



08

The Era of Financial  
Interconnectedness:  
How Can Asia Strengthen  
Financial Resilience?



# The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?

## Introduction

Twenty years after the Asian financial crisis (AFC), Asia stands strong, with more resilient financial systems and a solid economic outlook. The AFC triggered a wave of major economic and financial policy reforms, laying the foundations for a sustained period of high growth afterwards. The crisis exposed structural weaknesses and policy distortions in crisis-affected countries, combined with poorly planned financial liberalization and capital account opening. A surge in external capital inflows—driven in part by the region’s economic success and fixed exchange rates—led to rapid credit growth and asset price bubbles across crisis-affected countries. These financial imbalances quickly unraveled, triggering the crisis and threatening long-term economic growth.

The global financial crisis (GFC) that followed 10 years later led to a major change in thinking about the links between macroeconomics and finance, triggering changes in policy making. In particular, the GFC showed how risks of unbridled financial flows in an era of globalized finance and tightly interconnected financial markets could lead to a buildup of systemic risk and widespread financial instability. In emerging market economies, increasing financial integration can bring about excessive risk-taking and leverage. If poorly regulated and supervised, it can amplify the effects of financial cycles, create financial instability and damage the real economy. Thus, Asia’s increasingly integrated financial markets require a sound understanding of the associated risks and need to design appropriate policy responses.

The 2013–2014 “taper tantrum” exemplified the risks stemming from globalized finance. After the United States (US) Federal Reserve announced it was planning to end its ultra-loose monetary policy through gradual monetary policy normalization, many emerging market

economies—including some in developing Asia<sup>32</sup>—were hit by sudden large capital outflows and short-term financial instability. Thus, it is also important to understand the channels through which changes in monetary policy and financial conditions in advanced economies can affect emerging market macroeconomic and financial conditions and prepare policies that can mitigate these effects on financial stability.

Although the region has taken great strides in improving its financial resilience in the two decades since the AFC, significant structural weaknesses remain and new challenges have emerged. Remaining challenges include: (i) diversifying out of bank-dominated Asian financial systems, (ii) controlling rising credit and private sector debt, and (iii) avoiding high foreign currency-denominated debt financing. The recent rise in nonperforming loans and heavy reliance on US dollar-denominated debts are reemerging challenges in some economies. New challenges include: (i) links between financial cycles and the real economy, (ii) more rapid risk transmission from greater financial interconnectedness, and (iii) rising volatility from macrofinancial interlinkages. Taken together, these existing, reemerging and new challenges can exacerbate the region’s financial fragility. For example, a change in US dollar funding conditions transmits rapidly in a more interconnected and integrated global financial system, increasing the vulnerability of economies over-reliant on US dollar-denominated foreign debt.

This theme chapter analyzes these existing and new financial vulnerabilities and challenges. It identifies policy gaps, proposes policy considerations and offers suggestions on what can be done. In particular, it emphasizes policy options where increased regional cooperation can safeguard financial stability and promote financial resilience.

---

<sup>32</sup> See for example ADB (2014) and Estrada, Noland, Park, and Ramayandi (2015).

## Experiences and Lessons from Past Crises

To better analyze current financial vulnerabilities in Asia and identify policy gaps, it is worth taking a thorough look at three relatively recent international economic and financial crises—the AFC, GFC, and the European sovereign debt crisis (EDC)—to examine the causes, policy responses, and lessons learned.

### The Asian Financial Crisis

**The AFC disrupted a period of high economic growth as a currency and banking crisis triggered a regional economic crisis.**

After several years of high economic growth, the AFC began in Thailand in July 1997 and soon spread to Indonesia and Malaysia, before spilling over to other Asian economies with currencies tightly linked to the US dollar. The crisis originated in Thailand, triggered by the high volume of foreign capital that flooded into the country in the years leading to the crisis, fueling speculative markets in real estate and stocks alongside heavy domestic consumption. These contributed to a growing, unsustainable current account deficit. Authorities tried to defend the value of the Thai baht, but were ultimately forced to devalue the currency in early July 1997. In the following weeks, financial stress spread to neighboring economies as currency and then banking crises surfaced as the previously large capital inflows to the region slowed or reversed. It evolved into a more generalized regional economic crisis with deep impact on the real economy. In little more than a year, gross domestic product in Indonesia, Malaysia, the Philippines, the Republic of Korea, and Thailand fell a combined 30%. Banks succumbed to ever-expanding portfolios of nonperforming loans (NPLs). Investment rates plunged. And with several Asian economies amid deep recessions, spillovers affected trading partners across the region and around the globe.

**Among other factors, the AFC was caused by: (i) the nature of foreign borrowing, (ii) financial sector weaknesses, (iii) fixed exchange rates, and (iv) a region-wide loss of confidence that precipitated substantial capital outflows.**

The root of the AFC was the nature of foreign borrowing, which created a double maturity and currency mismatch. Much of the increasing foreign capital inflows were short-term (below 1-year) and unhedged. The lack of prudential supervision and proper regulations allowed these short-term inflows to be invested in long-term domestic projects—many in real estate and unproductive sectors (Sugisaki 1998, World Bank 1998). Thus, the maturity mismatch exposed the domestic financial systems to the risk that foreign loans might not be rolled over. The currency mismatch also arose from the *de facto* dollar peg in crisis-affected economies. The peg gave borrowers a false sense of security, encouraging them to take on increasing amounts of US dollar debt. It made domestic financial institutions less circumspect over exchange rate risks, in part due to the misplaced confidence that the US dollar loans could readily be repaid out of local currency earnings.

Weaknesses in the financial sector played a pivotal role as well. The region lacked the financial market infrastructure, supervision, and regulatory environment to efficiently allocate foreign capital inflows. Liberalizing local financial markets was premature and insufficiently regulated. Weak banking systems, poor corporate governance, and an overall lack of transparency exacerbated the loss of investor confidence in the region's financial systems.

The AFC prompted a wide array of reforms, including more flexible exchange rate regimes, stronger financial regulation and supervision, banking sector restructuring, and domestic and regional capital market development. Regional financial cooperation initiatives centered on: (i) establishing a regional mechanism for liquidity support and crisis management (the ASEAN+3 Chiang Mai Initiative [CMI] and the Chiang Mai Initiative Multilateralisation [CMIM]), (ii) strengthening regional macroeconomic and financial surveillance (the CMIM-associated ASEAN+3 Macroeconomic Research Office [AMRO]), and (iii) deepening regional capital markets—particularly through local currency bond market development (the ASEAN+3 Asian Bond Markets

Initiative [ABMI]). More recent regional initiatives to develop local capital markets include the ASEAN Capital Markets Forum and implementation plan,<sup>33</sup> and related initiatives under the Asia-Pacific Economic Cooperation forum (Goswami and Sharma 2011).

**Among the lessons learned from the AFC were the need to: (i) develop long-term currency bond markets as an alternative to bank financing, (ii) enhance the infrastructure of local capital markets, and (iii) undertake prudential regulation and supervision.**

One lesson from the crisis was the need to develop long-term local currency sovereign bond markets to avoid future currency and maturity mismatches and provide a more stable source of financing. More broadly, the crisis highlighted the need to develop the infrastructure of local capital markets and to establish mechanisms for adequate macroprudential regulation and supervision. Given the risks of foreign currency borrowing (and dollar funding in particular), local and international bank regulators need to maintain the safety and soundness of their domestic banking systems and be on the lookout for excessive capital inflows—specifically those that fund consumption or fuel local asset bubbles rather than contribute to expanding productive capacity. Apart from restrictions on short-term capital flows, protective measures designed to enhance financial resilience include ensuring adequate levels of foreign currency reserves and the development of cooperation mechanisms for cross-border crisis management (such as the CMIM). Finally, the AFC showed that the timing and sequence of external financial liberalization matters.

## The Global Financial Crisis

**The GFC began as a domestic mortgage crisis in the US, which rapidly spread worldwide after the failure of several “systemically important financial institutions”.**

The GFC unfolded largely because improperly designed regulatory systems facilitated overinvestment in real estate, financed by increasingly complex,

repackaged (and hard to trace) financial vehicles. It began as a domestic mortgage crisis in the US which rapidly spread across the world after the failure of Lehman Brothers Holdings, a major financial services company, and near-failure of American International Group (AIG), an insurance conglomerate. Financial institutions lost confidence in dealing with each other and international funding markets froze. The liquidity squeeze forced regulators worldwide to recapitalize financial institutions—including those not normally subject to bailouts—and become the lender of last resort for markets.

**The GFC showed how greater financial integration could lead to greater financial vulnerabilities—stemming from weaknesses in SIFIs, the lack of macroprudential supervision and the lack of monitoring mechanisms for the early detection of systemic risk.**

Aside from excessive borrowing and lending, poorly functioning credit markets, misaligned incentives, and a disconnect between regulatory structures and the rapidly integrated and sophisticated financial system, the GFC was also a product of the international transmission of systemic risk. The crisis underscored how increased financial integration and cross-border financial interlinkages can transmit risk globally—fueled by vulnerabilities and ultimate failure of “systemically important financial institutions” (SIFIs). The GFC also exposed the information gap between cross-border institutions and the inability of international and domestic regulatory structures to manage them effectively. It also exposed failures in financial market funding and the lack of prudential supervision (Arner 2009, Arner 2011). The excessive reliance on quantitative risk management mechanisms exacerbated the principal causes of the GFC (Arner 2009)—as they proved incapable of dealing with extreme market stress.

**The GFC triggered a series of financial regulatory reforms aimed at enhancing the resilience of the global financial system.**

The immediate government response was to inject massive amounts of capital to rescue SIFIs—an approach that differed from the International Monetary Fund (IMF) response to the AFC, which included very different measures, such as the closure of financial institutions and addressing of distressed assets

<sup>33</sup> The “Implementation Plan to Promote the Development of an Integrated Capital Market to Achieve the Objectives of the AEC Blueprint 2015” covers the adoption of international standards, progressive liberalization, and the sequencing of regional initiatives.

(Arner, Avgouleas, and Gibson 2017). Strengthening bank balance sheets and stabilizing financial systems ultimately restored banks' ability to resume lending.

The international Group of Twenty forum and newly created Financial Stability Board (FSB) established the foundations underlying the new regulatory framework.<sup>34</sup> They were charged with coordinating post-GFC responses and financial regulatory reforms, as well as setting financial standards and monitoring adherence to these standards. These reforms are still being implemented so their effectiveness cannot yet be fully gauged. Nonetheless, widening divergence in national regulatory practices has occurred recently along with a reluctance to abide by certain strictures—such as the capital adequacy frameworks set out in 2010 under Basel III.

**The major lessons of the GFC included the need to: (i) provide adequate financial supervision and macroprudential regulation, (ii) devise early warning systems to detect and mitigate the buildup of systemic risk, and (iii) design a framework to resolve SIFIs.**

Mechanisms for the early detection, mitigation, and effective resolution of crises and SIFIs are critical for financial stability and resilience. The inability to prevent and address systemic risk proved to be a crucial limitation of the regulatory architecture prevailing prior to the GFC (Arner 2009). Consequently, regulators need to identify and regulate SIFIs to mitigate the transmission of systemic risk. Moreover, they need to have the tools and mechanisms to ensure funding markets remain liquid under all market conditions.

More effective financial regulations and macroprudential supervision are critical to mitigating risks associated with complex financial instruments. Improving financial market infrastructure can likewise help contain possible sources of systemic risk (such as establishing central-counterparty clearinghouses). Regulatory bodies must possess the tools and mechanisms to assess and manage

risks across the financial system as well as those that aggregate over time.

The absence of an effective SIFI resolution mechanism was a main factor behind the Lehman Brothers collapse and near collapse of AIG. A critical regulatory deficiency was the inability to adequately respond to the failure of large financial conglomerates and identify the risks inherent in cross-border interactions and interconnections. Regulatory bodies must have appropriate resolution powers and measures at their disposal to prevent serious financial instability in times of stress. The AFC and the GFC more broadly highlighted the need to establish appropriate responses and resolution systems—particularly for domestic or regional SIFIs. Regional dialogue has helped—especially in the context of executing the ASEAN Banking Integration Framework.

## The European Sovereign Debt Crisis

**The EDC unfolded as the euro area struggled to deal with weaknesses and failures of banks operating across borders.**

The financial shocks during the GFC spilled over to most developed economies, including European Union (EU) members. Despite much discussion and work toward establishing a “Single Financial Market,” no single EU regulator existed. Adequate crisis resolution mechanisms—particularly those dealing with cross-border issues—were unavailable for nearly all EU jurisdictions (Avgouleas 2012). The threat of widespread bank failures thus accompanied the near collapse of the region's financial systems. The banking crisis eventually gave way to a sovereign debt crisis, triggered by the excessive leverage in the banking systems of countries such as Cyprus, Ireland, and Spain. At the same time, markets became increasingly reluctant to roll over Greek debt, resulting in eventual IMF and EU rescue programs.

<sup>34</sup> These include: (i) building high-quality capital and liquidity standards and mitigating procyclicality, (ii) addressing SIFIs and resolution regimes, (iii) improving over-the-counter derivatives markets, (iv) strengthening accounting standards, (v) strengthening adherence to international supervisory and regulatory standards, (vi) reforming compensation practices to support financial stability, (vii) developing macroprudential frameworks and tools, and (viii) expanding and refining the regulatory perimeter (Arner 2011).

### The crisis stemmed in part from the lack of transnational supervisory and regulatory structures to govern banks and other financial institutions.

In the immediate aftermath of the GFC, high public and private debt across euro area economies, a flawed macroeconomic framework, and the absence of institutions capable of handling cross-border banking crises contributed to the sovereign debt crisis. Also, regulatory and institutional features crucial to support financial stability were insufficiently robust or nonexistent. This was particularly relevant for those resolving cross-border financial institutions, deposit guarantee arrangements, and providing regulatory, supervisory, and fiscal arrangements. The severity grew given the tight links between financial institutions operating in a single market—as links amplified the transmission of shocks across market segments.

The EDC (and GFC) underscored a need to revisit existing models of financial market integration—to ensure they had institutions and structures that could underpin financial stability and economic growth.

### The EDC triggered a wave of regional policy initiatives toward establishing a European banking union—including a new European emergency financial assistance facility, euro area banking supervision, and resolution mechanisms.

