although the Fed has often acted as the lender of last resort to meet global US dollar demand, it may not offer the same support during funding stresses that are localized within regions. The Fed's conversion of FIMA to a standing facility would still require participating central banks to hold repo-able US Treasury securities to access the facility. ASEAN+3's CMIM facility is a crucial part of the regional safety net for resolving balance of payment issues. This facility enables regional cooperation, allowing other members to provide US dollar liquidity to a member in distress to meet its balance of payments needs.

Long-term policy direction—Diversifying from the US dollar

A diversification from the US dollar has been a long-discussed topic, but progress has been slow. The diversification does not imply a complete shift away from US dollars but rather that other currencies could find meaningful space in the ASEAN+3 financial system. Diversification would provide the ASEAN+3 financial system with alternatives in periods of stress emerging from or transmitted through a particular currency and make the system more resilient and agile to respond to external shocks. However, other major currencies, such as the euro, yen, Pound sterling, and renminbi, have historically been unable to displace the US dollar. This has hindered the international financial system's ability to reduce reliance on the US dollar (IMF 2022). Therefore, diversifying away from the dollar requires changes on multiple fronts, including trade invoicing and settlement, issuing debt, development of alternative payment systems, exploring technological potentials, and enhancing regional cooperation.

The shift away from US dollars in ASEAN+3 can be gradually achieved by increasing the use of local currencies in cross-border commercial transactions. Despite steady growth, the widespread adoption of local currencies has been hindered by issues related to cost, convenience, speed, access, and transparency (Ong and others 2023). Regional authorities have implemented measures to encourage the use of local currencies in commercial transactions within the ASEAN+3 region. These include promoting local currencies in trade and investment, setting up a local currency settlement framework, and establishing cross-border payment linkages. While these are positive steps, they require strong collaboration and cooperation, as many are implemented bilaterally. An ASEAN+3-wide collaboration is essential to establish a common infrastructure and promote the use of local currencies.

The other side of the solution involves making local currencies suitable for cross-border financial transactions. The use of local currency in cross-border commercial transactions needs to be complemented with the ability to conduct cross-border financial transactions in the domestic currency. According to the Bank for International Settlements (2011), this may involve: (1) relaxing of restrictions to buy or sell the local currency, (2) use for export invoicing, (3) ability of foreign entities (banks, NBFIs, corporates and governments) to hold the currency and financial instruments denominated in it, and (4) foreign entities are able to issue marketable financial instruments in the local currency. In the case of ASEAN+3, whose members are mostly emerging market economies, meeting these conditions could imply a compromise on policy flexibility, which is essential in maintaining macro financial stability and achieving domestic policy goals. However, providing greater access to domestic currency and securities for key trading and investment partners in the region could be a possible alternative to enable a "localized internationalization". The development of deep and liquid securities markets will make the domestic currency more attractive to foreign entities.

The Chiang Mai Initiative Multilateralization (CMIM) facility is evolving and can now provide support in US dollars and in local currencies. It has made significant progress with greater flexibility in the available financing currencies. A new CMIM instrument, the Rapid Financing Facility (RFF), incorporates eligible freely usable currencies (FUCs) and is exploring a paid-in-capital structure.[19] These initiatives will enhance CMIM's effectiveness to meet short-term urgent financing needs and make CMIM resources more sustainable. It may also help reduce the region's vulnerability to US dollar liquidity shocks by strengthening the regional financial safety net.

Beyond traditional diversification methods, the region should explore technological advances to reduce reliance on the US dollar for cross-border payments and transactions. Many ASEAN+3 central banks are studying the potential of CBDCs for cross-border and cross-currency payments. Projects like mCBDC, Project Dunbar, and Inthanon-LionRock, examine CBDCs' use in cross-border payments, trade settlement, and capital market transactions. The potential of multi-CBDC systems in liquidity provisioning, market making, and foreign exchange payments is being explored. Also, multi-CBDC arrangements could strengthen liquidity buffers through regional financing arrangements like the CMIM to support robust cross-border payment systems. Indeed, the CBDCs will still be tied to domestic currencies but technology can help eliminate many frictions which exist in the conventional systems and hinder the use of local currencies for cross-border transactions. The involvement of corresponding central banks in the development of CBDCs and related infrastructure will enhance the credibility of such a system.

[19] Eligible FUCs are USD, JPY and RMB.

Annex 3.1. Enhancing the Accuracy of Cross-Border Investment Data[20]

The original data on cross-border investment by counterpart economy in this report is sourced from the IMF Coordinated Portfolio Investment Survey for portfolio investments and the Coordinated Direct Investment Survey for direct investments. These datasets report direct counterparts based on residency, often identifying shell companies in small offshore financial centers as major counterparts. This method, known as residency-based statistics, can obscure the true distribution of investment risks and patterns. For example, Alibaba's 2014 IPO on New York Stock Exchange, the largest IPO at that time, was recorded as an investment to the Cayman Islands, not China.

Recent efforts to enhance investment data accuracy by Coppola and others (2021) and Damgaard, Elkjaer, and Johannesen (2024) have used commercially available microdata to remap investment data to a nationality-based framework.[21] This report adopts their mapping matrices and applies them to the latest available data. However, this approach has limitations. The stability of the mapping matrix over extended periods has not been fully investigated, and reliance on microdata from a limited number of countries might not represent the economies of AMRO member states. Despite these constraints, this methodology aims to offer a clearer picture of investment dynamics by mitigating the distortions inherent in residency-based statistics.

[20] The author of this annex is Yoki Okawa.
[21] Mapping matrix for FDI is constructed based on Damgaard et al (2024)'s data, and various additional assumptions. Details are available upon request.

