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SINGAPORE

SELECTED ISSUES

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June 23, 2025

Approved By
Asia and Pacific Department

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CONTENTS

FINANCIAL INTERCONNECTEDNESS IN ASIA AND THE PACIFIC—RECENT SHIFTS AND IMPLICATIONS FOR SINGAPORE[1]

This paper takes stock of the current state of financial interconnectedness in Asia and through Singapore, and explores the link between trade and financial flows. We find that Asian economies are not as financially integrated as their integration in trade would suggest and that Asia's financial integration with the rest of the world has been led by advanced economies in the region, including Singapore. The FDI network closely resembles the trade network and stands in contrast with the network for portfolio assets, which is dominated by advanced economies. Analysis based on a gravity model confirms that countries with strong prior trade linkages are likely to see higher FDI flows but finds no such relationship for portfolio flows. As Singapore continues to play a significant role in advancing financial integration in Asia, Singaporean banks are exposed to cross-border and FX funding risks. The authorities continue to make efforts to mitigate these risks.

A. Introduction

1. Over the past three decades, Asia has experienced extraordinary economic growth and structural transformation, significantly improving living standards and human development outcomes. Between 1990 and 2023, GDP per capita in the Asia-Pacific region more than doubled, and the region's contribution to global GDP growth surged from approximately a quarter to nearly two-thirds. Growth was facilitated by structural transformation, primarily the reallocation of labor from agriculture into more productive manufacturing and service sectors. International trade integration, notably through the expansion of manufacturing exports and regional supply chains, has been instrumental in accelerating this industrialization process. Simultaneously, the services sector has gained prominence, increasingly absorbing labor and enhancing productivity, particularly in tradable segments such as finance, business, and technology-related services.[2]

2. Although an extensive literature has studied Asia's expanding trade integration, less attention has been directed toward the evolution of financial integration across the region. Understanding financial linkages, including the role played by leading regional financial centers like Singapore, is becoming increasingly important as the world has been geoeconomically fragmented. A growing body of literature, sparked by trade tensions between the U.S. and China during 2018-19 as well as Russia's war in Ukraine in 2022, has studied geoeconomic fragmentation (Aiyar et al., 2023) and its impact on trade (2022 and 2023 IMF Regional Economic Outlook for Asia and the

[1] Prepared by Tristan Hennig, Ritu Basu, Cristian Alonso, and Wanying Li. The paper draws on ongoing analytical work by Tahsin Saadi Sedik, Cristian Alonso, Tristan Hennig, Henry Hoyle, Monica Petrescu, Ying Xu, and Yizhi Xu.

[2] See chapter 2 of the October 2024 Regional Economic Outlook for Asia and the Pacific for more detail on structural transformation in Asia.

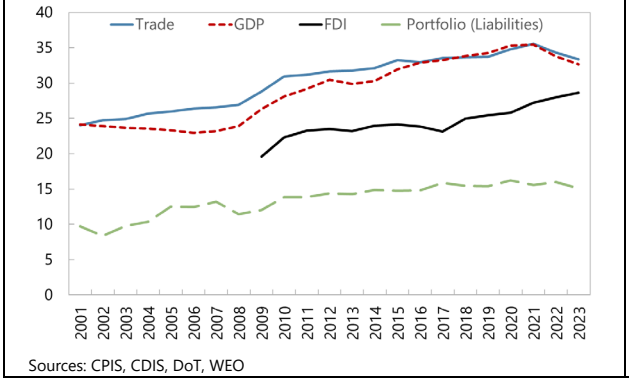
Pacific, Schulze and Xin (forthcoming)), FDI (2023 IMF World Economic Outlook), macrofinancial stability (2023 and 2024 IMF Global Financial Stability Report), and financial centers such as Singapore (Eklou and Ganpurev, 2023). The literature has documented signs of changing trade patterns and asset allocations which suggest that Asia could be particularly affected given its significant role in global trade. Other work has quantified the benefits of financial integration (e.g. Baek et al, 2023; Eyraud et al., 2017) in terms of a strong positive association between financial integration and output gains.

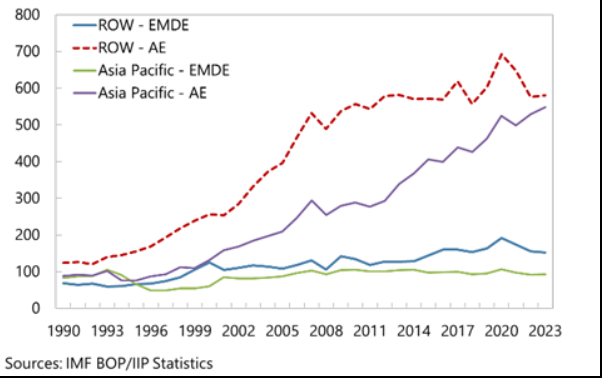
3. This paper analyzes financial interconnectedness within Asia and between Asia and the global economy, with special attention to Singapore's role as a financial intermediary. It sheds light on the interplay between financial flows and trade, recognizing that these two aspects of integration may reinforce each other, potentially magnifying benefits but also vulnerabilities. Section B provides a birds-eye view of financial integration in Asia using international investment position data. This is followed by analysis of the trade, FDI, and portfolio investment networks (Section C) and the relationship between financial flows and trade (Section D). Section E discusses the role of Singaporean banks as a key financial intermediary in Asia and analyzes their cross-border linkages. Section F concludes.