Four reforms are worth noting. First, the European Stability Mechanism was established, aimed at providing financial assistance to euro area economies and troubled banks during a crisis. Second, the Single Supervisory Mechanism (SSM) for euro area banks was organized under the European Central Bank (ECB). An October 2013 SSM Regulation gave the ECB investigatory and supervisory powers to: (i) license financial institutions in the European Monetary Union; (ii) monitor compliance with capital, leverage, and liquidity requirements; (iii) supervise financial conglomerates; and (iv) require banks to take remedial action when regulatory capital requirements are breached. Third, the EU plans for harmonizing members' resolution laws and introducing integrated resolution structures are being implemented. The single resolution mechanism (SRM) was established in 2014 to ensure continuity in essential banking operations; to protect depositors, assets and public

funds; and to safeguard overall financial stability. The mechanism should ensure speedy and credible resolution of cross-border failures. Based on the EU's "Single Rulebook",<sup>35</sup> both the SSM and the SRM are pillars of the European banking union. And fourth, the development of common EU rulebooks for the single market by the European Supervisory Authorities is under way.

### Financial stability risks rise as cross-border markets grow; international cooperation is needed to devise and implement measures that enhance financial stability.

With the failure of previous EU mechanisms to ensure financial market stability, the post-crisis reforms are milestones for greater integration and regionalism. The post-EDC response to further develop and run single market operations underscored the need to improve international and regional coordination.

The EDC highlighted the contagion risks inherent in a highly integrated system—a valuable lesson for Asia as financial integration and interconnectedness deepens. The EDC exposed weaknesses in national regulatory structures—particularly when addressing integrated financial markets. And it made clear the need for harmonized regulatory standards. Those most severely affected by the crisis had to adopt policies based on national circumstances, not necessarily harmonized or conforming to single market policies. This is increasingly relevant for Asia, given the region's heterogeneity in economic size, development, and sociopolitical context.

<sup>35</sup> The EU's "Single Rulebook" refers to a unified regulatory framework for the financial sector in the EU that seeks to ensure a consistent application of Basel III in the EU.

## Financial Conditions, Vulnerabilities, and Cycles in Asia

The AFC and GFC led to a major revision in thinking about the relationship between macroeconomics and finance—in particular the impact macrofinancial linkages can have on the real economy.

The significance of macrofinancial linkages and the impact financial channels have on the real economy has surfaced only recently. The GFC showed how the various forms of finance can become channels of transmission, amplification, and propagation of shocks—and become the source of shocks themselves. Prior to the GFC, few studies explored how macroeconomics and finance intersected—they were usually treated as separate issues. A lesson from the GFC was how financial markets can be less than fully efficient and subject to a herding behavior—among other biases. Prominent academics (for example, Blanchard et al. 2016) acknowledged the importance of macrofinancial linkages and the real economic effects shocks have on financial supply and demand. Spurred by the GFC, more empirical evidence has been collected on macrofinancial linkages and financial cycles and is being analyzed.

This section outlines both existing and newly emerging financial vulnerabilities and challenges<sup>36</sup> in the region.

## Current Status of Asia's Financial Conditions and Sources of Financial Vulnerability

While the region has taken great strides in enhancing financial resilience in the wake of the AFC, substantial challenges remain and new sources of vulnerabilities have emerged.

The AFC triggered a wave of major economic and financial policy reforms that laid a strong foundation for post-crisis recovery and sustained high growth. However, the GFC highlighted several remaining challenges, including: (i) the bank-dominated nature of Asian financial systems, (ii) the role of credit growth and rising private sector debt, and (iii) high exposure to foreign currency-denominated debt.

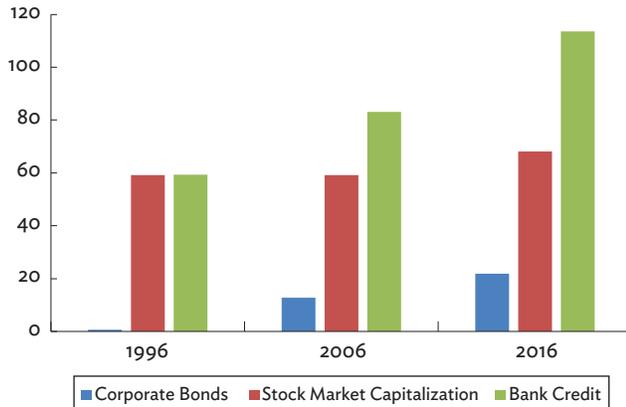
Banks remain the biggest source of corporate financing in emerging Asia. While stock market capitalization and bank credit were roughly equal sources of corporate funding in 1996 (59.1% and 59.4% of GDP, respectively), bank credit has ballooned in the two decades since. As of 2016, bank credit was 113.6% of corporate financing in emerging Asia (as a percentage of GDP), far outstripping stock market capitalization (68.1%) and corporate bonds (21.8%) (Figure 8.1).

Loans and leverage are rising in several economies, raising concerns of unsustainable credit booms.<sup>37</sup> And as credit increases and deviates from its long-run trend (Figure 8.2), credit gaps remain, if slightly narrowing. There was high credit growth during the pre-GFC period—particularly in Cambodia, India, Indonesia, the Lao People's Democratic Republic, Myanmar, the People's Republic of China (PRC), the Republic of Korea, and Viet Nam. However, others had low credit growth—Hong Kong, China; Japan; Malaysia; Taipei, China; and Thailand. Generally, credit growth has moderated since 2014, the result of a slowdown in net capital inflows—as global push factors grew bearish with the likely increase in the US Federal Fund rates, growth moderation in the PRC, and low global commodity prices.

<sup>36</sup> Online annex 2.A provides an overview of current financial and economic vulnerabilities compared with periods before the AFC and GFC. See also online annexes 2.B and 2.C for information on capital flows and exchange rate dynamics during past crises. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

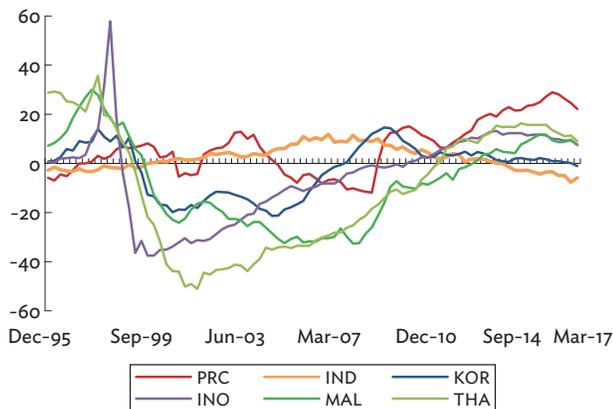
<sup>37</sup> See online annex 2.D for an overview on domestic credit growth and loan-to-deposit ratios since the pre-AFC period. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

**Figure 8.1: Corporate Financing as % of GDP—Emerging Asia (excluding HKG and SIN)**



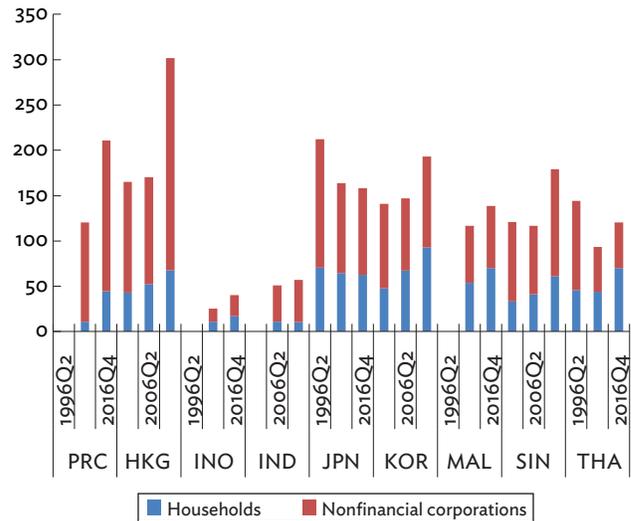
GDP = gross domestic product, HKG = Hong Kong, China, SIN = Singapore. Note: Emerging Asia (excluding Hong Kong, China and Singapore) includes the People’s Republic of China; India; Indonesia; the Republic of Korea; Malaysia; the Philippines; Thailand; and Viet Nam. Sources: ADB calculations using data from AsianBondsOnline. <https://asianbondsonline.adb.org>; International Monetary Fund (IMF). International Financial Statistics. [www.imf.org/en/Data](http://www.imf.org/en/Data); CEIC; and IMF. World Economic Outlook October 2016 Database. <https://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx> (all accessed March 2017).

**Figure 8.2: Deviation of Credit-to-GDP from Long-Run Trend (%)**



GDP = gross domestic product, IND = India, INO = Indonesia, KOR = Republic of Korea, MAL = Malaysia, PRC = People’s Republic of China, THA = Thailand. Notes: The credit-to-GDP ratio, published in the Bank for International Settlements database of total credit to the private nonfinancial sector, captures total borrowing from all domestic and foreign sources. In terms of financial instruments, credit covers the core debt, which is here equal to loans and debt securities. A credit-to-GDP gap is defined as the difference between the credit-to-GDP ratio and its long-term trend, in percentage points. The long-term trend is calculated using a one-sided Hodrick-Prescott filter with a smoothing parameter of 400,000. Source: Bank for International Settlements. <https://www.bis.org/> (accessed September 2017).

**Figure 8.3: Credit to Private Nonfinancial Sector—Selected Asian Economies (% of GDP)**



GDP= gross domestic product; HKG = Hong Kong, China; IND = India; INO = Indonesia; JPN = Japan; KOR = Republic of Korea; MAL = Malaysia; PRC = People’s Republic of China; SIN = Singapore; THA = Thailand. Notes: Credit covers core debt, equal to loans plus debt securities, and is provided by domestic banks, all other sectors of the economy and non-residents. Nonfinancial corporations include both private-owned and public-owned corporations; households include households and non-profit institutions serving households. For India, data starts second quarter of 2007. Source: Bank for International Settlements. <https://www.bis.org/> (accessed July 2017).

The combination of high leverage and slowing economic growth lowered the debt service capacity of many countries, raising the question of debt-at-risk. Corporate and household debt (and leverage) continues to be a concern for several economies in the region (Figure 8.3). The PRC’s leverage ratio, for instance, rose from 73% in March 2010 to 90% in March 2017, mostly due to growing corporate debt. The household debt-to-GDP ratio in the PRC more than doubled from 19% in March 2009 to 43% by September 2016. The Republic of Korea shows the same pattern—household debt increased from 74% of GDP in late 2008 to nearly 92% by September 2016. Thailand and Malaysia show similar trends. Mian, Sufi and Verner (2017) show that, in particular, an increase in the household debt-to-GDP ratio predicts lower GDP growth and higher unemployment in the medium run. Hence, these ratios could prove unsustainable should interest rates rise sharply—from rapid US monetary policy normalization, for example.

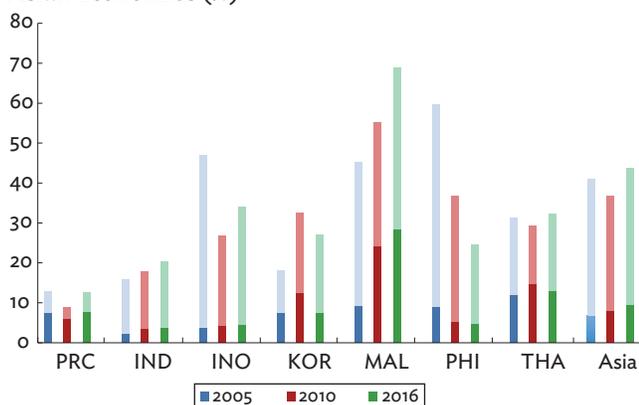
**Compared with the AFC, external positions remain strong; although foreign borrowing has increased over the past decade.**

Overall, total external debt<sup>38</sup> in emerging Asia (excluding Singapore and Hong Kong, China) was \$3.2 trillion in 2015—nearly 20% of the region’s GDP (up from 15% in 2005) (Figure 8.4). External debt ratios in India, Malaysia, the Republic of Korea, and Thailand increased, while those in Indonesia and the Philippines decreased. The PRC has maintained its debt level at about 12% of GDP.

Short-term external debt ratios also increased slightly. For Asia, short-term debt grew from 5.8% of GDP in 2005 to 7.9% in 2015. Malaysia had the largest rise—from 24% to 31% of GDP. Large short-term external debt increases the risk of potential currency and maturity mismatches.

By and large, bank capitalization is strong in emerging Asia—banks in the region remain sufficiently capitalized

**Figure 8.4: External Debt-to-GDP Ratio—Selected Asian Economies (%)**



GDP = gross domestic product, IND = India, INO = Indonesia, KOR = Republic of Korea, MAL = Malaysia, PHI = Philippines, PRC = People’s Republic of China, THA = Thailand.

Notes: Columns show the share of external debt as a percentage of GDP. The bold areas indicate the fraction of short-term external debt as a percentage of GDP.

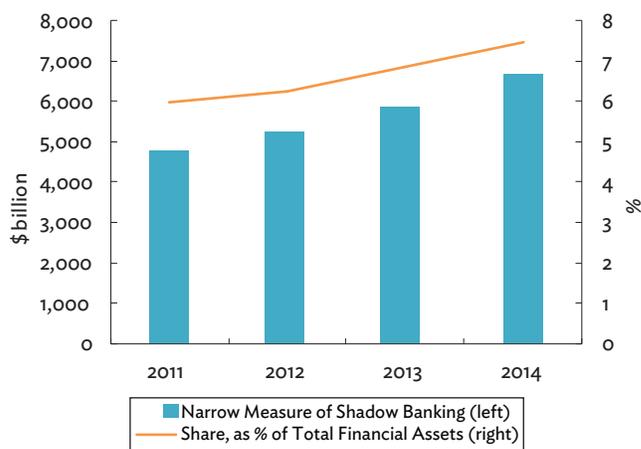
Sources: ADB calculations using data from CEIC; and World Bank Quarterly External Debt Statistics SDDS. <http://databank.worldbank.org/data/reports.aspx?source=quarterly-external-debt-statistics-sdds> (accessed June 2017).