Annex 3.2. Factors Behind the Important Role of the US Dollar in External Financing[22]

A dynamic panel regression is performed to investigate if ASEAN+3's economic ties with the US influences the share of the US dollar in ASEAN+3's external financing. The analysis considers the effect of inertia, which may slow down a shift away from US dollar financing. The dependent variable is the share of US dollar in external bank borrowing (source: BIS locational database).[23] The independent variables capture the share of export and imports (IMF direction of trade database), inward and outward FDI (IMF CDIS database), and inward and outward portfolio investments (IMF CPIS database) from the corresponding economies.[24] The results are tabulated in Table A3.2.1. The analysis follows Iancu and others (2022) for dynamic panel specification to account for the persistence of the dollar share:

$$y_{it} = \beta_0 y_{it-1} + X_{it}\beta + \gamma_i + \varepsilon_{it}$$

The model is estimated with the Arellano-Bond 2-step robust GMM on the differenced data using y_{t-2} as instruments. y_{t-2} is uncorrelated with $\Delta\varepsilon_{it}$ even with first order autocorrelation in ε_{it}

$$\Delta y_{it} = \beta_0 \Delta y_{it-1} + \Delta X_{it}\beta + \Delta\varepsilon_{it}$$

Table A3.2.1. Relationship Between Currency Share of External Borrowing and Connection to Corresponding Economy

	(1) World	(2) ASEAN+3	(3) Plus-3	(4) ASEAN-5	(5) Advanced economies	(6) Emerging economies	(7) Low-income countries
Variable	Currency Share	Currency Share	Currency Share	Currency Share	Currency Share	Currency Share	Currency Share
Lagged Currency Share (inertia)	0.546***	0.631***	0.640***	0.385***	0.496***	0.417***	0.706***
	(0.0396)	(0.111)	(0.147)	(0.118)	(0.0393)	(0.0500)	(0.0446)
Exports	0.0781**	-0.261*	-0.125	-0.392*	0.196*	0.0638*	-0.0505
	(0.0375)	(0.155)	(0.124)	(0.218)	(0.118)	(0.0377)	(0.0753)
Imports	0.0996*	0.181*	-0.375	0.561	0.000782	0.121**	0.464***
	(0.0548)	(0.103)	(0.344)	(0.364)	(0.0831)	(0.0561)	(0.0947)
Portfolio investments (from)	0.0461**	0.169***	0.297*	0.0532	0.290***	0.0346*	0.0538*
	(0.0194)	(0.0621)	(0.160)	(0.108)	(0.0937)	(0.0196)	(0.0300)
Portfolio investments (to)	-0.0106	0.0515	-0.0325	-0.0426	0.0410*	-0.0421**	0.00263
	(0.0126)	(0.0601)	(0.0519)	(0.0491)	(0.0237)	(0.0173)	(0.0168)
Foreign direct investments (from)	0.00284	-0.00205	0.00822	-0.0378	0.0374**	-0.000641	-0.0163
	(0.00904)	(0.0109)	(0.0178)	(0.0724)	(0.0189)	(0.0109)	(0.0168)
Foreign direct investments (to)	0.0148	-0.0151	-0.244	0.0642	0.0279	0.0150	0.000594
	(0.0119)	(0.0175)	(0.246)	(0.207)	(0.0201)	(0.0191)	(0.0135)
Observations	6,961	669	195	260	1,842	3,607	1,512
Number of country-currency pairs	557	52	15	20	142	288	127

Source: AMRO staff estimates.
Note: Dependent variable is share of USD/EUR/JPY in economies' external bank borrowing. Independent variables are lagged dependent variables, share of exports and imports with corresponding economies (US/Euro area/Japan), share of Portfolio Investments and FDI from/to the corresponding economies. Estimated using 2-step robust GMM from Arellano-Bond. Unbalanced panel from 2009 to 2022.

[22] The author of this annex is Yoki Okawa.

[23] Due to the small number of data points, especially for the subsample from the ASEAN+3 region, the share of the euro and yen in ASEAN+3 external financing are also included along with the region's economic ties with the euro area and Japan as independent variables.

[24] IMF CPIS and CDIS data are adjusted as discussed in Annex 3.1.

Annex 3.3. Drivers of the US Dollar Funding Stress in ASEAN+3[25]

A panel pooled regression is used to identify the drivers of the US dollar funding stress in ASEAN+3, as estimated using the cross-currency basis. Note that a widening of the basis (i.e. falling deeper into negative values) could be a sign of dollar funding stress. The potential drivers considered for the analysis include credit risks, foreign exchange market liquidity, volatility and expectations of exchange rate (against the US dollar)[26], and financial market volatility.[27]

Data and methodology

To examine the drivers for the ASEAN+3 region, the baseline panel pooled regression model is specified as follows:

$$y_{it} = c + \beta_1 y_{it-1} + \beta_2 x_{1t} + \beta_3 x_{2it} + \varepsilon_{it}$$

where:

y_{it} = dependent variable (basis)
y_{it-1} = lagged dependent variable
c = intercept
ε_{it} = error term
x_{1t} = common explanatory variables for all sample economies
x_{2it} = economy-specific independent variables
β_1 = coefficient of lagged dependent variable
β_2, β_3 = coefficients of independent variables

The dependent variable y_{it} denotes the short-term dollar funding stress for the economy i proxied by 3-month basis of its currency i vis-à-vis the US dollar. x_{1t} is a set of common independent variables, comprising the US London Interbank Offer Rate and overnight indexed swap (Libor-OIS) spread, and the Chicago Board Options Exchange volatility index (VIX). x_{2it} represents the group of domestic currency i -specific variables which include spot exchange rate, exchange rate volatility, expected appreciation or depreciation, and liquidity. Term spreads between the US Treasury bonds and domestic government bonds are also included. Table A3.3.1 describes the data sources and calculations for the variables.