B. Asia's Financial Integration with the Rest of the World

4. Economies in Asia and the Pacific are not as financially integrated as their integration in trade would suggest. While they make up over 30 percent of global trade and GDP, they hold less than 30 percent of the total inward FDI stock and make up less than 15 percent of global portfolio liabilities (Figure 1 left chart). Asia's share in global trade grew substantially in the late 2000s and early 2010s but has stabilized since then. In recent years, Asia's share of global FDI has risen but their share of global portfolio liabilities has been stable.

Figure 1. Asia and Pacific: Role in Global Trade and Finance

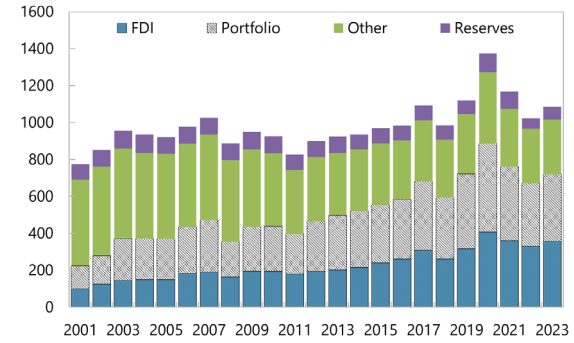




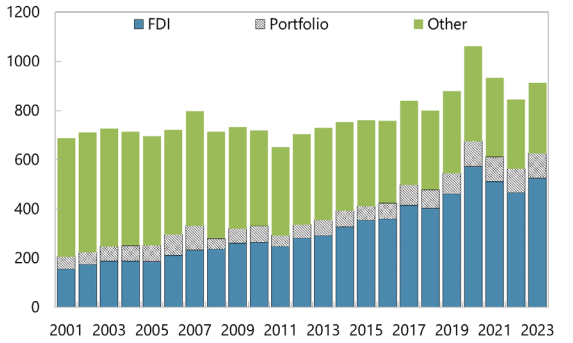
5. Asia's financial integration with the rest of the world has been led by advanced economies in the region. Taking the sum of cross-border assets and liabilities as reported in international investment position (IIP) data as a simple measure of an economy's financial links with

the rest of the world, a few notable differences between country groups within Asia emerge (Figure 1 right chart). The cross-border positions in Asian advanced economies have consistently expanded over the past three decades, rising from around 100 percent of their GDP in 1990 to over 500 percent in 2023. This trend has been observed across the board in this group. On the other hand, for emerging market economies in the region, their cross-border assets and liabilities as percent of GDP have remained relatively stable since 1990s, suggesting limited progress with their financial integration with the rest of the world.

Figure 2. Singapore: International Investment Position



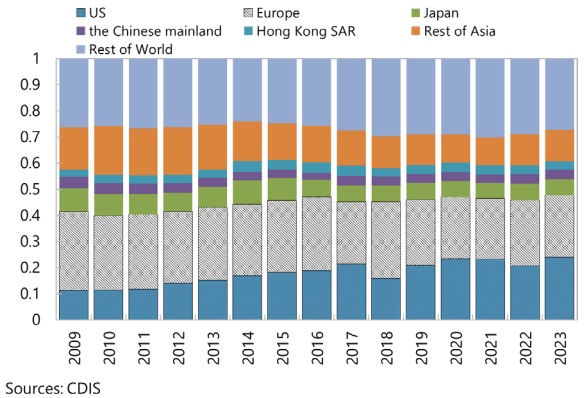
Sources: IMF Balance of Payments Statistics Database



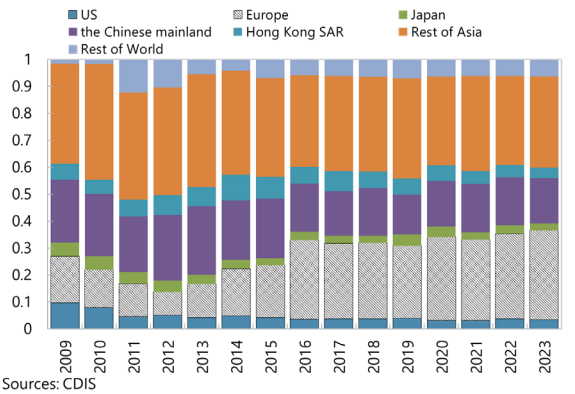
Sources: IMF Balance of Payments Statistics Database

6. Bilateral FDI and portfolio claim data highlight Singapore's role as a financial center in the region (Figure 3). About half of all FDI coming to Singapore is from either Europe or the United States. The United States has become increasingly important over time as a source of FDI inflows to Singapore while the role of Europe has diminished. Outbound FDI, on the other hand, is destined mostly to other parts of Asia, highlighting Singapore's role as a source of direct investment for the region. On the portfolio side, about a quarter of portfolio investments is in U.S. assets, with China also playing an increasing role. Portfolio liabilities are small overall (Figure 2).