<sup>38</sup> The economies included are Cambodia; India; Indonesia; Kazakhstan; the Lao People’s Democratic Republic; Myanmar; Malaysia; the People’s Republic of China; the Philippines; the Republic of Korea; Sri Lanka; Taipei, China; Thailand; and Viet Nam. If Hong Kong, China and Singapore are included, the external debt level is \$5.8 trillion, and the ratios for 2005 and 2010 are 30% and 33%, respectively.

to withstand modest shocks (for example, a rise in loan-loss provisioning consistent with a deceleration in trend economic growth and rising NPLs). However, the combination of high corporate leverage, large asset price volatility, and slowing growth is affecting bank asset quality in some countries.

Furthermore, there has been an increase in nonbank financing across the region in recent years. While this form of financing can provide a useful alternative to bank-based funding in spurring economic activity, it could also present a potential source of risk, facilitated through pronounced linkages with the banking sector (FSB 2017). As a share of total financial assets, nonbank financial intermediation<sup>39</sup> has remained steady in selected Asian economies<sup>40</sup> over the period 2010–2014 at around 22%. In absolute terms, there has been a slight increase from \$17 trillion to \$20 trillion in this measure. At the same time, assets of other financial intermediaries<sup>41</sup> across the region have increased

**Figure 8.5: Narrow Measure of Shadow Banking for Selected Asian Economies**



Notes: According to the Financial Stability Board’s methodology, the narrow measure of shadow banking includes nonbank financial entity types that are considered by authorities to be involved in credit intermediation where financial stability risks from shadow banking may occur. The measure has been aggregated for the following economies: Australia; Hong Kong, China; India; Indonesia; Japan; the People’s Republic of China; the Republic of Korea; and Singapore. The data spans from 2011 to 2014, due to availability. Source: Financial Stability Board (2015).

<sup>39</sup> The FSB (2017) defines this as a measure of all nonbank financial intermediation, comprised of other financial institutions (OFIs), insurance corporations, and pension funds.

<sup>40</sup> This includes Australia; Hong Kong, China; India; Indonesia; Japan; the People’s Republic of China; the Republic of Korea; and Singapore.

<sup>41</sup> OFIs are comprised of all financial institutions that are not classified as banks, insurance corporations, pension funds, public financial institutions, central banks, or financial auxiliaries (FSB 2017).

from \$7.3 trillion in 2010 to \$9.7 trillion in 2014. Most strikingly, the narrow measure of shadow banking<sup>42</sup> across selected Asian economies has seen a rapid increase from \$4.8 trillion in 2011 to \$6.7 trillion in 2014, representing a relative increase of as much as 40% over that period (Figure 8.5) (FSB 2015).<sup>43</sup>

## Reemerging Sources of Financial Vulnerability

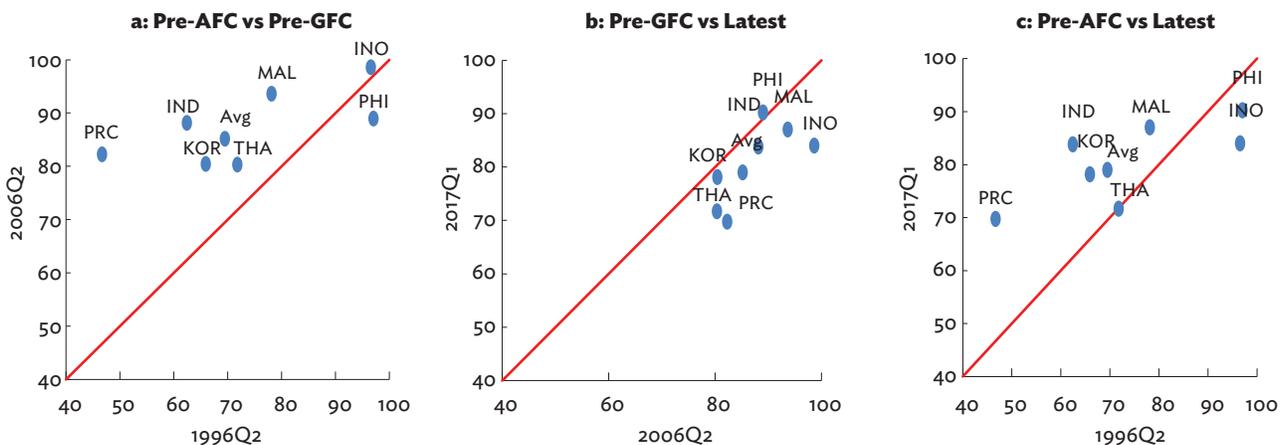
Some pockets of financial vulnerability reemerge in Asia. In particular, the recent increase in NPLs and continued reliance on the US dollar-denominated debt in some Asian financial systems are potential problems.

Although moderate relative to the AFC, NPLs have increased alongside default risks and a buildup of financial vulnerabilities (Table 8.1).

**The region's external debt positions have improved dramatically since the AFC; yet the US dollar remains the dominant currency for the region's international financial transactions.**

A large portion of foreign currency-denominated external debt in emerging Asia is in US dollars. In the first quarter of 2017, 79% of outstanding international debt securities in Asia's major emerging economies was denominated in US dollars.<sup>44</sup> Generally, the ratio of outstanding US dollar-denominated international debt securities to total international debt securities for these economies has increased over time (Figure 8.6). While the share of dollar-denominated debt securities has fallen moderately since the GFC, there has been an upward trend since the pre-AFC period. A high concentration of foreign debt in US dollars deepens an economy's exposure to dollar liquidity risks and more general susceptibility to external shocks.

**Figure 8.6: Evolution of the Share of Outstanding International Debt Securities Denominated in US Dollars (%)**



AFC = Asian financial crisis, Avg = Average, GFC = global financial crisis, IND = India, INO = Indonesia, KOR = Republic of Korea, MAL = Malaysia, PHI = Philippines, PRC = People's Republic of China, THA = Thailand.

Source: Bank for International Settlements. Debt Securities Statistics. <http://www.bis.org/statistics/secstats.htm> (accessed August 2017).

<sup>42</sup> This includes nonbank financial entity types that are considered by authorities to be involved in credit intermediation where financial stability risks from shadow banking may occur (FSB 2017).

<sup>43</sup> See FSB (2015) for the full dataset.

<sup>44</sup> Emerging Asia includes India, Indonesia, the Republic of Korea, Malaysia, the PRC, the Philippines, and Thailand. Data are from the BIS International Debt Securities dataset.

**Table 8.1: Bank Nonperforming Loans** (% of gross loans)

Economy	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Central Asia</b>										
Afghanistan										
Armenia		6.0	8.0	17.5	24.4	9.9	5.4	2.1	1.9	2.4
Azerbaijan					28.0	21.5	15.1	9.5	7.2	
Kazakhstan						11.9	8.4	4.3	3.3	2.4
Kyrgyz Republic		10.1	30.9	30.9	13.4	13.3	11.2	8.0		6.2
Tajikistan										11.3
<b>East Asia</b>										
China, People's Rep. of			28.5	22.4	29.8	26.0	20.4	13.2	8.6	7.1
Korea, Rep. of	5.8	7.4	8.3	8.9	3.4	2.4	2.6	1.9	1.2	0.8
Mongolia										
<b>South Asia</b>										
Bangladesh		40.7	41.1	34.9	31.5	28.1	22.1	17.5	13.2	12.8
India	15.7	14.4	14.7	12.8	11.4	10.4	8.8	7.2	5.2	3.5
Maldives										
Pakistan	20.7	19.5	22.0	19.5	23.4	21.8	17.0	11.6	9.0	7.3
<b>Southeast Asia</b>										
Indonesia		48.6	32.9	34.4	31.9	24.0	6.8	4.5	7.3	5.9
Malaysia	4.1	18.6	16.6	15.4	17.8	15.9	13.9	11.7	9.4	8.5
Philippines	4.7	12.4	14.6	24.0	27.7	14.6	16.1	14.4	10.0	7.5
Thailand		42.9	38.6	17.7	11.5	16.5	13.5	11.9	9.1	8.1
Economy	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Central Asia</b>										
Afghanistan				49.9	4.7	5.0	4.9	7.8	12.1	15.2
Armenia	2.4	4.3	4.9	3.0	3.4	3.7	4.5	7.0	7.9	9.3
Azerbaijan			3.5	4.7	6.0	5.7	4.5	4.4	5.3	
Kazakhstan	2.7	7.1	18.9	20.9	20.7	19.4	19.5	12.4	8.0	7.9
Kyrgyz Republic	3.6	5.3	8.2	15.8	10.2	7.2	5.5	4.5	7.1	
Tajikistan	4.8	5.4	9.6	7.4	7.2	9.5	13.2	20.4	19.1	
<b>East Asia</b>										
China, People's Rep. of	6.2	2.4	1.6	1.1	1.0	1.0	1.0	1.1	1.7	1.7
Korea, Rep. of	0.7	0.6	0.6	0.6	0.5	0.6	0.6	0.6		
Mongolia		7.2	17.4	11.5	5.8	4.2	5.3	5.0	7.5	8.5
<b>South Asia</b>										
Bangladesh	14.5				5.8	9.7	8.6	9.4	8.4	
India	2.7	2.4	2.2	2.4	2.7	3.4	4.0	4.3	5.9	7.6
Maldives						20.9	17.6	17.5	14.1	11.1
Pakistan	7.4	9.1	12.2	14.7	16.2	14.5	13.0	12.3	11.4	11.1
<b>Southeast Asia</b>										
Indonesia	4.0	3.2	3.3	2.5	2.1	1.8	1.7	2.1	2.4	3.0
Malaysia	6.5	4.8	3.6	3.4	2.7	2.0	1.8	1.6	1.6	1.7
Philippines	5.8	4.6	3.5	3.4	2.6	2.2	2.4	2.0	1.9	2.0
Thailand	7.9	5.7	5.2	3.9	2.9	2.4	2.3	2.3	2.7	2.9

Notes: White cells denote a nonperforming loan ratio below 5%, yellow between 5% and 10%, and orange above 10%. Blank cells indicate data are unavailable. Sources: ADB calculations using data from Bank of Mongolia; and World Bank. World Development Indicators. <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators> (accessed October 2017).

## Box 8.1: The Influence of US Dollar Funding Conditions on Asia's Financial Markets

The US dollar has long been the major funding currency of international debt. With 79% of major emerging Asian economies' outstanding international debt securities denominated in US dollars as of the first quarter of 2017—the dollar liquidity and bilateral exchange rate movements have important implications for financial stability.<sup>a</sup>

Traditionally, based on the Mundell-Fleming model, analysts would argue a currency appreciation hampers trade by making exports more expensive to foreign buyers, and thus lowering output through the trade channel (Fleming 1962; Mundell 1963). However, recent evidence points to an alternative channel through which changes in the exchange rate could affect the economy. For instance, Borio and Lowe (2002), and Reinhart and Reinhart (2009) note currency appreciation is usually associated with

strong credit growth and loosening financial conditions, thus having expansionary effects on an economy. More recently, Hofmann, Shim and Shin (2017) investigate the financial channel, focusing on how the bilateral exchange rate against the US dollar affects financial conditions in emerging market economies. They suggest using a balance-sheet approach in understanding the underlying economic mechanism, implying that an appreciation in local currency against the US dollar would improve a country's balance sheet capacity as the value of (dollar-denominated) liabilities relative to assets decreases.

$$\Delta y_{i,t} = \alpha_i + \delta \Delta y_{i,t-1} + \alpha_1 \Delta BER_{t-1} + \alpha_2 \Delta NEER_{i,t-1} + \beta \Delta CPI_{t-1} + \gamma \Delta IP_{t-1} + \theta \Delta r_{i,t-1} + \eta_1 \Delta VIX_{t-1} + \eta_2 \Delta CPIUS_{t-1} + \eta_3 \Delta IPUS_{t-1} + \eta_4 \Delta MMUS_{t-1} + \mu_i + \varepsilon_{i,t} \quad (1)$$

### Effect of Bilateral Exchange Rate Against US Dollar on Financial Conditions

	(1)	(2)	(3)	(4)	(5)
$\Delta BER_{i,t-1}$	-0.0561*** (0.0171)	0.00848 (0.0104)			0.00495 (0.0103)
$\Delta NEER_{i,t-1}$	0.0873*** (0.0188)		0.0390*** (0.0115)	0.0340*** (0.0113)	
$\Delta BER_{orth_{i,t-1}}$				-0.0833*** (0.0191)	
$\Delta NEER_{orth_{i,t-1}}$					0.0784*** (0.0195)
$\Delta VIX_{t-1}$	0.00115* (0.000631)	0.00117* (0.000635)	0.00127** (0.000635)	0.00113* (0.000627)	0.00119* (0.000633)

\*\*\* = significant at 1%, \*\* = significant at 5%, \* = significant at 10%. Standard errors in parentheses.

US = United States,  $\Delta BER$  = month-on-month log change in bilateral exchange rate against US dollar (an increase indicates an appreciation of the local currency),  $\Delta NEER$  = month-on-month change in nominal effective exchange rate (an increase indicates an appreciation of the local currency),  $\Delta BER_{orth}$  = orthogonal residuals of  $\Delta BER$  on  $\Delta NEER$  regressions, separately for each economy in the sample,  $\Delta NEER_{orth}$  = orthogonal residuals of  $\Delta NEER$  on  $\Delta BER$  regressions, separately for each economy in the sample,  $\Delta VIX$  = month-on-month log change in the Chicago Board Options Exchange volatility index.

Note: Other controls include the domestic and US change in year-on-year growth in consumer price index; the domestic and US change in year-on-year growth in the industrial production index; month-on-month change in lending rate, which is defined as the average short-term (1-year) lending rate of the commercial banks in the economies; the month-on-month change in 3-month money market rate in the US.

Sources: ADB calculations using data from Bank for International Settlements. Consumer Price Statistics. <http://www.bis.org/statistics/cp.htm?m=6%7C348>; Bank for International Settlements. Effective Exchange Rate Indices. <http://www.bis.org/statistics/eer.htm?m=6%7C187>; Bloomberg; Haver Analytics; and International Monetary Fund. International Financial Statistics. <http://data.imf.org/?sk=388DFA60-1D26-4ADE-B505-A05A558D9A42> (all accessed August 2017).

Empirically, Hofmann, Shim and Shin (2017) show that bilateral exchange rate fluctuations significantly impact financial conditions in emerging economies. In particular, they show that a local currency appreciation increases investors' bond inflows, suppresses local currency and foreign currency sovereign bond spreads, and consequently loosens financial conditions. Using a similar empirical approach but focusing on emerging Asian economies, a dynamic panel data model—using Anderson-

<sup>a</sup> Emerging Asian economies include India, Indonesia, Malaysia, the People's Republic of China, the Philippines, the Republic of Korea, and Thailand.