The economies in the sample are China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand with monthly data generated by averaging daily data spanning from January 2008 to January 2024. The data frame is unbalanced due to the differences in the length of the individual economy's data series. All the variables take the form of their first difference to address unit-root concerns and ensure stationarity. The results for the baseline model are tabulated in Table A3.3.2.

Quantile regression and findings

A quantile[28] regression is used to analyze the consistency of drivers of the dollar funding stress across different percentiles of the conditional distribution. Under extreme conditions, market participants can respond differently to various factors, making quantile regression particularly beneficial. Table A3.3.3 compares the results of the baseline pooled model with those of quantile regression across different percentiles.

[25] The authors of this annex are Chiang Yong (Edmond) Choo and Eunmi Park.
[26] The volatility, expectations and the level of exchange rates for domestic currency used in this analysis are all based on exchange rate against the US dollar, unless otherwise specified.
[27] The model and variable selection closely references Barajas and others (2020), and Tang and Wong (2022).
[28] In this analysis, a quantile refers to a point in the data distribution that divides the dataset based on a specified proportion. For example, the 1st percentile is the value below which 1 percent of the data falls, and the 25th percentile is the value below which 25 percentiles of the data falls.

Table A3.3.1. Data Sources and Calculations of Model Variables

Variable	Indicator	Data source	Calculation
y_{it}	Cross-currency basis	Bloomberg AMRO calculations	Construct based on spot and 3-month forward exchange rates, and 3-month annualized interest rates
x_{1t}	Libor-OIS spread (Perceived credit risk in the interbank lending market)	Bloomberg AMRO calculations	3-month US LIBOR – 3-month OIS rate
	Market expectations of volatility based on 30-day S&P 500 options *(CBOE VIX index)*	Bloomberg	
x_{2it}	Spot dollar rate with respect to currency *i (Bilateral exchange rate)*	FRED, CEIC AMRO calculations	Normalized to base January 2006 = 100
	Volatility of dollar with respect to currency *i*	Bloomberg	3-month 25-delta FX call option implied volatility of currency *i*
	Expected movement of dollar with respect to currency *i*	Bloomberg	3-month 25-delta FX option risk reversal of currency *i*
	FX market liquidity *(Bid-ask spread in spot market)*	Bloomberg AMRO calculations	For exchange rate of currency *i* against US dollar: (Ask price – Bid price)/Bid price x 100%
	Term spread differential *(spread between 10-year and 2-year yield)*	Bloomberg AMRO calculations	10-year and 2-year spread differential between currency *i* bond and UST

Source: Authors' compilation.
Note: FX = foreign exchange, UST = US Treasury

Table A3.3.2. Baseline Regression Results for 3-Month Basis (Pooled Panel Model)

Variable \ Group	Selected SEAN+3	ASEAN+3 AEs	ASEAN+3 EMs	ASEAN+3 IFCs
Intercept	1.017	0.604	1.802	0.052
	(0.893)	(1.602)	(1.708)	(0.472)
Lagged y_{it}	0.180***	0.200***	0.167***	0.008
	(0.023)	(0.036)	(0.038)	(0.025)
Spot dollar strength	-2.632***	-2.517***	-2.687**	-2.248***
	(0.560)	(0.726)	(1.247)	(0.571)
Exchange rate volatility	-0.122*	-0.480***	-0.018	0.042
	(0.064)	(0.168)	(0.114)	(0.034)
Exchange rate expectations	-0.001	-0.001	-0.001	0.002
	(0.003)	(0.003)	(0.0006)	(0.004)
Libor-OIS spread	-87.159***	-106.905***	-65.640***	-88.604***
	(5.556)	(10.454)	(10.602)	(2.893)
FX market liquidity	-0.007	0.023	-0.012	-0.007
	(0.011)	(0.040)	(0.015)	(0.011)
Financial market volatility	-0.123***	-0.130	-0.169**	-0.064***
	(0.043)	(0.091)	(0.080)	(0.023)
Term spread differential	24.515***	63.914***	19.696**	6.111*
	(5.318)	(11.361)	(8.893)	(3.203)
R^2	0.321	0.549	0.176	0.776
Observations	1,344	384	576	384

Source: AMRO staff estimates.
Note: Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent respectively. Numbers in parentheses denote standard errors. AE = advanced economy; EM = emerging market. Selected ASEAN+3 includes China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand. ASEAN-3 advanced economies include Japan, and Korea. ASEAN+3 emerging market economies include China, Malaysia, and Thailand. ASEAN+3 international financial centers include Hong Kong, and Singapore.