Figure 3. Singapore: International Investment Position Breakdown

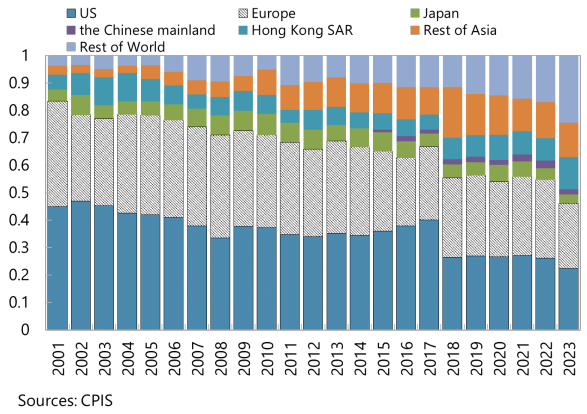


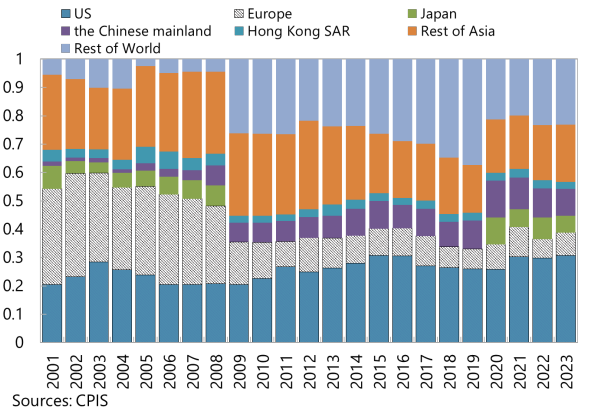
Sources: CDIS



Sources: CDIS

Figure 3. Singapore: International Investment Position Breakdown (concluded)





C. Network Analysis on Financial Integration in Asia

7. Network analysis can illustrate the status and development of financial integration in Asia. Network analysis is a method of studying the structure and dynamics of a system by examining its constituents or "nodes" (in our case different countries) and the connections or "edges" between them (in our case the flow of goods or investment between countries). We will capture the evolution of the role different countries play in the network by looking at eigenvector centrality which is a measure of the influence a node has in a network, whereby a node is important if other import nodes point to it.

8. Figure 3 shows the topology of three networks: trade, FDI, and portfolio investment. The left column shows snapshots of the different networks as of 2023 (latest available), and the right column shows the evolution of centrality scores for selected nodes within those networks.

- In the trade network, the centrality measures nicely document the rise of the Chinese mainland since the 1980s which is mirrored almost perfectly by the declining importance of Japan. India, Hong Kong SAR, Singapore, and the ASEAN countries are also well represented with Vietnam standing out as having risen substantially in importance over time. Singapore's centrality has been on a slowly decreasing trend since peaking in the late 1990s.

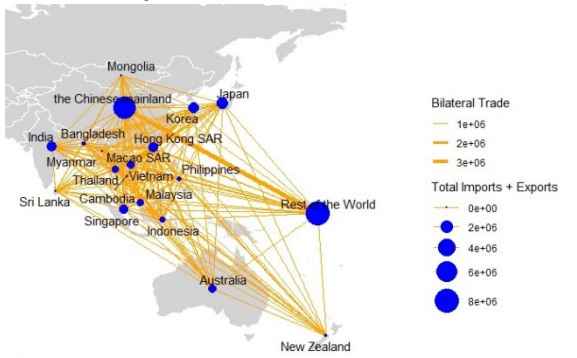
- The structure of the network for direct investment resembles that of the trade network fairly closely. The Chinese mainland stands out as having managed to attract a substantial amount of FDI and Japan's relative decline can also be observed in this network. Hong Kong SAR and Singapore play a much more important role in this network than in the trade network, likely due to their nature as financial centers. Singapore's importance has grown steadily, having attracted a significant amount of FDI in recent years.

- The network for portfolio investments, on the other hand, is disconnected from the trade and FDI networks. Japan remains the biggest Asian holder of portfolio assets, although slightly less

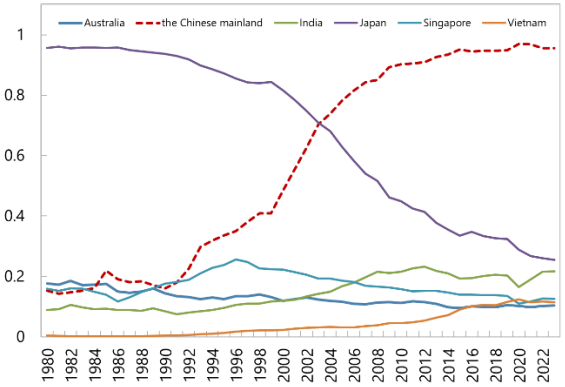
dominant now than in the early 2000s, followed by Australia. India and the Chinese mainland play an increasing role but remain small in size. Singapore's centrality has been broadly stable. Overall, the network of portfolio assets within Asia is dominated by advanced economies.