Hsiao's instrumental variable estimation (Anderson and Hsiao 1982)—offers some interesting results (box table).

The dependent variable is defined as the month-on-month change in local currency bond spread (LC spread)—an increase represents tightening domestic financial conditions.<sup>b</sup> It is regressed on the US dollar bilateral exchange rate (approximating the financial channel of exchange rates) and the nominal effective exchange rate (approximating the trade channel of the exchange rate). Monthly data from December 2006 to December 2016 for eight emerging Asian economies are used and five different model specifications are employed.<sup>c</sup>

First, a 1% appreciation of the domestic nominal effective exchange rate increases the LC spread by 8.7 basis points, indicating that exchange rates affect the economy through the trade channel. Second, a 1% appreciation of the domestic bilateral exchange rate against the US dollar decreases the LC spread by 5.6 basis points, thereby loosening domestic financial conditions. These results show exchange rates affect the economy through both trade and financial channels. Column (2) shows that without controlling for the trade channel, the bilateral exchange rate against the US dollar has a negligible net effect on financial conditions. On the other hand, column (3) indicates that without controlling for the change of bilateral exchange rate against the US dollar, the nominal effective exchange rate still has a significant impact on domestic financial conditions. Horse-race regressions between  $\Delta\text{NEER}$  vs.  $\text{BER}_{\text{orth}}$  and  $\Delta\text{BER}$  vs.  $\text{NEER}_{\text{orth}}$  reported in columns (4) and (5) further demonstrate pronounced pure effects of the financial and trade channels. In sum, the regression results are qualitatively matched with the findings of Hofmann, Shim, and Shin (2017)—that emerging Asian financial markets are particularly susceptible to changes in global dollar funding conditions.

Empirical evidence shows the significant impact of a change in bilateral US dollar exchange rates on sovereign bond spreads in selected emerging Asian economies with important implications for their financial conditions (Box 8.1). Generally, an appreciation of domestic currency against the US dollar improves the country's balance sheet capacity—decreasing the value of dollar-denominated liabilities relative to assets. Policy makers need to monitor this interplay between the bilateral exchange rate and local financial market conditions.

<sup>b</sup> Defined as the difference between the 5-year sovereign local currency bond yield and the 5-year US Treasury yield.

<sup>c</sup> Estimations are calculated for India, Indonesia, Malaysia, the People's Republic of China, the Philippines, the Republic of Korea, Thailand and Viet Nam.

## New Global Financial Conditions and Vulnerabilities

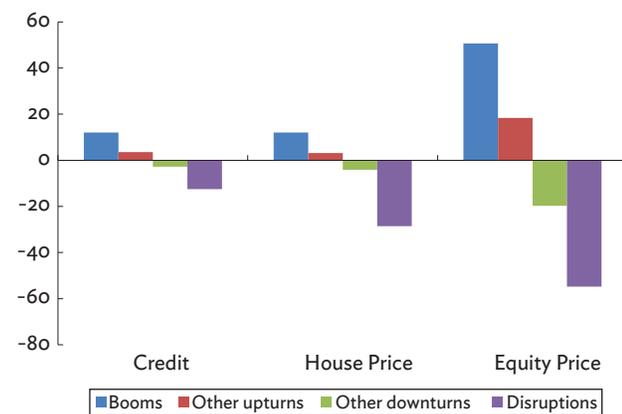
This section briefly looks at the characteristics of financial cycles and how financial crises cause spillover effects. It also examines the emergence and impact of a global financial cycle.

### Financial Cycles: Characteristics and Interplay with the Business Cycle

**Financial cycles are longer lasting, more volatile, and more closely related to impending financial crises than business cycles.**

In contrast to more frequently examined business cycles, financial cycles last longer, are associated with greater volatility and are more closely linked to impending financial crises. Financial cycles—typically related to credit, housing, or equity prices—can stretch over a decade or two, up to twice the typical 6 to 8 year length

**Figure 8.7: Average Amplitude of Financial Booms and Busts**



Notes: Figures reflect the average amplitude of upturns and downturns, measured in percentages. The amplitude for upturns (downturns) is calculated based on the 1-year change in each respective financial variable after its trough (peak). Booms are the top 25% of upturns calculated by amplitude. Disruptions (crunches, busts, and collapses) are the worst 25% of downturns calculated by amplitude. The dataset includes 21 Organisation for Economic Co-operation and Development (OECD) countries and covers quarterly data from 1960 to 2007 and draws from International Monetary Fund's International Financial Statistics and OECD (updated to account for data revisions).

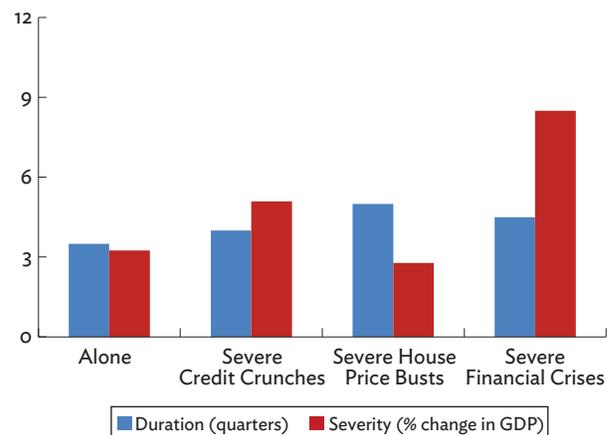
Source: Claessens, Kose, and Terrones (2011) as in Claessens (2017).

of business cycles. Financial cycles also have particularly long boom periods and show higher volatility (Figure 8.7).<sup>45</sup> The heightened volatility arises from a myriad of factors—including deeper contraction phases relative to business cycles, lengthy downturns in housing prices and credit upturns, and the high coincidence of financial cycle peaks and subsequent financial turmoil. Cycles of credit, housing, and equity prices also tend to reinforce one another. In addition, these cycles coincide globally, underscoring the impact of growing cross-border interconnections.

**While financial booms can enhance and lengthen expansions, ensuing financial disruptions will likely amplify and lengthen recessions.**

The effects of financial cycles spillover to the business cycle, at times with strong interactions. This is evident as recessions coinciding with financial contractions are longer and deeper, and as credit fluctuations are strongly linked to changing output levels (Figure 8.8). Higher credit expansion prior to a financial crisis, for

**Figure 8.8: Impact of Financial Disruptions on Recessions**

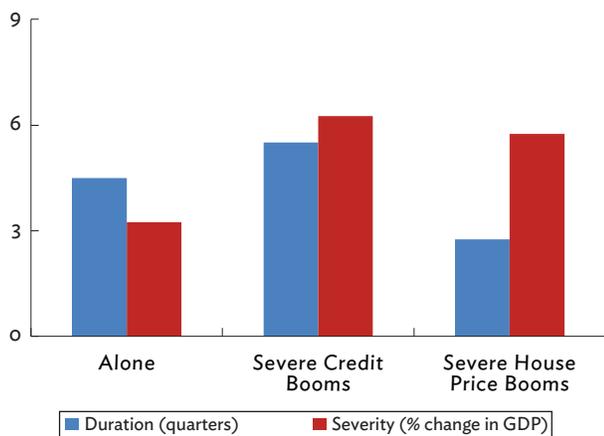


GDP = gross domestic product.

Notes: Severe credit crunches and equity or house price busts are in the top half of all crunch and bust episodes. Duration is the number of quarters from peak to trough in output. The dataset includes 21 Organisation for Economic Co-operation and Development (OECD) countries and covers quarterly data from 1960 to 2007. It draws from International Monetary Fund's International Financial Statistics and OECD (updated to account for data revisions).

Source: Claessens, Kose, and Terrones (2011 and 2014) as in Claessens (2017).

<sup>45</sup> Based on a dataset covering the following economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The same dataset is used for Figures 8.8-8.9.

**Figure 8.9: Impact of Financial Booms on Expansions**

GDP = gross domestic product.

Notes: The dataset includes 21 Organisation for Economic Co-operation and Development (OECD) countries and covers quarterly data from 1960 to 2007. It draws from International Financial Statistics and OECD (updated to account for data revisions).

Source: Claessens, Kose, and Terrones (2011 and 2014) as in Claessens (2017).

instance, has been shown to stall post-crisis recovery (Taylor 2015). Co-movements between financial and business cycles can similarly occur during periods of economic and financial growth—with financial booms enhancing and lengthening output growth (Figure 8.9). Thus, the dynamics of the financial cycle needs to be better understood—to more effectively detect early signs of financial stress and the buildup of systemic risk. Financial regulation and macroprudential policies have an important role to play in moderating the negative impact of these cycles.

Financial crises are often preceded by rising asset prices—housing prices and credit. Their effects can include a substantial fall in credit volume and asset prices, impairments to financial intermediation, large-scale balance sheet problems, and a sudden stop in capital flows (particularly in emerging markets). These force public interventions or financial regulatory reforms.<sup>46</sup> Nonetheless, the government's response can benefit the economy in the long run, as crises can be the impetus to much needed and often difficult reforms—often politically difficult to implement during normal times.

**The deeply interconnected nature of financial systems is underscored by the high degree of synchronization of financial cycles globally.**

A global financial cycle—showing commonalities in credit, asset prices, and financial conditions across countries—appears in part driven by financial and economic conditions in major financial centers, such as the US, euro area, Japan, and the United Kingdom—the G4 (Rey 2013). US monetary policy, global liquidity conditions (especially US dollars), the strength of G4 banking systems, and global risk aversion all have important implications for the high synchronicity of global capital flows and its financial ramifications for Asia.

**The global financial cycle matters for financial stability in emerging economies, with liquidity conditions in advanced economies affecting international capital flow dynamics.**

Among the lessons from past crises have been the long-lasting destabilizing effects large and volatile capital flows can have on emerging market economies. In an increasingly integrated global financial system, this is even more crucial when designing effective policy responses given more rapid international risk transmission. This amplifies shock propagation and synchronization in the region, potentially undermining financial stability.

Empirical results suggest that monetary policy in advanced economies—in the form of low interest rates, quantitative easing, and market expectations about policy moves—heavily impacts capital inflows to Asia (see Bhattarai, Chatterjee, Park 2015; Kim 2014; Chen, Filardo, He, and Zhu 2012; Villafuerte 2017). Changes in monetary policy can also trigger increased capital flow volatility. These inflows create upward pressure on asset prices (currencies, equities, and bonds) and increase foreign ownership of local currency securities in target economies, thereby increasing local financial market sensitivity to swings in foreign investor sentiment.

<sup>46</sup> See Annex 8.1 for a chronological overview and description of past financial crises, theories, and policy advice.

## Asia's Financial Interconnectedness, Transmission, and Spillovers of Shocks and Risks

Financial integration and interconnectedness allow for a more efficient allocation of financial resources and create greater opportunities for economic growth globally. But they could also lead to increased financial fragility. As the AFC and GFC demonstrated, deeper cross-border financial linkages and associated increased volumes of cross-border financial flows can be a source of financial volatility and contagion, in particular to emerging market economies.

In such a highly interconnected financial environment, shocks in one part of the system can be amplified and transmitted through exposures to common financial intermediaries or markets. Therefore, policy makers must better understand the mechanisms underlying the transmission of financial risk. They need to carefully monitor Asia's financial network development and understand how deepening financial interconnectedness relates to financial stability risks—such as vulnerability to external shocks, financial contagion, or liquidity risks stemming from foreign currency funding.

This section starts with an analysis of the evolution of Asia's financial network using equity market return data. Moreover, it features two empirical applications that analyze specific sources of risks stemming from financial interconnectedness. First, using bilateral cross-border data on bank liabilities between countries, it shows how large borrowing exposures to advanced economies can be a source of financial distress when a financial crisis strikes. The crisis can spread to borrowing economies, with a negative impact on regional financial stability. Second, the macrofinancial effects associated with NPLs in Asia are examined, with a discussion of the possible role inter-regional and intraregional spillover effects play.

## Asia's Financial Sector Network

**Since the late-1990s, international financial crises have highlighted the advantage of viewing the global financial system as a network of economies, where cross-border financial linkages play a fundamental role in the spread of systemic risk.**

Daily equity market returns (in local currencies) from 42 markets around the world (15 from Asia) are used to analyze the changing nature of Asia's financial networks for six key periods over the past 20 years.

The empirical analysis is conducted to effectively model the changing network of financial markets within and between Asia and the rest of the world to capture its evolution through six time periods over the last two decades—before, during, and after the AFC and GFC, respectively. For each period, the direction of financial links between markets, the relative significance of those links and their strength is examined. It provides a comprehensive overview of Asia's financial network over time. The network structure allows an examination of the possible buildup of systemic risks within the network and identifies channels of contagion arising from financial market interconnectedness and cross-border financial linkages.

**An advantage of network analysis is that it improves understanding of the way in which financial stress transmits between markets, helping facilitate policy making during times of financial distress.**

The advantage of network analysis lies in its ability to better understand the mechanisms underlying the transmission of financial stress between markets, to help identify and monitor network nodes that act as critical links between regions and can therefore facilitate the transmission of shocks. More generally, it can help authorities design appropriate policy responses and targeted interventions to promote financial stability and resilience.

**Data of 42 equity market indexes (in local currencies)—15 located in Asia—are used to provide a comprehensive analysis of Asia’s financial network over 1996–2016.**

The analysis draws on the approaches developed in Dungey et al. (2017b), Diebold and Yilmaz (2009, 2014), and Billio et al. (2012), primarily to document changes in the characteristics of Asia’s financial network over time—changes in the number and strength of links between financial markets in the network. To derive a comprehensive representation, two main steps are

applied using vector autoregression (VAR) models (Box 8.2). First, a VAR considers the relationships between all of the asset markets. Within that framework, nested Granger Causality tests determine which links are statistically significant. Second, the relative strength of the identified links—a spillover measure—is assessed through a forecast error variance decomposition, whereby the sources of observed volatility in each return are attributed to shocks in source nodes. These network statistics allow for a detailed analysis of Asia’s financial network and how it has evolved.