Table A3.3.3. Selected ASEAN+3: Quantile Regression Results for 3-Month Basis

Model / Variable	Baseline model	Quantile regression			
		25th percentile	15th percentile	5th percentile	1st percentile
Intercept	1.017	-7.343***	-13.178***	-30.786***	-74.796***
	(0.893)	(0.627)	(0.811)	(2.959)	(7.570)
Lagged y_{it}	0.180***	0.140**	0.179***	0.145***	0.228***
	(0.023)	(0.056)	(0.059)	(0.028)	(0.060)
Spot dollar strength	-2.632***	-1.091***	-1.165**	-3.204***	-5.336
	(0.560)	(0.401)	(0.508)	(0.998)	(3.282)
Exchange rate volatility	-0.122*	0.010	-0.145	-0.384	-0.885**
	(0.064)	(0.054)	(0.124)	(0.241)	(0.398)
Exchange rate expectations	-0.001	-0.001***	-0.002***	0.004	-0.011***
	(0.003)	(0.0005)	(0.0004)	(0.038)	(0.001)
Libor-OIS spread	-87.159***	-74.609***	-73.001***	-83.602***	-101.653*
	(5.556)	(10.183)	(4.430)	(5.810)	(52.389)
Foreign exchange market liquidity	-0.007	-0.022*	-0.037***	-0.033*	-0.007
	(0.011)	(0.013)	(0.006)	(0.018)	(0.011)
Financial market volatility	-0.123***	-0.155***	-0.148**	-0.115***	0.173
	(0.043)	(0.027)	(0.060)	(0.044)	(0.218)
Term spread differential	24.515***	9.278**	12.218**	17.956	23.867
	(5.318)	(4.157)	(5.266)	(11.951)	(78.616)
R^2	0.321	0.187	0.225	0.313	0.421
Observations	1,344	1,344	1,344	1,344	1,344

Source: AMRO staff estimates.
Note: Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent respectively. Numbers in parentheses denote standard errors. Selected ASEAN+3 includes China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand.

Annex 3.4. Stress in US Dollar Funding Conditions and Effect on "Cross-Border" Bank Lending[29]

A panel regression is performed to investigate if stress in US dollar funding markets affects cross-border lending by banks in advanced economies to ASEAN+3 economies.

Data and methodology

Panel regressions with the following specification are estimated (Model 1):

$$y_{ijt} = \alpha_0 + \beta_1 CCB_{it} + \xi \text{Controls}_{it} + \theta_{jt} + \varepsilon_{ijt}$$

where y_{ijt} is total currency lending from home country i, to recipient country j, during quarter-year t. CCB_{it} is the quarterly average of daily cross-currency basis of country i, for quarter-year t. ξ_{it} is a vector of home (lender) economy macroeconomic and banking sector control variables such as real GDP growth rate, inflation, home economy banking sector size, equity, deposits, total loan, and profitability ratios that might affect cross-border lending. θ_{jt} are recipient economy-quarter fixed effect. This allows the specification to more cleanly capture the effects of US dollar funding stress in lender's economy on cross-border lending to recipient economies by holding time-varying demand-side factors constant (Khwaja and Mian, 2008).

The baseline lender sample consists of 20 advanced economies for which basis can be reliably constructed, and who also report their cross-border lending activities in the BIS locational data. Basis is constructed for the euro, Pound sterling, Australian dollar, Canadian dollar, Swiss franc, Danish krone, Swedish krona, Japanese yen, Korean won, and Hong Kong dollar.[30] These lenders lend to over 200+ recipient economies in total and include all ASEAN+3 economies. The sample is an unbalanced panel that runs from the first quarter of 2008 till fourth quarter of 2023.

Additional specifications that focus on if stress in US dollar funding markets differentially affects cross-border lending to ASEAN+3 economies are also estimated (Model 2):

$$y_{ijt} = \alpha_0 + \beta_1 CCB_{it} \, x \, (\text{ASEAN+3})_j + \beta_2 CCB_{it} + \beta_3 (\text{ASEAN+3})_j + \xi \text{Controls}_{it} + \theta_{jt} + \varepsilon_{ijt}$$

where ASEAN+3 is a dummy variable that equals 1 if the recipient economy is an economy in ASEAN+3. The same specification is also used to estimate various sub-economy groupings in ASEAN+3 (advanced economies, international financial centers, emerging market economies, and the BCLMV grouping of Brunei, Cambodia, Lao PDR, Myanmar and Vietnam). The results are tabulated in Table A3.4.1.

[29] The author of this annex is Wen Yan Ivan Lim.

[30] There are 11 lender economies in the sample that use the Euro. They are Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, and Luxembourg. The following interest rates in the 3-month tenor are used to construct the CCB (basis): US (SOFR OIS), Euro (EURIBOR), British Pound (ICE LIBOR), Australian dollar (AUD OIS), Canadian dollar (Canada Bankers Acceptances), Swiss Franc (CHF SARON OIS), Danish Krone (CIBOR), Swedish Krona (STIBOR), Japanese Yen (JPY OIS), Korean Won (KKRIBOR), and Hong Kong Dollar (HIBOR).

Table A3.4.1 Panel Regression Results of US Dollar Funding Stress (Basis) on Cross-Border Lending