Figure 4. Asia and Pacific: Network Analysis on Financial Integration

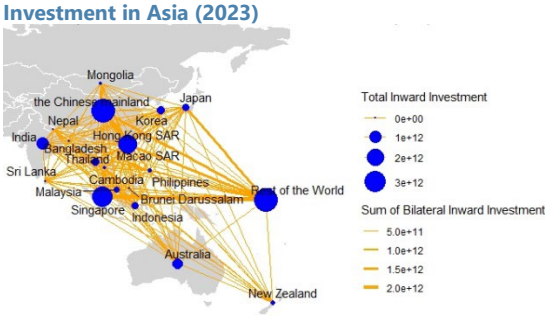
Network Graph of Cross-Border Trade in Asia



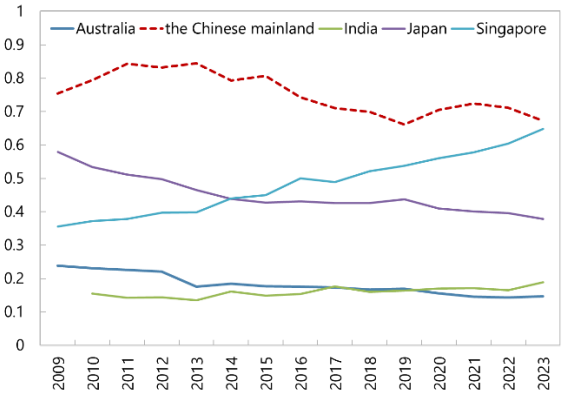
Eigenvector Centrality in the Trade Network



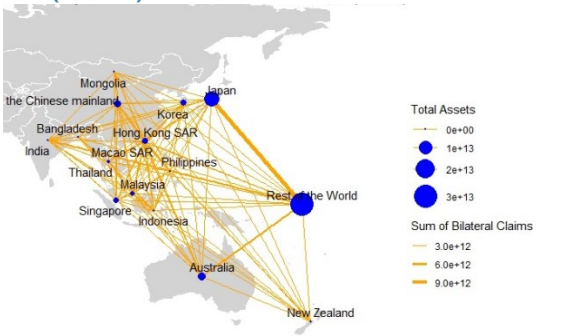
Network Graph of Cross-Border Inward Direct Investment in Asia (2023)



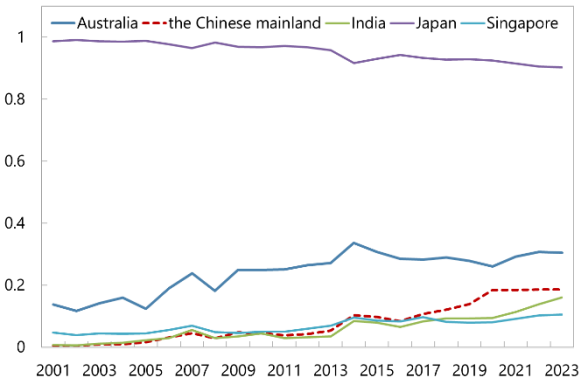
Eigenvector Centrality in the CDIS Network



Network Graph of Cross-Border Portfolio Investment in Asia (2023H2)



Eigenvector Centrality in the CPIS Network



Note: In the network of portfolio assets, the edge between economy A and B represents the sum of the claims of economy A on economy B and the claims of economy B on economy A. Eigenvector centrality values shown are relative to the centrality of the "Rest of the World" node.

D. Relationship between Trade and Financial Interconnectedness

9. This section looks at the relationship between trade and financial exposures, particularly stocks of FDI and portfolio investments. The goal of this analysis is to gain a better understanding of how changes in trade patterns might portend changes in asset allocation. This matters particularly for Asia and the Pacific given its deep integration into global supply chains. One question that arises in this context is whether asset allocations are likely to change in a way similar to the recent geopolitically motivated shifts in trade.

10. To analyze the relationship between trade and asset allocation, we employ a modified gravity model. Inspired by Newton's law of universal gravitation, the gravity model has become a standard framework for analyzing bilateral interactions such as trade, investment, migration, and financial flows between countries. The core intuition of the gravity model is that interactions between two countries are directly proportional to their economic sizes—usually measured by GDP or market size—and inversely proportional to their geographic or economic distance. The simplicity and intuitive appeal of the model, alongside its empirical robustness, have led to widespread adoption across various fields.