## Box 8.2: Deriving Asia’s Financial Sector Network: Data, Methodology, and Model

The data employed in the analysis is comprised of daily equity price indexes in local currencies of 42 markets over 1996–2016,<sup>a</sup> with 15 located in Asia. The observations are broken down into six phases covering the periods before, during and after the 1997/98 Asian financial crisis (AFC) and 2008/09 global financial crisis (GFC). Box tables 1 and 2 list the economies included, grouped by region and the time series observation in each subsample period.

Phase One and Phase Four correspond to the periods prior to the AFC and the GFC, respectively. Phases Two and Five indicate the crisis periods (see Dungey, Fry, and Martin 2006; and Dungey, Milunovich, Thorp, and Yang 2015 for more on the recognized crisis durations). Phases Three and Six cover the period following each crisis, and can be seen as recovery periods.

Using network analysis, the direction, relative significance, and strength of links between equity markets (or nodes) are determined. To study the changes in the networks across the six time periods, several aspects are assessed: (i) the changing completeness (or density) of the network; (ii) the changing number of links between nodes; (iii) the changing strength of links between nodes; (iv) the net and gross change in links between nodes; (v) “betweenness”, closeness, and eigenvalue centrality (indicating the substitutability of a node, the sum of distances to all other nodes, and the proximity between nodes, respectively); and (vi) Jaccard statistics (or the similarity of networks

<sup>a</sup> The analysis is conducted using demeaned returns and actual day dating.

### 1: Markets Grouped by Region

Europe	Asia	North America
United Kingdom	Australia	Canada
	People’s Republic of China	United States
<i>Euro Area</i>	Hong Kong, China	
Austria	India	<b>Latin America</b>
Belgium	Japan	Argentina
Finland	Republic of Korea	Brazil
France	Singapore	Chile
Germany		Mexico
Greece	ASEAN4	
Ireland	Indonesia	<b>Africa</b>
Italy	Malaysia	Egypt
Netherlands	Philippines	South Africa
Portugal	Thailand	
Spain	<i>Other Asia</i>	
<i>Other Europe</i>	New Zealand	
Czech Republic	Pakistan	
Denmark	Sri Lanka	
Hungary	Taipei,China	
Poland		
Sweden		
Switzerland		
Turkey		

Source: Dungey et al. (2017a).

Continued on next page

## Box 8.2 continued

**2: Time Series Observation in Each Subsample Period**

Phase	Time period	Number of observations
All Phases	1 March 1995–30 December 2016	5738
Phase 1	1 March 1995–1 July 1997	650
Phase 2	2 July 1997–31 December 1998	391
Phase 3	1 January 1999–31 December 2002	1042
Phase 4	1 January 2003–14 September 2008	1287
Phase 5	15 September 2008–31 March 2010	602
Phase 6	1 April 2010–30 December 2016	1761

Source: Dungey et al. (2017a).

from one period to the next). However, the analysis finds that betweenness, closeness, and eigenvalue centrality of the nodes do not provide particularly useful information for tracking changes between different periods.

The analysis employs a vector autoregression (VAR) model to analyze the existence and strength of the links between markets. It draws on the methodological approaches developed in Dungey et al. (2017b) in identifying a network of financial linkages between nodes (represented by index equity market data for each economy), where the links between them (edges) are determined by an adjacency matrix that includes both the direction and strength of the links and a measure of their statistical significance. Existing links are identified through nested Granger causality tests of links between nodes. If one node Granger causes the other one, then the link is recognized as existing in the network. If the Granger causality is not significant, then the link is nonexistent. The relative strength of the links is determined by using a forecast error variance decomposition approach.

The combination of the two methodologies draws on the work of Diebold and Yilmaz (2009, 2014) and Billio et al. (2012). It is driven in part by the limitation that statistical significance is not a strong point of VAR models. The Granger causality approach is used to weed out the spuriously large or poorly estimated linkages from the adjacency matrix resulting from the VAR approach.

The use of data on equity rather than bank liabilities (utilized more frequently in other studies) was due in part to the availability and extensiveness of the data; to its ability to more accurately reflect market sentiment; and to the concern that concentrating analysis and reforms on one sector could create shocks that transmit through other markets.

Source: Dungey et al. (2017a)

### Empirical results reveal a complex global financial network, highlighting the high degree of financial market interconnectedness.

Figure 8.10 maps the identified global financial network over the entire sample period. The thickness of the lines denotes the strength of the links, the size of the nodes increases with the number of outward links of each respective market, and the color indicates the outward spreading region in which the market is located.

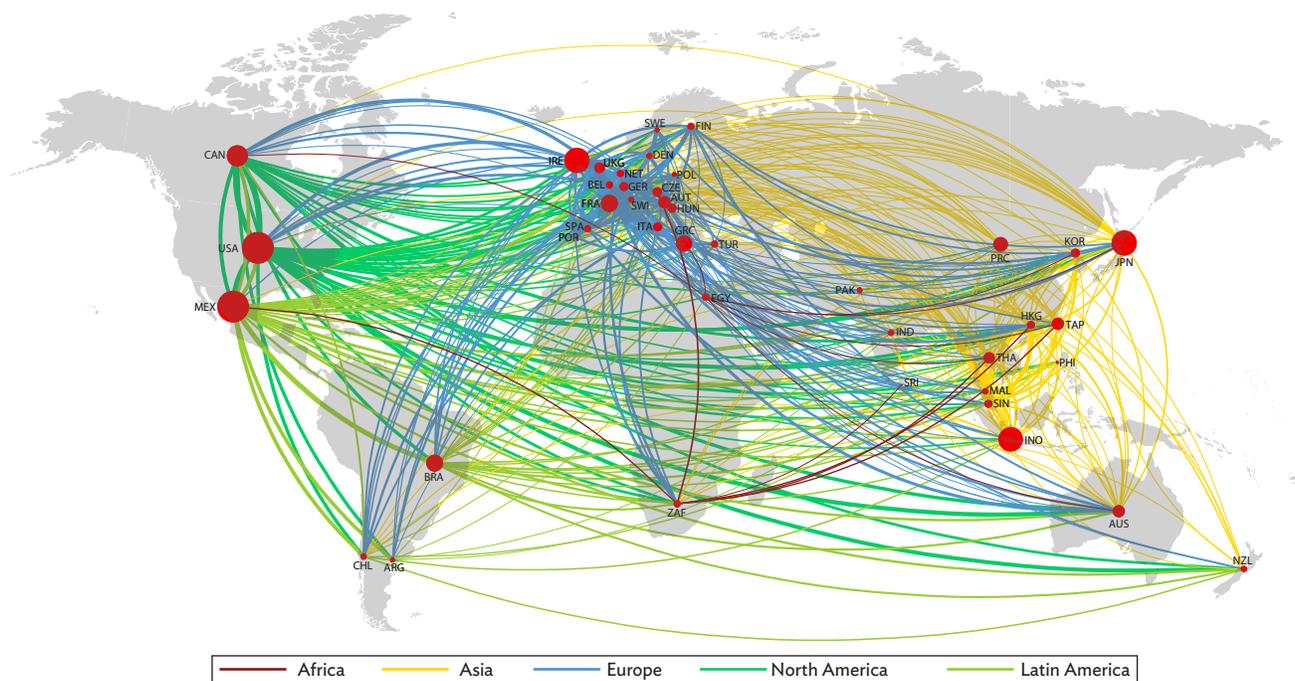
The complexity of the relationships between nodes is evident as there are 1,722 possible connections between nodes. The markets involved are highly interconnected, though some nodes are relatively isolated. The diagram reflects the relatively strong significance of the relationships between European markets in the sample, particularly euro area members. Financial interconnectedness within Asian economies is also visible.

### Tracking the development of the network over time shows that its density has changed substantially before and after crises.

Figure 8.11 illustrates the evolution of the financial network over time. During the transition from pre-crisis to crisis, a quick buildup of significant or strong links takes place. During periods of stress, markets become more interconnected (as demonstrated by the growing number of weaker connections coinciding with fewer strong connections). By contrast, after a crisis, many connections fail, with the decrease not offset by a rise in links elsewhere. In this way, crisis periods increase degrees of connectedness, while recovery phases reduce them.<sup>47</sup>

Table 8.2, Panel A indicates that the number of statistically significant edges in the network has grown less monotonically than what may initially be suggested by the panels. While only 12.2% of possible linkages were statistically significant before the AFC, it jumped by 45% (to 305 links) during the AFC before returning to close to pre-crisis numbers after the crisis. During the buildup

<sup>47</sup> It is worth noting the complications of using completeness statistics to understand the evolution of a network. The completeness of a network may fall due to an increased number of linkages outweighed by the fall in their average strength (similar to what occurred during the AFC) or it may rise due to an overwhelming increase in the number of links (as occurred during the GFC).

**Figure 8.10: Network Plots for Entire Sample**

ARG = Argentina; AUS = Australia; AUT = Austria; BEL = Belgium; BRA = Brazil; CAN = Canada; CHL = Chile; CZE = Czech Republic; DEN = Denmark; EGY = Egypt; FIN = Finland; FRA = France; GER = Germany; GRC = Greece; HKG = Hong Kong, China; HUN = Hungary; IND = India; INO = Indonesia; IRE = Ireland; ITA = Italy; JPN = Japan; KOR = Republic of Korea; MAL = Malaysia; MEX = Mexico; NET = Netherlands; NZL = New Zealand; PAK = Pakistan; PHI = Philippines; POL = Poland; POR = Portugal; PRC = People's Republic of China; SIN = Singapore; SPA = Spain; SRI = Sri Lanka; SWE = Sweden; SWI = Switzerland; TAP = Taipei, China; THA = Thailand; TUR = Turkey; UKG = United Kingdom; USA = United States; ZAF = South Africa.

Notes: Sample period: 1 March 1995 to 30 December 2016. The figure displays the return-based network of markets. Edges were calculated with bivariate Granger causality tests between markets (nodes) at the 5% level of significance. The thickness of the lines indicates the relative strength of links between markets. The size of the nodes increases with the number of outward links of each respective market, and the colors indicate the outward spreading region in which the market is located. Connectivity lines (edges) and nodes were drawn using *ggplot* and *ggrepel* packages of R version 3.4.1 (Wickham 2009, Slowikowski 2016).

Sources: ADB calculations using data from Bloomberg (accessed February 2017). Methodology based on Dungey et al. (2017a). World map was taken from ADB. Climate Change Resilience in Asia's Cities (infographic). <https://www.adb.org/news/infographics/climate-change-resilience-asias-cities>.

to the GFC, the number of links again increased by 10% (to 237 links). During the GFC, the number of links jumped dramatically to 389 before declining again to a level similar to the AFC.

Overall, the empirical results show interconnectedness increases during periods of stress, followed by a decrease during recovery phases, with the average strength of linkages growing pre-crisis, before declining significantly. The changing magnitude of the linkages is also worth noting, as the strength of market connections change from being very tight to being loose, with the number of weak links growing and the number of strong links decreasing. The number of links common to two adjacent time periods—the Jaccard similarity statistic

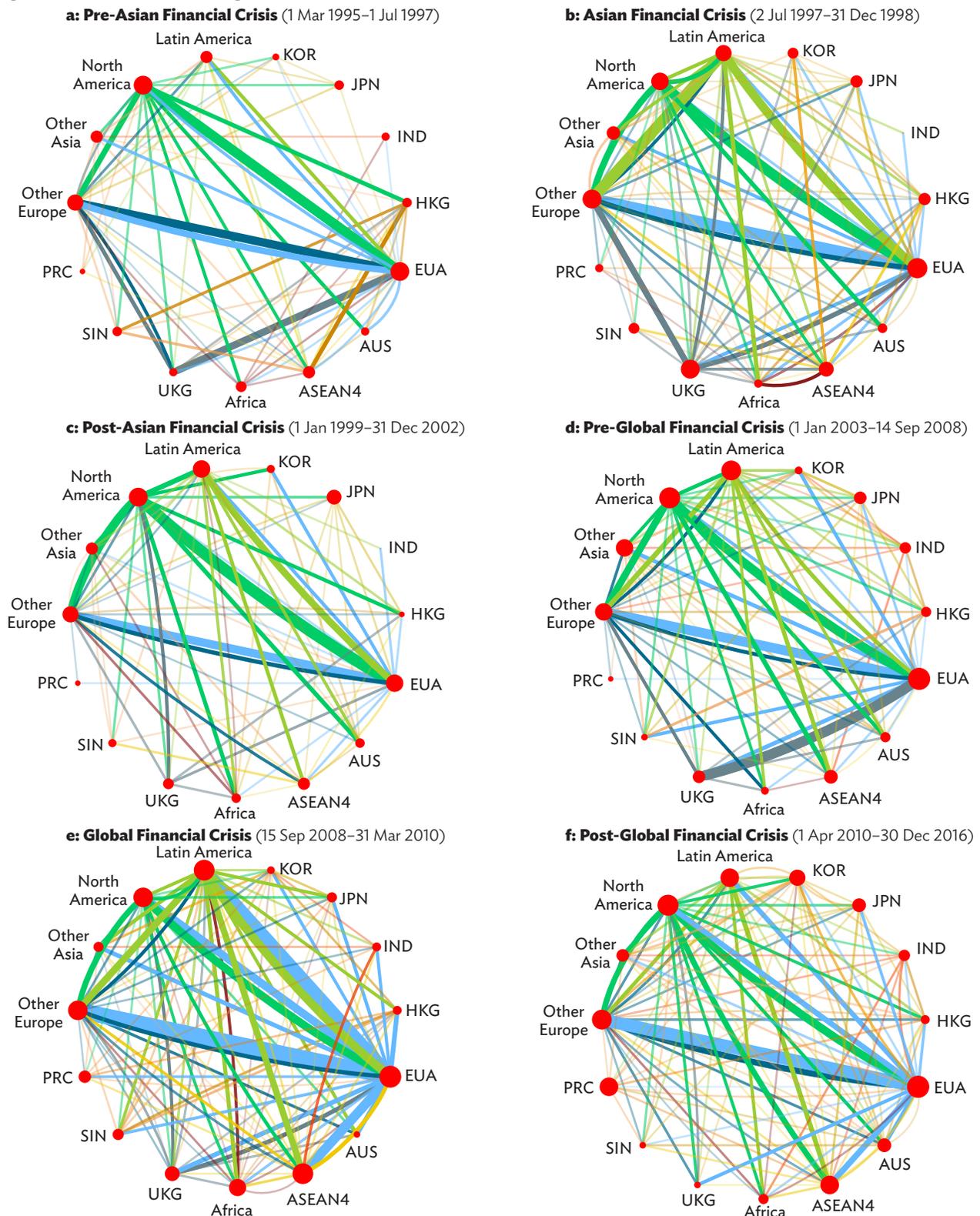
(Table 8.3)—also increases over time before decreasing following the GFC.<sup>48</sup>

**The analysis also suggests a general deepening of Asia's market connections with the rest of the world—as well as within the region—over the past two decades.**

In charting the network changes over time, the role and changing links to and from specific economies can be

<sup>48</sup> It is worth noting that the Jaccard statistics depicted in the third row of Table 8.3 are low, reflecting few common links between two time periods. This reflects, in part, the significant growth in the number of links in the network over the sample period (with 45% more links post-GFC compared with pre-AFC) and that this growth leads to a reduction in the Jaccard statistic by construction. The first two rows of the table highlight stability in the network in terms of link retention across time periods. Apart from the post-GFC phase, the proportion of links removed during each phase is falling, from 80% to 65%. The links are therefore more likely to be retained over the sample period.