Recipient economies	All			A+3	A+3 IFC	A+3 AE	A+3 EME	BCLMV
Variable	Log (Total Bank Loans to Recipient Economy)							
Basis	0.02***	0.11***	0.04***	0.03***	0.03***	0.03***	0.04***	0.04***
	(6.89)	(19.77)	(6.97)	(4.75)	(5.56)	(5.96)	(6.45)	(7.8)
Basis x ASEAN+3				0.12***				
				(6.37)				
Basis x ASEAN+3 IFC					0.50***			
					(11.26)			
Basis x ASEAN+3 AE						0.54***		
						(10.01)		
Basis x ASEAN+3 EME							0.06**	
							(2.07)	
Basis x BCLMV								-0.18***
								(-5.52)
Home Bank Equity/ Total Assets			9.86***	9.86***	9.86***	9.86***	9.86***	9.86***
			(59.04)	(59.06)	(59.09)	(59.06)	(59.04)	(59.05)
Home Bank Deposits/ Total Assets			-1.11***	-1.11***	-1.11***	-1.11***	-1.11***	-1.11***
			(-48.46)	(-48.50)	(-48.51)	(-48.53)	(-48.46)	(-48.46)
Home Bank Return on Assets			-5.93***	-5.94***	-5.94***	-5.96***	-5.93***	-5.94***
			(-15.10)	(-15.11)	(-15.11)	(-15.18)	(-15.10)	(-15.12)
Home Bank Total Loans/Total Assets			-0.83***	-0.83***	-0.83***	-0.83***	-0.83***	-0.83***
			(-41.56)	(-41.62)	(-41.60)	(-41.66)	(-41.57)	(-41.55)
Home Log Banking Sector Assets			0.21***	0.21***	0.21***	0.21***	0.21***	0.21***
			(92.31)	(92.31)	(92.37)	(92.28)	(92.31)	(92.32)
Home Inflation			0.08***	0.08***	0.08***	0.08***	0.08***	0.08***
			(43.58)	(43.57)	(43.62)	(43.56)	(43.58)	(43.6)
Home Real GDP Growth			0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
			(5.15)	(5.13)	(5.14)	(5.1)	(5.15)	-5.15
Intercept	0.51***	0.55***	-2.36***	-2.36***	-2.36***	-2.35***	-2.36***	-2.36***
	(205.3)	(165.76)	(-59.40)	(-59.39)	(-59.45)	(-59.30)	(-59.40)	(-59.40)
Quarter FE	No	No	No	No	No	No	No	No
Recipient Economy FE	Yes	No	No	No	No	No	No	No
Recipient Economy-Quarter FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	145,295	144,996	132,202	132,202	132,202	132,202	132,202	132,202
Adjusted R^2	0.490	0.458	0.515	0.516	0.516	0.516	0.515	0.516

Source: AMRO staff estimates.
Note: ASEAN+3 = all economies in ASEAN+3. ASEAN+3 IFC = Hong Kong and Singapore. ASEAN+3 AE = Japan and Korea. ASEAN+3 EME = China, Indonesia, Malaysia, Philippines, and Thailand. ASEAN+3 BCLMV = Brunei, Cambodia, Lao PDR, Myanmar, and Vietnam; FE = fixed effects. Total Bank Lending from Lender Economy to Recipient Economy data are from BIS Locational Data A.62. Inflation and GDP Growth data are from Haver Analytics while banking sector variables are from BankFocus. t-statistics are reported in parenthesis. Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent, respectively. The first three columns are estimated using Model 1 while columns 4–8 are estimated using Model 2.

Annex 3.5. Stress in US Dollar Funding Conditions and Impact on Banking Sector Stability[31]

A panel regression is deployed to study if the tightening of US dollar funding spills over to domestic banking sector stability in selected ASEAN+3 economies.

Data and methodology

Panel regressions with the following specifications are estimated:

$$y_{ijt} = \alpha_0 + \beta_1 CCB_{ijt} + \theta_i \text{ or } \phi_{it} + \varepsilon_{ijt}$$

where y_{ijt} the average one year ahead banking sector probability of default (PD) in basis points, calculated as the average PD for banks in country *i*, for month *j*, of year *t*.[32] Since the construction of bank PDs includes both macro- and bank-level variables, additional control variables are not included in the baseline. Instead, the specifications rely on various fixed effects to alleviate concerns related to omitted variables. Two models are estimated that incorporate different fixed effects: θ_i indicates economy, while ϕ_{it} are a set of country-year fixed effects. CCB_{ijt} is the monthly average of the daily values of the basis. The baseline regression includes seven ASEAN+3 economies (China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand) and is estimated with data from January 2008 till December 2023. Table A3.5.1 tabulates the results of the analysis. Interaction terms denoting three major crisis periods (global financial crisis, European debt crisis, and the onset of COVID-19 pandemic) are included in the main model to study if the effects of the basis on banking sector PD is more acute during these periods and the results are tabulated in Table A3.5.2.

Table A3.5.1 Panel Regression Results of US Dollar Funding Stress (Basis) on Banking Sector Stability

Dependent	Banking Sector 1-year Ahead Probability of Default							
Economy Variable	Selected ASEAN+3		ASEAN+3 International Financial Centers		ASEAN+3 Advanced Economies		ASEAN+3 Emerging Market Economies	
Basis	-0.0534	-0.1033**	-0.4033***	-0.2237***	-0.3143***	-0.3655***	0.0543***	0.0095
	(-1.4881)	(-2.4488)	(-9.4666)	(-3.4118)	(-7.4309)	(-7.8967)	(4.0631)	(0.7076)
Intercept	48.7361***	44.7451***	16.1550***	23.2130***	54.4071***	50.3913***	55.5227***	50.7158***
	(19.115)	(14.1367)	(8.7825)	(9.3242)	(15.6269)	(14.6272)	(34.6181)	(33.0722)
Economy FE	Yes	No	Yes	No	Yes	No	Yes	No
Economy-Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,351	1,344	386	384	386	384	579	576
Adjusted R^2	0.497	0.836	0.342	0.776	0.341	0.812	0.755	0.919

Source: AMRO staff estimates.
Note: Selected ASEAN+3 = China, Hong Kong, Japan, Korea, Malaysia, Singapore, and Thailand. ASEAN+3 IFC = Hong Kong and Singapore. ASEAN+3 advanced economies = Japan and Korea. ASEAN+3 emerging market economies = China, Malaysia, and Thailand. Banking Sector Probability of Default data is from NUS-CRI. t-statistics are reported in parenthesis. Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent, respectively.

[31] The author of this annex is Wen Yan Ivan Lim, with data support from Kit Yee Lim.