11. The basic gravity equation is often augmented with additional explanatory variables, such as trade agreements, shared language, colonial ties, common borders, and institutional similarities, all of which enhance the model's explanatory power. While initially designed to explain determinants of trade, Portes and Rey (2005) demonstrated that gravity models could explain financial transactions just as effectively as they explain trade in goods. Theoretical foundations have also been developed: Okawa and van Wincoop (2012) demonstrated how a model for bilateral asset holdings that takes a gravity form can be derived from first principles. In recent years, gravity models have been used to study the impact of geopolitics and geoeconomic fragmentation on trade and financial flows, for example by Gopinath et al. (2024) and Catalan et al. (2024). We use the following specification:

$$X_{ij,t} = exp\left[\beta_1 Trade_{ij,t-1} + \mu_{i,t} + \delta_{j,t} + \varphi_{i,j}\right] + \varepsilon_{ij,t},$$

where i and j denote the origin and destination country. We include origin-time ($\mu_{i,t}$), destination-time ($\delta_{j,t}$), and origin-destination ($\varphi_{i,j}$) fixed effects. This so-called "fully saturated" specification allows us to focus on the impact of trade as the included fixed effects capture all time-variant factors that are specific to the origin and destination country (such as growth and country risk) as well as all time-invariant factors that are specific to the relationship between the origin and destination country (such as geographic distance and common border).

12. Relative to a traditional gravity model, which would seek to model trade as the dependent variable, we include trade on the right-hand side in our model of financial exposures. To address the potential endogeneity of the trade variable, we lag it by one year, thereby making use of the fact that a given year's financial flows cannot directly influence the previous year's volume of trade. We estimate the model by maximum likelihood. If countries allocate

more FDI and portfolio investments to those countries with which they have greater trade links, $\beta_1 > 0$ should hold. The data on FDI and portfolio investments are obtained from the CDIS and CPIS databases, respectively, while the data on trade is from the direction of trade statistics (DOTS).

13. We find that trade is a key driver for FDI but not for portfolio investments. Table 1 shows the results of our baseline specification, where the dependent variable is stocks of inward FDI and portfolio investments, while trade is measured as the sum of exports and imports normalized by the geometric average of the countries' GDP. The coefficient for lagged trade is significant at the 99 percent level when using FDI as the dependent variable. A one percentage point increase in the bilateral trade relationship (as percent of average GDP) is associated with an increase in the FDI stock by approximately 0.5 percent. Meanwhile, the coefficient for lagged trade when using portfolio investment as the dependent variable is insignificant for all types (assets/liabilities and debt/equity). The findings are robust to using shares rather than stocks (that is, taking the share of recipient country i in the total cross-border allocation of source country j as the dependent variable and measuring trade as the share of trade of source country j that takes place with country i) as well as including additional lags of the trade variable.

Table 1. Gravity Model Results on Trade and Financial Interconnectedness

	(1) FDI	(2) Assets: Portfolio	(3) Assets: Debt	(4) Assets: Equity	(5) Liabilities: Portfolio	(6) Liabilities: Debt	(7) Liabilities: Equity
Trade (-1)	0.005***	-0.000	0.001	0.000	0.001	0.003	0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Observations	143,658	156,872	140,455	119,888	149,783	135,842	114,644
Country-Year FE	Y	Y	Y	Y	Y	Y	Y
Counterpart-Year FE	Y	Y	Y	Y	Y	Y	Y
Country Pair FE	Y	Y	Y	Y	Y	Y	Y
Pseudo R2	0.984	0.993	0.987	0.994	0.993	0.987	0.994

Standard errors clustered by country-pair are shown in parentheses
* p<0.10, ** p<0.05, *** p<0.01

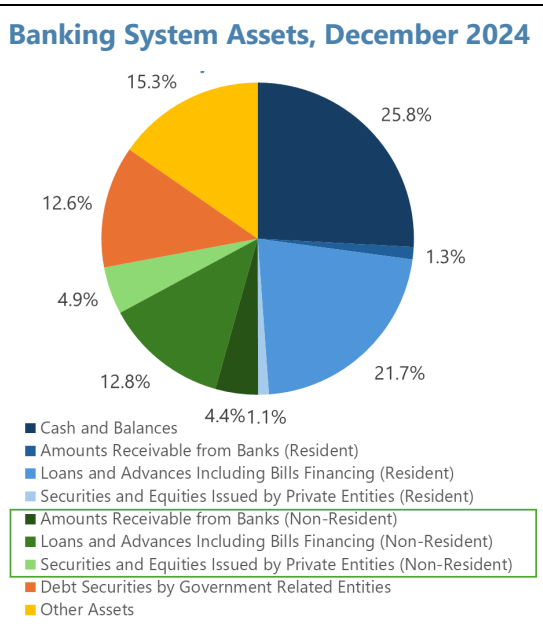
E. Cross-Border Linkages of Singaporean Banks

14. Singaporean banks play a key role in financial intermediation for global and regional economies. Singapore is an international financial center and its banking sector assets totaled 512 percent of GDP in December 2024 (in part captured by other investment holdings, ¶6). Through their extensive cross-border linkages, Singaporean banks function as a crucial intermediary channeling capital between advanced economies and emerging Asian markets. This section focuses on the cross-border linkages of Singapore's banking sector.