**Figure 8.11: Evolution of Weighted Networks**



ASEAN4 = Association of Southeast Asian Nation (Indonesia, Malaysia, Philippines, and Thailand); AUS = Australia; EUA = euro area; HKG = Hong Kong, China; IND = India; JPN = Japan; KOR = Republic of Korea; PRC = People's Republic of China; SIN = Singapore; UKG = United Kingdom.

Notes: The figure displays the returns-based network of 15 equity markets and regional groupings from 1 March 1995 to 30 December 2016. These are defined in Box 8.2. Edges were calculated using bivariate Granger causality tests between markets at the 5% level of significance. The thickness of the lines indicates the average relative strength of each market (or regional grouping). The size of the nodes increases with the number of outward links of each respective market (or regional grouping).

Sources: ADB calculations using data from Bloomberg (accessed February 2017); and methodology based on Dungey et al. (2017a).

**Table 8.2: Network Statistics**

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
<b>Panel A</b>						
Average strength	0.0260	0.0235	0.0236	0.0276	0.0260	0.0225
Number of edges	210	305	214	237	389	306
Completeness	0.2570	0.2252	0.1820	0.2034	0.2734	0.1990
<b>Panel B</b>						
	Phase 1 to Phase 2	Phase 2 to Phase 3	Phase 3 to Phase 4	Phase 4 to Phase 5	Phase 5 to Phase 6	
<b>Edges Formed</b>						
	0.0194	0.0169	0.0208	0.0225	0.0211	
	264	159	180	306	233	
	0.1608	0.0968	0.1163	0.1864	0.1424	
<b>Edges Removed</b>						
	0.0206	0.0196	0.0180	0.0207	0.0229	
	169	250	157	154	316	
	0.1640	0.1536	0.1020	0.0994	0.1957	

Notes: The average link strength is estimated from the connectedness of each respective network. The number of edges was calculated using bivariate Granger causality tests between network nodes (entities). For the definition of phases 1–6, see Box 8.2.

Sources: ADB calculations using data from Bloomberg (accessed February 2017); and methodology based on Dungey et al. (2017a).

**Table 8.3: Jaccard Statistic for All Economies in the Sample (%)**

	Phases				
	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6
Edges removed as proportion of Phase t-1	80.48	81.97	73.96	64.98	81.23
Edges formed as proportion of Phase t	86.56	74.30	75.95	78.66	76.14
Jaccard statistic for all edges	8.65	11.85	14.47	15.29	11.74

Notes: For the definition of phases 1–6, see Box 8.2.

Sources: ADB calculations using data from Bloomberg (accessed February 2017); and methodology based on Dungey et al. (2017a).

seen. Over the course of the period studied, the number of direct connections from the PRC grew; the PRC also grew more connected to ASEAN economies and North America. Following the AFC, Singapore and Hong Kong, China established increasing inward-linkages with Asian economies, highlighting their importance as critical avenues for connecting Asia's markets to the rest of the world.<sup>49</sup> Thus, shocks originating in Asia's markets could spread to the US and other developed markets via a conduit of regional hubs—Singapore and Hong Kong, China. This is in line with Remolona and Shim (2015), who highlight the special financial intermediary role played by Singapore and Hong Kong, China as regional

banking centers. In more recent years, however, many Asian markets have increased and strengthened direct links to external markets.

**The analysis shows the complexity of expanding financial networks and highlights a growing internationalization and interconnectedness of Asian financial markets.**

The analysis empirically illustrates the nature of the global and regional financial network, embedding the direction, statistical significance, and strength of interlinkages into a single framework. The evolution of the network over the sample period clearly indicates the growing internationalization and interconnectedness of Asia's markets. The analysis also highlights specific instances where this occurred through market

<sup>49</sup> See online annex 2.E for a tabulation of the in- and out-linkages of the markets included in the study. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

interaction with local or regional hubs—particularly Hong Kong, China or Singapore. However, over time Asia’s markets increasingly link directly with other regions.

Strikingly, the analysis shows just how interconnected Asia’s financial markets are, and their associated shared risks and vulnerabilities. This underscores the need for coordinated action in designing and structuring policies aimed at making the region’s financial systems more resilient. As past crises have taught us, economies cannot safeguard financial stability alone. Rather, national policies need to be supplemented regionally to make Asia more resilient.

Finally, one limitation inherent in the model follows from the use of the single dimension of asset markets in the analysis. Equity markets may not fully capture the complexities in overall financial linkages between economies. The challenge to researchers and policy makers is to include different asset markets and potentially different players to better reflect the complexity of multiple layers of financial interconnectedness between economies. Sovereign bond market networks will, for instance, differ from equity market networks (Dungey et al. 2017a), and real economy networks—such as trade networks or input-output production networks (Pesaran and Yang 2016)—are closely tied to financial networks, but the weights on the nodes can be different and multidimensional.<sup>50</sup>

## Global Financial Interconnectedness of the Banking Sector

### The GFC highlighted how financial weaknesses and vulnerabilities can intensify with greater financial interconnectedness.

Although the GFC originated in advanced economies—unlike the AFC—emerging economies were also hit due to the increasingly interconnected global financial system. Banks in emerging economies faced a liquidity crunch as some troubled banks in advanced economies unwound their international investment positions and

withdrew funds from emerging markets. These spillovers were exacerbated if the troubled banks were larger and more interconnected—SIFIs were responsible for transmitting financial distress to well-connected financial institutions.

### Recent studies look at possible contagion through domestic banks’ liability-side exposure to foreign banks during the GFC.

A few recent studies highlight the risk of financial spillovers emanating from bank exposures on the liabilities side. An examination of the Northern Rock bank run in the United Kingdom demonstrates how a potential financial disruption can unfold as creditors pull back leverage in an effort to limit risk exposure.

Given the importance of the liability side as a channel of financial contagion, an empirical investigation tests the contagion effect of an economy using bilateral data on bank claims between economies. The goal is to empirically measure the effect of direct and indirect exposures of emerging economies to crisis-affected economies and to test whether these exposures can account for the capital outflows from emerging economies. Using data from 27 different Bank for International Settlements (BIS) reporting economies, 62 counterparty emerging economies are chosen for the model. These also include 12 emerging Asian economies (Box 8.3).<sup>51</sup>

### An emerging economy’s direct and indirect exposures on the liability side to crisis-affected banks in advanced economies can explain the capital outflows experienced during the GFC.

The results reveal that both direct and indirect exposures to crisis-affected economies play an important role in explaining the capital outflows experienced by emerging market economies during the GFC. These findings highlight the importance of the banking channel for financial distress transmitted from advanced lending economies to borrowing emerging economies. Analyzing the impact of exposures to foreign liabilities on capital outflows during the GFC (Table 8.4) shows that the coefficients of direct exposure of the banking sector

<sup>50</sup> See online annex 2.F for a discussion on the use of high frequency data in assessing financial networks. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

<sup>51</sup> Bangladesh, Georgia, India, Indonesia, the Kyrgyz Republic, Malaysia, Mongolia, Pakistan, the Philippines, the Republic of Korea, Sri Lanka, and Thailand.

## Box 8.3: Assessing Interbank Contagion During the Global Financial Crisis: Data, Methodology, and Model

The data are bilateral information on cross-economy liability positions collected from Bank for International Settlements (BIS) consolidated banking statistics and locational banking statistics.<sup>a</sup> These data allow an empirical assessment of how shocks transmit through bank exposures on the liability side. The consolidated banking statistics are the consolidated claims of internationally active banks headquartered in 30 BIS reporting economies against 223 counterparty economies.<sup>b,c</sup> Similar to the consolidation approach adopted by financial regulatory supervisors, these statistics include claims of a bank's foreign affiliates, but exclude intragroup positions.<sup>d</sup> Locational banking statistics report the outstanding claims of banks in 43 BIS reporting economies.<sup>e</sup>

Of the counterparty economies, a set of 62 emerging economies is chosen.<sup>f</sup> The list of emerging economies is adopted from Park, Ramayandi, and Shin (2016), Eichengreen and Gupta (2015), and Lim, Mohapatra, and Stocker (2014). To measure the extent to which an emerging

economy's liability side was exposed to borrowing from crisis economies,<sup>g</sup> two indicators are constructed:

$$DE_{i,t}^f = \sum_{j \in C_t} share_{ij,t}^f, \quad share_{ij,t}^f = \frac{f_{cijt}}{\sum_{k=1}^N f_{cikt}}$$

$$IDE_{i,t}^f = \sum_j share_{ij,t}^f \cdot DE_{j,t}^f$$

Direct exposure of foreign claims on an emerging economy  $i$  at time  $t$  to banks in crisis economies, denoted by  $DE_{i,t}^f$ , is measured by the sum of shares of foreign claims held by all economies that experienced crises. However, the direct measure alone cannot convey the full extent of an economy's exposure to crisis-affected economies—as it neglects the economy's exposure to economies not directly hit by the crisis, but similarly exposed to crisis-affected economies—therefore facing indirect liquidity problems. Consequently, an indirect exposure of foreign claims of an emerging economy  $i$  at time  $t$ ,  $IDE_{i,t}^f$ , is defined accordingly.

Additionally, direct and indirect exposures of the banking sector,<sup>h</sup>  $DE_{i,t}^b$  and  $IDE_{i,t}^b$ , are constructed to account for the fact that banking sector liabilities play a crucial role in transmitting shocks (for example, see Hahm, Shin, and Shin, 2013). Direct and indirect exposures of short-term maturities,<sup>i</sup>  $DE_{i,t}^s$  and  $IDE_{i,t}^s$ , are constructed using data on claims on maturities with less than 1-year on the counterparty economy. As long-term claims are not easily withdrawn—even by troubled banks—it is more likely that sudden withdrawals of short-term borrowings occur in case the lending economy experiences a credit crunch.

Finally, according to the hypothesis that economies more exposed—directly and indirectly—to banks in crisis economies suffered more from capital outflows during the global financial crisis (GFC), a measure of capital outflows

<sup>a</sup> BIS compiles and publishes two sets of statistics on banks' international positions. Consolidated banking statistics measure banks' country risk exposures by capturing the worldwide consolidated claims of internationally active banks headquartered in BIS reporting economies. Locational banking statistics provide information about the currency composition of bank balance sheets and the geographical breakdown of counterparties by capturing outstanding claims and liabilities of banks located in BIS reporting economies, including intragroup positions between offices within the same banking group.

<sup>b</sup> In the consolidated banking statistics, claims refer to outstanding loans and holdings of securities by reporting banks. See Park and Shin (2017) for the full list of reporting economies.

<sup>c</sup> Since the number of the BIS reporting economies is limited—that is, there are other claims of banks with controlling parents located outside the BIS reporting economies—the sum of all claims of these reporting economies against a counterparty would not equal the sum of all liabilities held by the counterparty. However, since the BIS reporting economies include most economies active in international bank loans, actual total foreign claims on a counterpart are not expected to deviate much from the sum of bank claims of just the reporting economies.

<sup>d</sup> Detailed explanations of the BIS consolidated banking statistics can be found in BIS (2016).

<sup>e</sup> In 2016, there were 43 reporting economies. However, when the direct and indirect exposures in 2007 are measured, the number with bilateral data available drops to 29. Park and Shin (2017) list reporting economies of locational banking statistics in 2007.

<sup>f</sup> See Park and Shin (2017) for a full list of emerging economies.

<sup>g</sup> Crisis-affected economies are defined according to Dates for Banking Crises, Currency Crashes, Sovereign Domestic or External Default (or Restructuring), Inflation Crises, and Stock Market Crashes (Varieties). Carmen Reinhart Author Website. <http://www.carmenreinhardt.com/data/browse-by-topic/topics/7/> (accessed July 2016)

<sup>h</sup> These disaggregated data are available in the consolidated banking statistics only on an ultimate risk basis. In the locational banking statistics, bilateral claims on the banking sector are available for total cross-border claims and cross-border loans.

<sup>i</sup> Short-term claims are available only for consolidated banking statistics international borrowings on an immediate counterparty basis.

## Box 8.2 continued

from economy  $i$  during the GFC,  $Koutflow_i$ , is defined as follows:

$$Koutflow_i = \frac{TFC_i^{max} - TFC_i^{min}}{TFC_i^{max}}$$

where  $TFC_i^{max}$  and  $TFC_i^{min}$  are the maximum and the minimum levels of total foreign claims on economy  $i$  during the period from the first quarter (Q1) of 2007 to Q4 2009. It is assumed that the difference between the maximum and the minimum levels of foreign claims on economy  $i$  during the period represent the volume of capital outflows from economy  $i$ . Total foreign claims are measured by adding foreign claims on economy  $i$  across all reporting economies.