[32] Bank PD data is from NUS-CRI and is constructed using 12 bank-level attributes and 4 macro-financial factors. The 12 bank-level attributes are: distance-to-default (level and trend), cash-to-total assets (level and trend), current assets-to-current liabilities (level and trend), net income-to-total assets (level and trend), relative size (level and trend), relative market-to-book ratio and, idiosyncratic volatility. The 4 macro-financial variables are: stock-index returns, short-term risk-free rate, economy-level distance-to-default for financial and non-financial firms. See NUS-CRI (2022) for a description of the construction of bank PDs.

Table A3.5.2. Panel Regression Results of US Dollar Funding Stress (Basis) on ASEAN+3 Banking Sector Stability During Crises

Economy	Selected ASEAN+3	ASEAN+3 International Financial Centers	ASEAN+3 Advanced Economies	ASEAN+3 Emerging Market Economies
Variable	**Banking Sector 1-Year Ahead Probability of Default**			
Basis	0.0572***	-0.0973	-0.0697	0.0753***
	(3.4694)	(-1.3570)	(-1.4954)	(3.5541)
Basis x global financial crisis	-0.2906***	-0.3044***	-0.2067***	-0.1791***
	(-5.0641)	(-3.2656)	(-2.9935)	(-4.8727)
Basis x European debt crisis	0.0369**	-0.7485**	-1.0542***	0.0339*
	(2.2081)	(-2.1596)	(-5.7883)	(1.6693)
Basis x COVID-19	-0.2191***	-0.1092	-0.1440**	-0.2731***
	(-5.0310)	(-1.3306)	(-2.0833)	(-8.4329)
Global financial crisis	8.6755	11.2680	30.5635**	4.8904
	(0.9593)	(1.2218)	(2.1248)	(0.7665)
European debt crisis	12.1461***	-30.0443**	-43.7246***	7.3636**
	(2.8686)	(-2.1940)	(-4.3092)	(2.473)
COVID-19	-11.0252***	1.2372	-20.4766***	-14.2423***
	(-2.6644)	(0.2484)	(-3.2551)	(-3.8569)
Intercept	52.5544***	25.2767***	65.5258***	55.0216***
	(39.4626)	(10.1556)	(18.9948)	(26.8249)
Country FE	Yes	Yes	Yes	Yes
Observations	1,351	386	386	579
Adjusted R^2	0.630	0.431	0.432	0.806

Source: AMRO staff estimates.
Note: The global financial crisis (European debt crisis) is a dummy variable that equals 1 for June 2008 to June 2009 (May 2011 to June 2012) respectively while COVID is a dummy variable that equals 1 for the first six months of year 2020. t-statistics are reported in parenthesis. Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent, respectively.

Annex 3.6. Stress in US Dollar Financing Conditions and Effect on Foreign Portfolio Flows[33]

Data and methodology

Panel regressions with the following specifications are estimated to investigate if US dollar funding stress affects capital flows:

$$y_{ijt} = \alpha_0 + \beta_1 CCB_{ijt} + \varepsilon_{ijt}$$

where y_{ijt} is either debt or equity flows (in billions of US dollar, source: country authorities) for country *i*, for month *j*, of year *t*. CCB_{ijt} is the monthly average of the daily values of cross-currency basis (in basis points, "basis"). The baseline regression estimates four ASEAN+3 economies individually (China, Korea, Malaysia and Thailand) using an unbalanced panel from January 2008 to December 2023. The results have been tabulated in Table A3.6.1. Interacted *i* dummy terms denoting stress episodes are used to study if the relationship between portfolio flows and basis strengthens during these episodes. The results are tabulated in Table A3.6.2.

Table A3.6.1. Panel Regression Results of US Dollar Funding Stress (Basis) on Cross-border Debt and Equity Flows into ASEAN+3 Economies

Economy	CN	KR	MY	TH	CN	KR	MY	TH
Variable	Debt Flows				Equity Flows			
Basis	0.0045*	0.0026	0.0089***	0.0005	0.0049	0.0026*	0.0047***	0.0019*
	(1.6962)	(1.3473)	(4.2988)	(0.2493)	(0.4679)	(1.9379)	(3.3413)	(1.9209)
Intercept	3.6045***	1.8515***	1.0819***	0.6792***	3.3696***	0.3836	0.3205***	-0.0385
	(3.1207)	(6.1896)	(4.8813)	(4.2984)	(3.7777)	(1.5607)	(2.8102)	(-0.4966)
Observations	194	194	194	192	110	194	173	194
Adjusted R^2	0.00254	0.00630	0.0829	-0.00505	-0.00730	0.00833	0.0681	0.00508

Source: AMRO staff estimates.
Note: Debt and Equity Flows are from Institute of International Finance (IIF), obtained through Haver Analytics. t-statistics are reported in parenthesis. Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent, respectively. CN = China; KR = Korea; MY = Malaysia; TH = Thailand.

Table A3.6.2. Panel Regression Results of US Dollar Funding Stress (Basis) on Cross-border Debt and Equity Flows into ASEAN+3 Economies During Crises