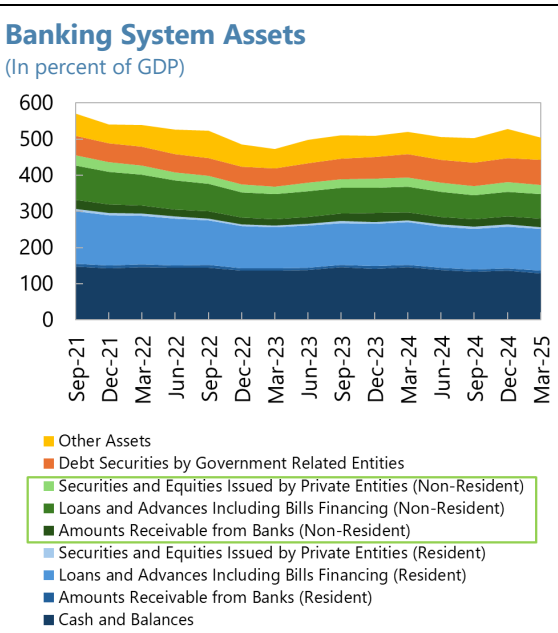
15. Banks in Singapore have large cross-border asset exposures relative to the size of the economy. Banks' claims on non-residents totaled 116.6 percent of GDP in December 2024, accounting for about 22 percent of total banking sector assets. They comprised loans and advances

including bills financing to non-residents (67.4 percent of GDP or 12.8 percent of total banking system assets), securities and equities issued by private non-resident entities (25.9 percent of GDP or 4.9 percent of total banking system assets), and amounts due from non-resident banks (23 percent of GDP or 4.4 percent of total banking system assets). Banks' claims on non-residents declined from 141.3 percent of GDP in December 2021 to 116.6 percent of GDP in December 2024, contributed mostly by the decline in loans to non-residents from 89.6 percent of GDP in December 2021 to 67.4 percent of GDP in December 2024.

Figure 5. Singapore: Cross-Border Assets of Banking System



Sources: Monetary Authority of Singapore; and IMF staff calculations.

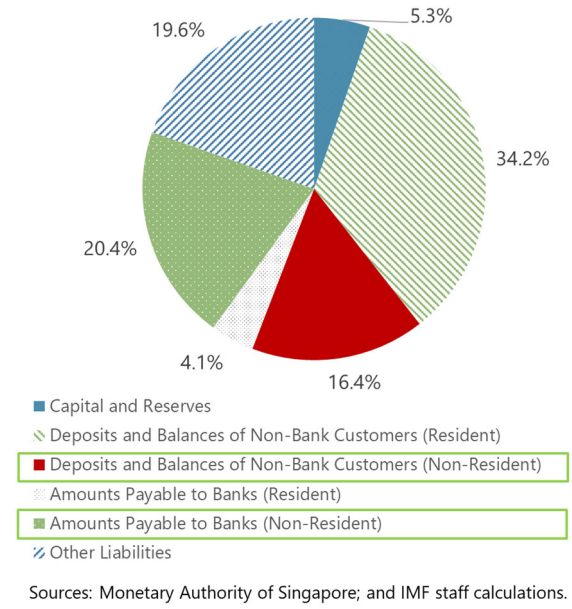


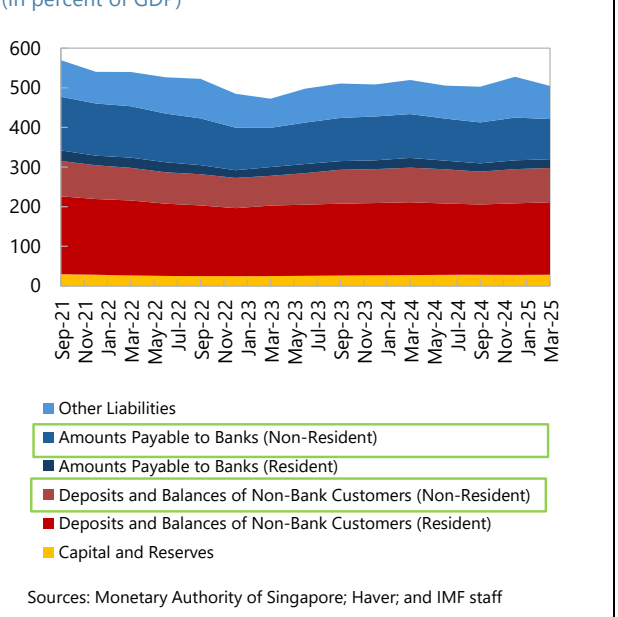
Sources: Monetary Authority of Singapore; and Haver.