To measure the extent to which capital outflows from emerging economies during the GFC were triggered by direct and indirect exposures vis-à-vis crisis-affected advanced economies, the following regression equation for all three exposure definitions is applied:

$$Koutflow_i = \beta_0 + \beta_1 DE_{i,2007}^j + \beta_2 IDE_{i,2007}^j + \beta_3 X_{i,2007} + \varepsilon_{i,j=f,b,s}$$

where  $DE_{i,2007}^j$  and  $IDE_{i,2007}^j$  are measures of direct and indirect exposure in Q4 2007, while  $X_{i,2007}$  captures other control variables of economy  $i$  at time  $t$ , that include aggravation of current account balances, real exchange rate appreciation before the GFC, increase in domestic credit-to-gross domestic product (GDP) ratio, inflation rate, and real GDP growth rate.<sup>j</sup>

Source: Park and Shin (2017).

are positive and statistically significant, regardless of whether indirect exposure is added, and whether economy-specific control variables ( $X_{i,2007}$ ) are included in the analysis. It is also worth noting that the coefficient of indirect exposure of the banking sector is positive, although it is not statistically significant, when controlling for the full set of other variables. In particular, the addition of sovereign credit rating seems to play a role in mitigating the effect of an economy's indirect exposure. Therefore, Table 8.4 indicates that it is predominantly the banking sector's direct exposure, as opposed to indirect exposure, which explains the capital outflows experienced by emerging economies.<sup>52</sup>

This empirical exercise shows that shocks in advanced economies are transmitted to emerging economies as the credit crunch experienced by troubled banks in turn triggers a run on banks and other entities in emerging economies. The findings underscore the significance of both the degree of an economy's direct and indirect exposures through the banking sector to crisis-affected countries as an important determinant of capital outflows. Hence, these findings suggest that the global banking network of aggregate cross-border lending can be a channel for a global liquidity crunch that can spread financial shocks globally. This liquidity issue of creditor banks can be particularly problematic for emerging market economies, as they rely heavily on foreign borrowing denominated in foreign currency.

The findings are consistent with the conclusions of recent financial contagion studies that highlight the financial vulnerabilities facing economies not directly affected by a crisis—that stem from deleveraging by creditors in crisis-affected economies, and exacerbated by a wider, denser global financial network (see Shin 2009). The results also demonstrate how financial distress can be transmitted from creditor economies to borrowing economies through their funding channels—highlighting the important dimension of the liability side (as in Čihák, Muñoz, and Scuzzarella 2011).

<sup>j</sup> See Eichengreen and Gupta (2015) and Park, Ramayandi, and Shin (2016) for the motivation for including these as explanatory variables.

<sup>52</sup> For more on the impact of direct and indirect exposures of foreign claims and of short-term international borrowings on capital outflows during the GFC, see Online Annexes 2.G and 2.H. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

**Table 8.4: Impact of Direct and Indirect Exposures of the Banking Sector on Capital Outflows during the Global Financial Crisis**

Variables	(1)	(2)	(3)	(4)
	Outflow	Outflow	Outflow	Outflow
Direct exposure of banking sector	0.257*** [0.075]	0.228** [0.085]	0.282*** [0.078]	0.253*** [0.086]
Indirect exposure of banking sector			0.722** [0.285]	0.359 [0.269]
Increase in current account deficit (2004–2007)		-0.006 [0.004]		-0.005 [0.004]
Average change in real exchange rate (% annual, 2003–2007)		-0.676* [0.366]		-0.667* [0.355]
Increase in credit to GDP ratio (2004–2007)		0.005** [0.002]		0.004** [0.002]
GDP growth (% annual, 2007)		-0.017* [0.009]		-0.016 [0.010]
Inflation rate (2007)		-0.023*** [0.008]		-0.022*** [0.008]
Chinn-Ito Index (2007)		0.124** [0.060]		0.126** [0.061]
S&P Sovereign Local Currency Credit Rating (2007)		-0.021** [0.010]		-0.020** [0.010]
Observations	60	49	60	49
R-squared	0.111	0.459	0.212	0.483

\*\*\* = significant at 1%, \*\* = significant at 5%, \* = significant at 10%. GDP = gross domestic product. Robust standard errors in brackets.

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct and indirect exposures are calculated using cross-border claims on the banking sector based on locational banking statistics. See Shin and Park (2017) for more detailed data descriptions. Source: Park and Shin (2017).

**The findings underscore the need for Asia's emerging economies and the region generally to monitor global conditions affecting their external liability side; and ensure adequate foreign currency liquidity coverage.**

These findings are highly relevant for policy makers—as they support the idea that cross-border bank lending can serve as an avenue for transmitting global liquidity problems from creditor to borrower economies. They highlight an important channel of contagion and financial vulnerability linked to financial integration and financial interconnectedness.

Even though regional banking has grown in Asia (Remolona and Shim 2015)—underscored by the increase of Asia's cross-border bank liabilities sourced within Asia (from 18.8% in 2011 to 25.7% in 2016)—around three-quarters of Asia's cross-border bank liabilities in 2016 came from external sources, mostly advanced economies (see Table 4.6 in Financial Integration section above).

Even economies not directly hit by a crisis can become vulnerable to its effects—threatening financial stability. Therefore, policies that aim to strengthen regional financial stability and resilience should consider this potential impact. The findings highlight the relevance of considering foreign liability exposure when designing macroprudential policies, capital flow management measures, and financial regulations—both nationally and regionally. While these policies currently focus on the fundamentals of emerging economies, they also need to consider the soundness of lender countries and the cooperation between lender and borrower countries to regulate global SIFIs. As discussed by Ghosh et al. (2014), there is scope for enhanced cooperation on capital flow management measures, not only between source and recipient economies, but also among recipient economies themselves.

Also, the results support the need for emerging economies to closely monitor global financial conditions—in line with Cerutti, Claessens, and Puy (2015). While these results depict the risks of

contagion originating from advanced economies, they can equally appear in an expanding regional banking network. As analyzed by Remolona and Shim (2015), some regional banks in Asia have become increasingly important as a future source of systemic risk. Adequately monitoring their cross-border activities and properly supervising these banks will be key to enhancing regional financial resilience.

## Macrofinancial Impacts of NPLs and Financial Spillovers across Asia

The recent rise of NPLs in some Asian economies calls for close monitoring due to potential macrofinancial feedback effects and implications for the region's financial stability.

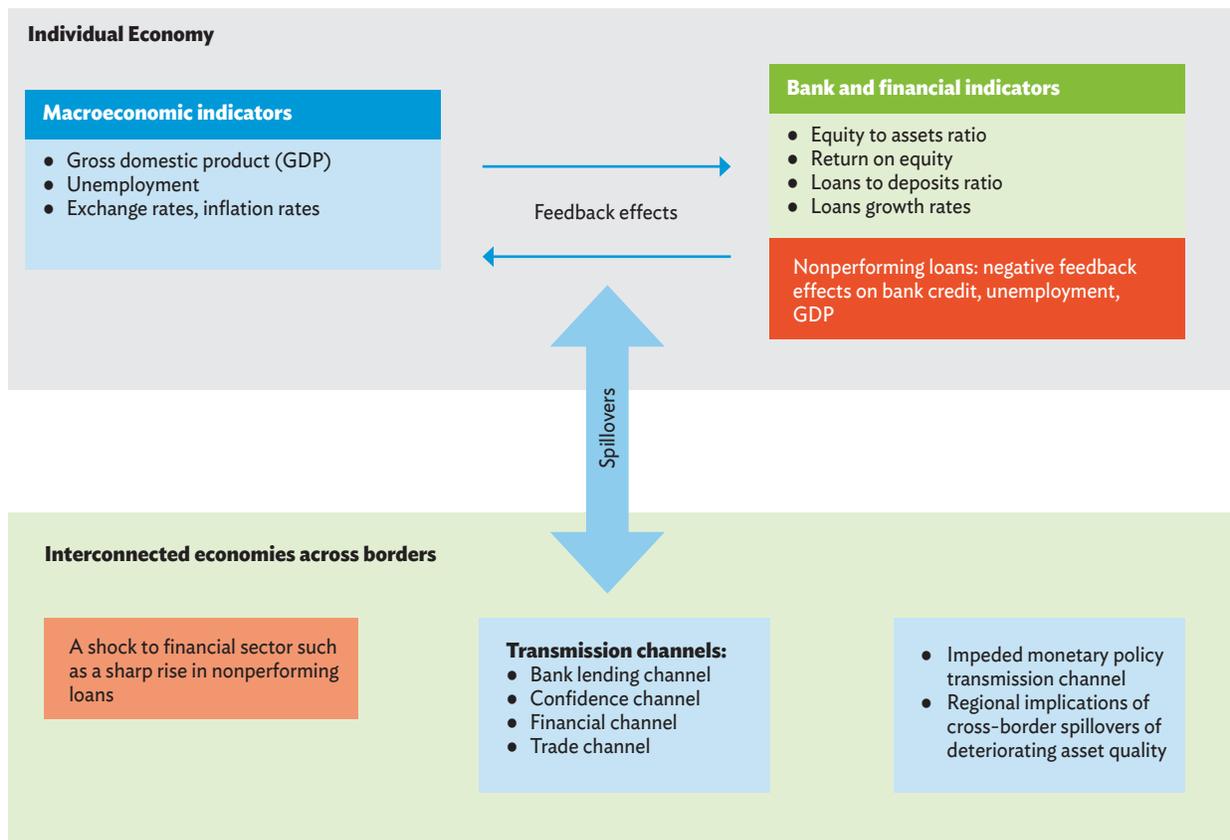
The rise of NPLs needs to be closely monitored. Figure 8.12 describes the dynamics underpinning

macroeconomic and financial spillovers, as well as their macrofinancial feedback effects. This conceptual framework captures the interplay between macrofinancial variables and NPLs along with the potential channels of financial spillovers across borders.

**NPL ratios have recently begun to rise in several developing Asian economies—an emerging concern due to macrofinancial feedback effects.**

NPL ratios in Asia have been trending downward since the AFC—particularly in Southeast Asia, where NPL ratios were 3% or below in 2016 (see Table 8.1). This contrasts starkly against the skyrocketing NPL ratios immediately following the crisis in 1999, when they were well above 30% of all loans in Indonesia and Thailand, 29% in the PRC, and over 10% in India, Malaysia and the Philippines. The improved bank asset quality has been attributed to stronger growth in nominal

**Figure 8.12: Macrofinancial Impacts of Nonperforming Loans**



Sources: Conceptual framework by ADB, based on Arslanalp, Liao and Seneviratne (2016); Beaton, Myrvoda, and Thompson (2016); Beck, Jakubik, Piloii (2013); De Bock and Demyanets (2012); Espinoza and Prasad (2010); Klein (2013); Lee and Rosenkranz (2017); Makri, Tsagkanos, Bellas (2014); Martin (2017); Nkusu (2011); Park (2017); Shu, He, Dong, Wang (2016); Swiston and Bayoumi (2008).

incomes and credit, increased financial inclusion, and better supervision of bank credit risk management and underwriting.

However, global headwinds and moderating growth in the PRC in recent years exerted downward pressure on the region's economic conditions. Coupled with greater financial volatility following the start of US monetary policy tightening and financial spillovers from the PRC, bank balance sheets have deteriorated, causing a buildup of NPLs in the region. In particular, since 2010, NPLs—by amount and/or share of total loans—increased in Bangladesh and India (South Asia); Hong Kong, China; Mongolia, and the PRC; (East Asia); and in Cambodia, Indonesia, Singapore, and Thailand (Southeast Asia).<sup>53</sup> This sustained increase is particularly visible in the PRC,<sup>54</sup> India,<sup>55</sup> and Mongolia.

A large sustained NPL buildup could damage the financial sector and likewise lead to a reduction in credit supply and slowdown in overall economic activity. Multiple studies establish a link between deteriorating macroeconomic conditions (as captured by rising unemployment, slower growth, or falling asset prices) and unfavorable financial conditions (such as debt service problems or mounting distressed assets on bank balance sheets) (see Beaton, Myrvoda, Thompson 2016; Beck, Jakubik, and Piloju 2013; De Bock and Demyanets 2012; Espinoza and Prasad 2010; Klein 2013; Makri, Tsagkanos, Bellas 2014; Nkusu 2011).

### Increasing NPL levels reflect weak macroeconomic conditions and excess leverage; and they have harmful feedback effects on the overall economy.

Empirical evidence on the determinants of NPLs in Asia has been limited. And they have not been analyzed from a regional perspective. Nevertheless, there is consensus that two groups of factors determine how NPLs evolve over time. One is overall macroeconomic conditions, which affect borrowers' debt servicing capacity and explain credit risk. There are also bank-specific factors, which focus on variables that can signal or induce risky lending, affecting each bank's NPL level.

Existing studies led to several important insights. First, most studies place greater emphasis on the role of macroeconomic conditions in determining NPLs (as opposed to bank-specific factors), with the analysis performed using aggregate/country-level data. Second, there are very few Asian studies that model NPLs and their macrofinancial feedback effects. Finally, few attempts have been made to control for structural changes such as those relating to the AFC or GFC.

Therefore, a panel VAR analysis of macrofinancial implications of NPLs in emerging Asia offers new insights and significant evidence for the feedback effects of NPLs on real economy and financial variables (Box 8.4). These effects are bidirectional—as macroeconomic conditions impact financial indicators (such as NPLs) and financial conditions in turn affect macroeconomic indicators. In particular, changes in the NPL ratio Granger-cause<sup>56</sup> changes in the policy rate, credit growth, GDP growth, and unemployment (Table 8.5). The other direction of causality also holds as macroeconomic indicators also Granger-cause change in the NPL ratio. Moreover, the panel VAR impulse response functions (Figures 8.13, 8.14) confirm that positive shocks to GDP growth and credit supply both slow NPL ratio growth, while contractionary monetary policy shocks and shocks to unemployment both increase NPL ratio growth. More importantly, rising NPL ratio growth decreases GDP growth, credit supply, and increases the unemployment rate. By magnitude, a one standard deviation shock in NPL ratio would lead to about 0.18 percentage point contraction in GDP growth rate, about 3.61 percentage

<sup>53</sup> Based on ADB calculations using NPL data from CEIC; International Monetary Fund. International Financial Statistics. <https://imf.org/en/Data>; and World Bank. World Development Indicators. <http://databank.worldbank.org> (all accessed October 2017). For more details, see Table 8.1. and Online Annex 2.1. [https://aric.adb.org/aeir2017\\_onlineannex2.pdf](https://aric.adb.org/aeir2017_onlineannex2.pdf)

<sup>54</sup> According to the China Banking Regulatory Commission, the volume of NPLs was equal to CNY433 billion in March 2011, and jumped to as much as CNY1,640 billion in June 2017. Hence, even though the reported NPL ratio still does not exceed 2% in the PRC, the size has almost quadrupled over the last 6 years.