Economy	CN	KR	MY	TH	CN	KR	MY	TH
Variable	Debt Flows				Equity Flows			
Basis	0.0075	-0.0168***	0.0151***	-0.0076*	0.0000	-0.0061	0.0065***	0.0026
	(1.3069)	(-3.8281)	(3.1008)	(-1.8013)	(0.0023)	(-1.0727)	(4.6576)	(0.831)
Basis x global financial crisis	-0.0090	0.0253***	-0.0088	0.0077*		0.0052		-0.0014
	(-1.5552)	(5.2481)	(-1.4981)	(1.7996)		(0.8542)		(-0.4401)
Basis x European debt crisis	-0.0113	0.0233**	0.0157	0.0169		0.0419	-0.0076***	0.0002
	(-0.8630)	(2.1815)	(1.0228)	(0.9282)		(1.3212)	(-3.2224)	(0.0276)
Basis x COVID-19	0.0303**	0.0297***	0.0035	0.0459***	0.1383***	0.0582***	0.0017	0.0254***
	(2.1186)	(5.3313)	(0.3827)	(4.438)	(11.2103)	(5.3827)	(0.9429)	(6.0147)
Global financial crisis	-4.3133***	4.1220***	-0.6230	-0.2391		-1.6687		-0.0950
	(-2.7348)	(2.7936)	(-0.5007)	(-0.9528)		(-1.1188)		(-0.3163)
European debt crisis	-5.2773	2.3907*	2.4082*	2.4978*		3.2490	-0.4858	0.2027
	(-0.7176)	(1.8492)	(1.7498)	(1.6941)		(0.9478)	(-1.4436)	(0.2897)
COVID-19	1.7044	4.4649***	-0.6283	1.3660	3.6350**	1.8254	-0.1080	0.7358**
	(0.712)	(5.0437)	(-0.3967)	(1.3128)	(2.5322)	(0.8522)	(-0.4213)	(2.1025)
Intercept	4.1361***	0.2957	1.4501***	0.2427	3.2904***	-0.0585	0.4435***	0.0001
	(2.7296)	(0.6899)	(3.9336)	(0.9908)	(3.6171)	(-0.1200)	(3.8459)	(0.0003)
Observations	194	194	194	192	110	194	173	194
Adjusted R^2	-0.0213	0.0608	0.115	0.110	0.0510	0.0859	0.0964	0.0328

Source: AMRO staff estimates.
Note: the global financial crisis (European debt crisis) is a dummy variable that equals 1 for June 2008 to June 2019 (May 2011 to June 2012) respectively while COVID-19 is a dummy variable that equals 1 for the first six months of year 2020. t-statistics are reported in parenthesis. Asterisks (*, **, ***) denote significance levels at 10 percent, 5 percent, and 1 percent, respectively.
CN = China; KR = Korea; MY = Malaysia; TH = Thailand.

[33] The author of this annex is Wen Yan Ivan Lim.

Annex 3.7. The Federal Reserve as A Global Lender of Last Resort[34]

Over the past two decades, the Fed has intermittently assumed the role of the global lender of last resort, offering US dollar liquidity via swap lines and repos during crises, which helped stabilize international financial markets (Goldberg and Ravazzolo 2021). This annex examines previous instances of market stress and the Fed's response and tries to shed some light on the motivations behind its actions as a global lender of last resort during crises.

Historically, the Fed provided swap line or repos arrangements with five major central banks and nine other central banks to alleviate US dollar funding stress, during the global finance crisis (GFC), European debt crisis and COVID-19 crisis.[35] Swap lines were heavily used by central banks, particularly the five major central banks, which helped ease the dollar funding stress and avoid disorderly conditions in the forex market (Figure A3.7.1). Note that these three instances had led to weakness in global markets and could have potentially impacted the US financial system. The Fed's response to this external financial turmoil was motivated by the US economic interests, as it was aimed at mitigating the spillover to US economic and financial conditions. (Cassetta 2022)

In comparison, there were also instances where the Fed opted not to intervene, even amid significant global disruptions. For example, during events such as the 2013 taper tantrum, the episode of emerging market stress in 2015, and the Fed's 2022 monetary tightening, the Fed did not act to soothe the markets despite notable capital outflows and currency depreciation in emerging market economies. This reflected a prioritization of domestic monetary policy goals over global financial stability concerns. Former Fed Vice Chairman Stanley Fischer once noted that the Fed was not mandated to support stability of the international financial system (Fischer 2015). Former Fed Chairman Ben Bernanke echoed this sentiment, asserting that "setting US monetary policy to achieve some set of global macroeconomic objectives seems both impractical and inconsistent with the Fed's mandate" (Bernanke 2015).

The criteria behind the Fed's choice of swap partners and the terms of swap lines are not clearly defined. Literature highlights various factors that may influence these decisions, including the exposure of US banks, US asset ownership, economic significance, bilateral trade with the US, reserves, economic policies, and political alignment (Aizenman, Ito, and Pasricha 2021). While the final determinants are still subject to debate, it is evident that the Fed tends to establish swap lines with advanced economies and on favorable terms.

Presently, the Fed maintains a standing swap line network with five major central banks, including the ECB and the Bank of Japan. By contrast, the Fed only established temporary swap lines with a few emerging market economies considered as systemically important for the global financial system and are linked to the US interests.[36] Furthermore, compared with swap lines that the Fed established with advanced economies, those with emerging market economies were collateralized, requiring foreign central banks to provide US Treasury bonds and other assets held with the Fed as collateral (Cassetta 2022). This additional requirement highlights a differentiated approach by the Fed towards advanced economies and emerging economies.

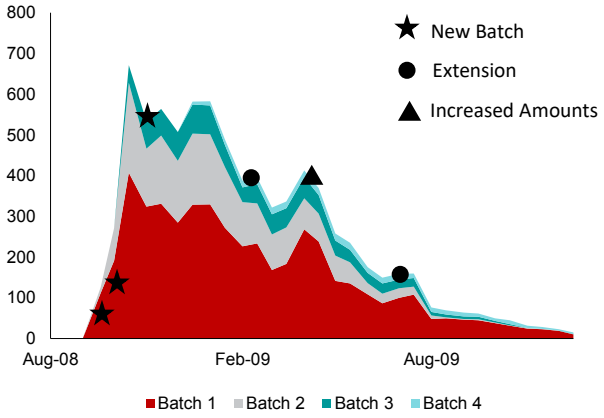
[34] The authors of this annex are Leilei Lu and Yang Jiao

[35] Major central banks including those in Japan, Europe, the UK, Switzerland, and Canada had unlimited swap line arrangements with the Fed during the global financial crisis, European debt crisis and the COVID-19 crisis. Other central banks including those in Australia, Denmark, Korea, New Zealand, Norway, Singapore, Sweden, Brazil, and Mexico had a total of USD 225 billion and USD 450 billion swap line arrangements with the Fed during the global financial crisis and the COVID-19 crisis respectively.