16. On the liability side, banks in Singapore rely on deposits for funding and interbank borrowing from abroad. Based on staff's estimate, the liabilities of the Singaporean banking system to non-residents totaled 194.4 percent of GDP in December 2024, accounting for 36.8 percent of total banking sector liabilities. They included non-bank deposits by nonresidents (86.7 percent of GDP) and amounts payable to non-resident banks, including interbank loans (107.7 percent of GDP).[3]

[3]The deposits of resident non-bank resident customers, largely include retail deposits of Singaporean residents, and also deposits of NBFIs and government and statutory bodies in Singapore. Singapore's foreign exchange derivatives market, the third largest globally, has grown 45 percent since 2019, primarily driven by asset managers, bank treasurers, and corporate treasurers using FX swaps and cross-currency swaps (BIS Triennial Central Bank Survey, 2022).

Figure 6. Singapore: Funding Structure of Banks



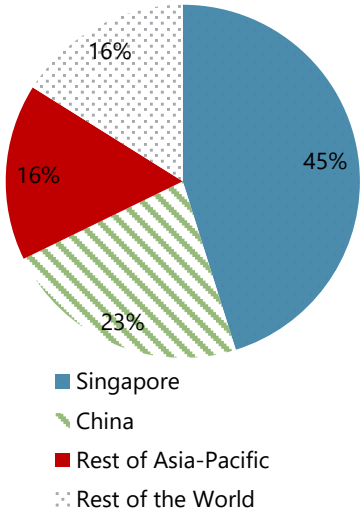


17. Local domestic systemically important banks (D-SIBs) have regionally diversified loan portfolios and rely on deposits denominated in foreign currencies. Three local DSIBs (DBS, UOB, and OCBC) accounted for approximately 52 percent of Singapore's banking sector assets in December 2024, forming the backbone of Singapore's financial sector. These banks have ample capital and liquidity, maintain strong credit ratings, and have established extensive regional operations spanning multiple jurisdictions, currencies, and regulatory environments. Local D-SIBs have regionally diversified loan portfolios, providing loans to borrowers in Singapore (45 percent of total), China (including Hong Kong SAR and Taiwan Province of China, 23 percent), Asia and Pacific excluding China (16 percent), and the rest of the world (16 percent).[4] Notably, about 61 percent of local D-SIBs' loans and deposits were denominated in foreign currencies in 2024Q4. Loans denominated in U.S. dollars accounted for about 22 percent of total loans, and deposits denominated in U.S. dollars accounted for about 34 percent of total deposits.

[4] Note that the Asia-Pacific region the left chart of Figure 7 includes South and Southeast Asia for DBS, and Malaysia, Thailand and Indonesia for UOB. However, DBS and UOB have operations in other parts of Asia and the Pacific, which are subsumed under the category of the "rest of the world."

Figure 7. Singapore: Cross-Border Exposure and Funding Structure of Local D-SIBs

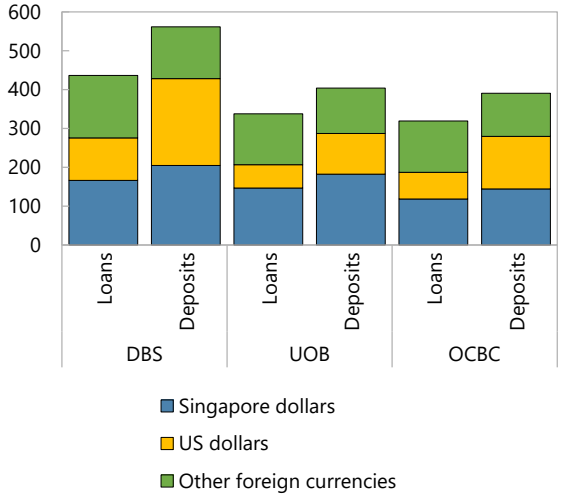
Local D-SIBs Loans by Region, 2024Q4



Sources: DBS, UOB financial statements and OCBC annual report; and IMF staff calculations

Local D-SIBs Deposits and Loans by Currency, 2024Q4

(In billions of Singapore dollars)



Sources: DBS, UOB, OCBC financial statements; and IMF staff calculations.

18. Singaporean banks' extensive cross-border linkages imply distinct vulnerabilities. Banks in Singapore are exposed to various shocks including: global and regional macroeconomic shocks, a sharp tightening in global financial conditions entailing high global interest rates, shortage in U.S. dollar liquidity, which negatively affects U.S. dollar funding and spillovers from banking sector stresses outside Singapore. Given interconnectedness, these shocks could impact Singaporean banks but also broader regional financial stability. Singapore has weathered such shocks in the past relatively well (e.g., the Global Financial Crisis, the onset of the COVID pandemic, and the banking turmoil in the U.S. and Europe in 2023).

19. MAS's stress tests suggest that Singapore's banks are resilient against the risks arising from their cross-border linkages.

- MAS's Industry-Wide Stress Test in November 2024 (MAS, 2024) assessed the resiliency of D-SIBs in Singapore against an adverse scenario featuring an intensification of geopolitical conflicts, trade tensions, and global inflationary pressures. The scenario entails a global recession affecting countries and regions on which D-SIBs have exposures, including China and other Asian economies amid elevated interest rates. In the adverse scenario, D-SIBs' CET1 capital adequacy ratio remains above the regulatory minimum of 9 percent (including the capital conservation buffer of 2.5 percent).

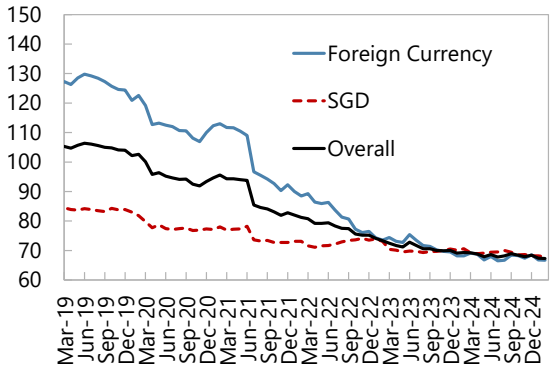
- The MAS 2024 Industry-Wide Stress Test also assessed the resiliency of Singapore's banking system against cross-border interbank contagion, using a tail risk scenario of default of a single

country's banking sector. This triggers second round shocks within the network, and is transmitted through several channels, including counterparty country banking system defaults and funding liquidity stresses from the pullback of funding lines, triggering asset fire sales. The results of the interbank contagion analysis suggest that D-SIBs can withstand such shocks in terms of capital and liquidity regulatory requirements. The stress tests draw on the network analysis framework developed by Espinosa-Vega and Solé (2010); an earlier analysis by IMF staff using the framework and conducted under the 2019 Financial Sector Assessment Program (IMF, 2019b) showed that Singapore's banks were most exposed to major advanced economies such as Japan, Hong Kong SAR, and the United States (also see Section B), while shocks originating in or transmitted through Singaporean banks would also affect banks in the ASEAN region.

Figure 8. Singapore: Loan to Deposit Ratio and Liquidity Coverage Ratio (LCR) by Currency

Loan to Deposit Ratio by Currency

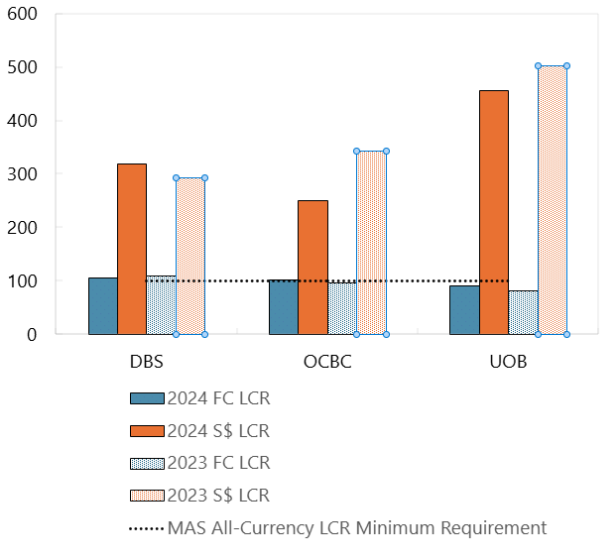
(In percent)



Note: This covers loans extended by the banking sector, excluding interbank lending. Data has a structural break in July 2021 reflecting removal of DBU-ACU divide & revision of MAS 610/1003.
Sources: Monetary Authority of Singapore; and CEIC data.

Local DSIBs' LCRs

(In percent)



20. Singaporean banks' resilience against FX funding risks has improved. Their FX loan-to-deposit (LTD) ratio declined from above 120 percent in 2019 to around 70 percent in 2024, reaching a level similar to the Singapore dollar LTD ratio. IMF staff analysis shows that the FX liquidity coverage ratio (LCR) for three local D-SIBs was close to 100 percent in 2023 and 2024, while their overall LCRs are well above the regulatory requirement of 100 percent. The improved resilience against FX funding risks is supported by MAS's supervisory efforts, including (i) cashflow-based liquidity stress tests, which indicate that D-SIBs have sufficient FX liquidity buffers on a daily basis, against all currencies including the U.S. dollar, and (ii) close engagement with banks to strengthen FX liquidity management and develop contingent FX funding plans. MAS has enhanced the monitoring of key funding markets in coordination with central banks globally, while making efforts to further deepen and strengthen Singapore's FX market to serve the growing trading and hedging needs in the region.

F. Conclusion

21. Our analysis provides useful insights for investment and financial flows in Asia and Singapore. Both the network analysis and the gravity model point to much stronger links between trade and FDI than between trade and portfolio flows. Our results suggest that a reconfiguration of supply chains could lead to the redirection of FDI along similar lines. While FDI typically is more stable and slow-moving than portfolio flows, escalating trade measures and prolonged trade policy uncertainty could affect FDI flows. Our findings also suggest that portfolio flows in Asia have not been associated with trade flows. Finally, as Singapore continues to play a significant role in advancing financial integration in Asia, Singaporean banks will remain exposed to cross-border and FX funding risks. Efforts to mitigate these risks will be important for the region's continued macro-financial stability.

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