[36] For example, the Fed established a swap line with Mexico during GFC because Mexico was a close neighbour which may pose national security threat and are economically intertwined with the US.

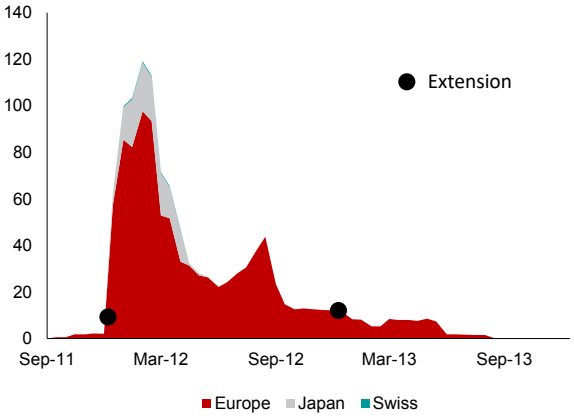
Figure A3.7.1 Selected Central Banks: Swap Line Amounts Outstanding
(Billions of US dollar)

Global financial crisis



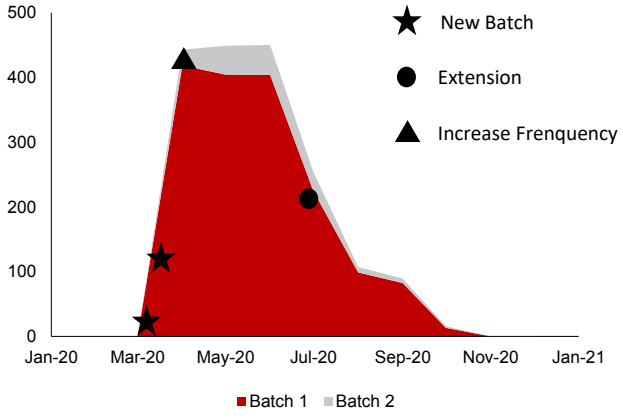
Source: Federal Reserve.
Note: Batch 1 includes the European Central Bank and the Swiss National Bank, whose announcement date was on 12 December 2007. Batch 2 includes Bank of Japan, the Bank of England, and the Bank of Canada, whose announcement date was 18 September 2008. Batch 3 includes Bank of Australia, the Sveriges Riksbank, Danmarks Nationalbank and the Norges Bank, whose announcement date was 24 September 2008. Batch 4 includes the Reserve Bank of New Zealand, Banco Central do Brasil, the Banco de Mexico, the Bank of Korea, and the Monetary Authority of Singapore, announced the swap lines on 28 and 29 October 2008. Fed extended the swap lines on 3 March and 25 June, and increased amounts on 6 April 2009.

European debt crisis



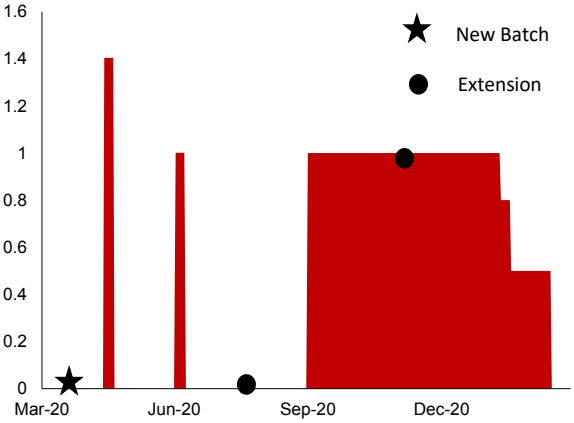
Source: Federal Reserve.
Note: During European debt crisis, Fed had announced swap lines with five major central banks on 9 May 2010, and extended them on 21 December 2010, 29 June and 30 November 2011, 13 December 2012, converted temporary bilateral liquidity swap arrangements to standing arrangements on 31 October 2013. Fed lowered the price and extended of the swap lines on 30 November and extended again on 13 December 2012.

COVID-19 crisis



Source: Federal Reserve.
Note: Batch 1 includes the European Central Bank and the Swiss National Bank, whose announcement date was on 12 December 2007. Batch 2 includes Bank of Japan, the Bank of England, and the Bank of Canada, whose announcement date was 18 September 2008. Batch 3 includes Bank of Australia, the Sveriges Riksbank, Danmarks Nationalbank and the Norges Bank, whose announcement date was 24 September 2008. Batch 4 includes the Reserve Bank of New Zealand, Banco Central do Brasil, the Banco de Mexico, the Bank of Korea, and the Monetary Authority of Singapore, announced the swap lines on 28 and 29 October 2008. Fed extended the swap lines on 3 March and 25 June, and increased amounts on 6 April 2009.

COVID-19 crisis (FIMA)



Source: Federal Reserve.
Note: The data source used for this chart is updated on a weekly basis. Fed announced Foreign and International Monetary Authorities (FIMA) Repo Facility on 31 March, extending it on 29 July and 16 December 2020. The facility was made a standing facility on 28 July 2021.

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