<sup>55</sup> The distressed assets of India's state-owned banks are concentrated in a few dozen large corporate accounts. Concerns over the problem have grown as estimates of bad loans held by three large corporate sector lenders have increased. Bank stress is compounded by a lack of private sector investment, which fell in three quarters of 2016 (Financial Times 2017).

<sup>56</sup> Variable  $x_t$  granger causes variable  $z_t$ , if  $z_t$  can be predicted more efficiently if the information of  $x_t$  is taken into account in addition to all other available information.

## Box 8.4: Estimating Macrofinancial Implications of Nonperforming Loans: Data, Methodology, and Model

The analysis investigates nonperforming loans (NPLs) in emerging Asia from 1994 to 2014. The study had two goals. First, the determinants of NPLs were analyzed using bank-level and macroeconomic data using a dynamic panel data model framework. Second, the feedback effects of deteriorating bank asset quality (rising NPLs) were examined using a panel vector autoregression (PVAR) model. The latter is explained in more detail below.

The analysis uses panel data of an economy's annual macroeconomic and financial indicators covering 32 economies: Afghanistan; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; Georgia; Hong Kong, China; India; Indonesia; Japan; Kazakhstan; the Kyrgyz Republic; the Lao People's Democratic Republic; Malaysia; Mongolia; Myanmar; New Zealand; Pakistan; the People's Republic of China; the Philippines; the Republic of Korea; Samoa; Singapore; Sri Lanka; Tajikistan; Thailand; Turkmenistan; Uzbekistan; and Viet Nam.

The following economy-level data on financial and macroeconomic variables were used:

nplr	NPL ratio defined as the ratio of NPLs to total loans of the economy's overall banking system
$\Delta$ nplr	Change in NPL ratio
$\Delta$ loans	Loan growth rate defined as the year-on-year growth rate of loans of the overall banking system
$\Delta$ gdp	Real gross domestic product (GDP) growth rate
unemployment rate	The number of unemployed as percentage of total labor force
$\Delta$ unemp	Change in the unemployment rate
Policyrate	Policy rate
$\Delta$ policyrate	Change in policy rate
inf	Inflation rate defined as the year-on-year growth rate of the consumer price index
$\Delta$ inf	Change in inflation rate

Source: CEIC and Bankscope.

To investigate the feedback effects of NPLs on the real economy, the PVAR model is estimated as

$$Y_{i,t} = \Pi_0 + \sum_{j=1}^n \Pi_j Y_{i,t-j} + \varepsilon_{i,t},$$

$$\varepsilon_{i,t} = u_i + e_{i,t}$$

where  $Y_{i,t}$  is the vector of endogenous variables,  $\varepsilon_{i,t}$  is the composite error term consisting of the economy fixed effects ( $u_i$ ) and idiosyncratic errors ( $e_{i,t}$ ). In the baseline specification,  $Y_{i,t}$  consists of four endogenous variables— $\Delta nplr_{i,t}$ ,  $\Delta loans_{i,t}$ ,  $\Delta unemp_{i,t}$ , and  $\Delta policyrate_{i,t}$ —where subscripts  $i$  and  $t$  denote economy  $i$  and year  $t$ , respectively. For robustness checks, the PVAR both in level and first difference forms are estimated and yield qualitatively similar findings. Results of model selection tests developed by Andrews and Lu (2001) reveal that the optimal lag order is one, hence the first lag of each of the four endogenous variables in the estimation are included. Using the programs developed by Abrigo and Love (2015), the PVAR is estimated using generalized method of moments (GMM) techniques to derive consistent estimates of the parameters.

Following Espinoza and Prasad (2010), the identification strategy is based on a Cholesky decomposition with  $\Delta policyrate$  appearing first in the ordering, followed by  $\Delta loans$ ,  $\Delta unemp$  ( $\Delta gdp$  for specification 2) and finally  $\Delta nplr$ . This ordering assumes that the NPL ratio can affect unemployment (or economic growth in specification 2) or credit growth only with a lag and not instantaneously. This is consistent with documented empirical evidence that causality runs initially from economic growth to NPLs. For robustness checks, alternative Cholesky orderings proposed by Klein (2013) and De Bock and Demyanets (2012) are tried, which assume NPLs have a contemporaneous effect on GDP growth; unemployment and inflation affect NPLs only with a lag. Qualitatively, the results are similar across alternative Cholesky orderings.

Note: Empirical results have been derived using Stata 13.

Source: Lee and Rosenkranz (2017).

**Table 8.5: Results of the Panel Vector Autoregression Granger Causality Test**

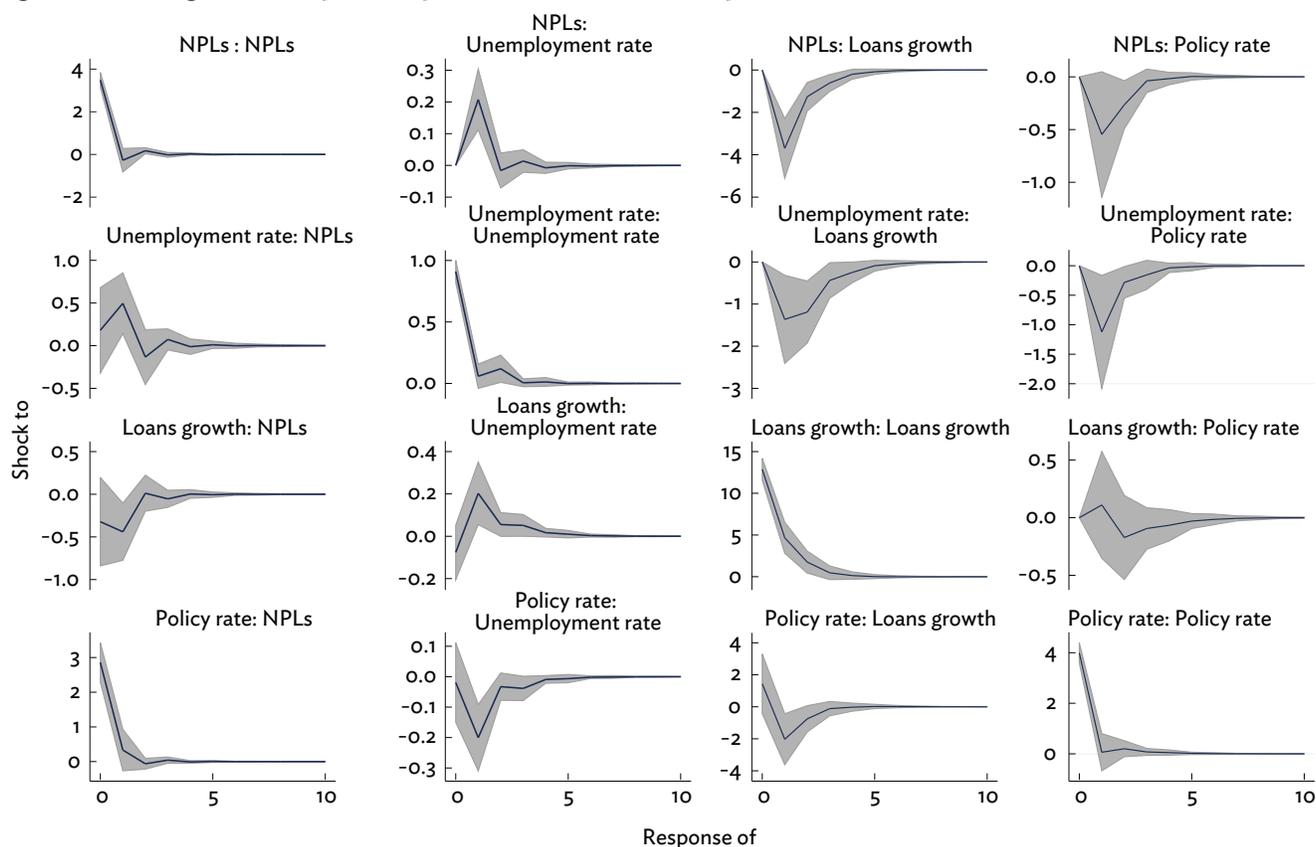
Dependent	Regressors		Baseline Specification		
	$\Delta$ policyrate	$\Delta$ loans	$\Delta$ unemp	$\Delta$ nplr	Joint
$\Delta$ policyrate		0.02	5.24**	3.22*	13.66***
$\Delta$ loans	0.43		6.72**	28.63***	50.60***
$\Delta$ unemp	30.30***	9.33***		19.28***	32.94***
$\Delta$ nplr	3.84**	6.57**	8.05**		17.53***

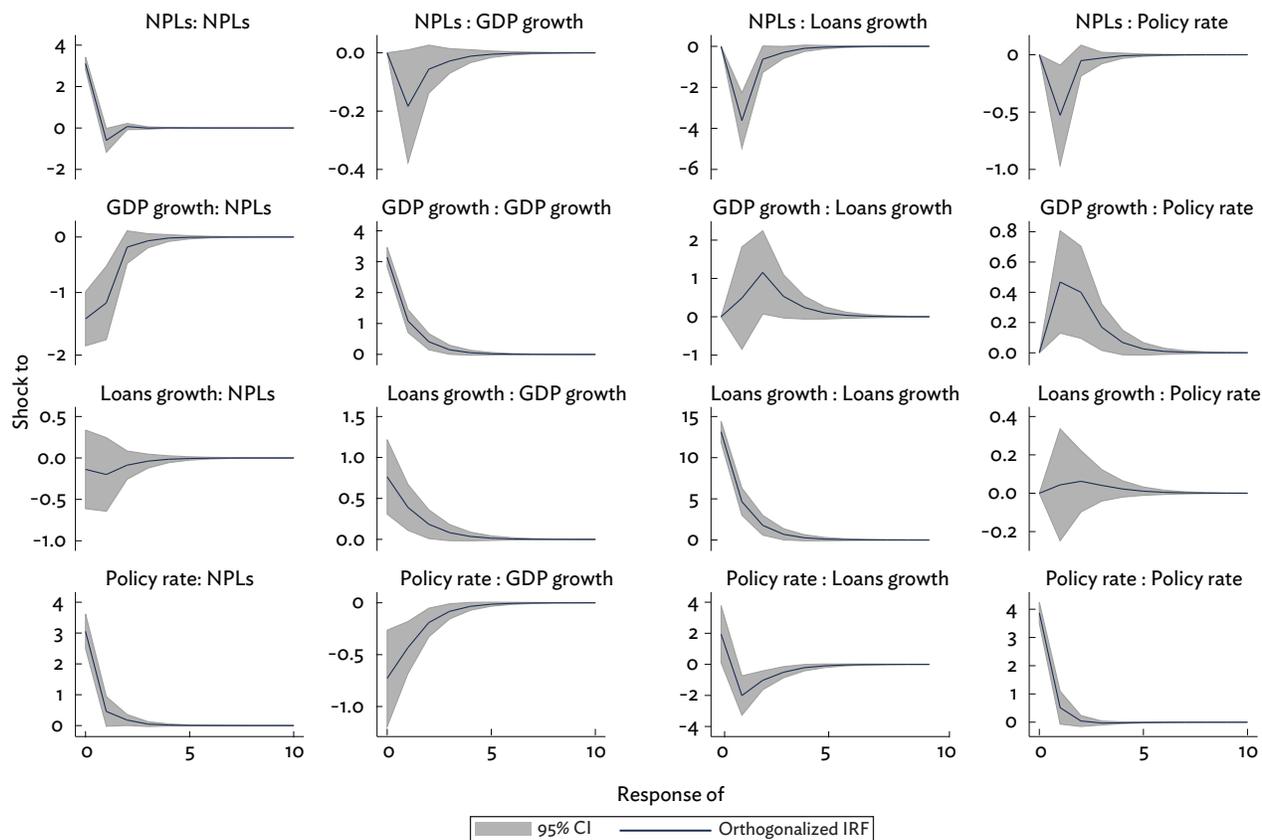
Dependent	Regressors		Specification 2		
	$\Delta$ policyrate	$\Delta$ loans	$\Delta$ gdp	$\Delta$ nplr	Joint
$\Delta$ policyrate		0.06	2.41	5.62**	10.81**
$\Delta$ loans	0.81		2.78*	29.68***	43.40***
$\Delta$ gdp	0.76	0.29		3.45*	6.74*
$\Delta$ nplr	6.51**	0.22	15.56***		20.10***

\*\*\* = significant at 1%, \*\* = significant at 5%, \* = significant at 10%. Empirical results are derived using Stata 13.  
 Source: Lee and Rosenkranz (2017).

**Figure 8.13: Orthogonalized Impulse Response Functions—Baseline Specification**



CI = confidence interval, GDP = gross domestic product, IRF = impulse response functions, NPLs = nonperforming loans. Responses are denoted in percentage points.  
 Note: 95% CI are generated by Monte Carlo draws with 5000 repetitions. Empirical results are derived using Stata 13.  
 Source: Lee and Rosenkranz (2017).

**Figure 8.14: Orthogonalized Impulse Response Functions—Specification 2**

CI = confidence interval, GDP = gross domestic product, IRF = impulse response functions, NPLs = nonperforming loans. Responses are denoted in percentage points.

Note: 95% CI are generated by Monte Carlo draws with 5000 repetitions. Empirical results are derived using Stata 13.

Source: Lee and Rosenkranz (2017).

point decline in the loan growth rate, and about 0.21 percentage point rise in unemployment after 1 year.<sup>57</sup>

### The macrofinancial impact of NPLs may spill over to other economies, transmitted through various channels.

In an increasingly integrated global financial system, financial shocks can be transmitted across borders with greater speed and frequency. The cross-border transmission of the impact of NPLs operates through various channels: (i) cross-border bank lending, (ii) changes in investor confidence, (iii) changes in bank asset (or liability) value due to financial market fluctuations, and (iv) a trade channel where lower growth in high NPL economies translates into lower import demand (Martin 2017, IMF 2015).

<sup>57</sup> Over 3 years, a one percentage point shock to the in NPL ratio leads to a cumulative effect of about 0.1 percentage point contraction in the GDP growth rate, about 1.5 percentage point decline in loans growth, and about 0.1 percentage point pickup in unemployment after a year.

Recent experience in Europe demonstrates the negative impact of a large overhang of distressed assets weighing on domestic bank balance sheets is not confined to high-NPL economies, but can extend to the region as a whole.

The euro area's recent experience with distressed assets shows the systemic implications of NPLs and illustrates how NPL problems can spread across financially integrated markets. Largely as a legacy of the European sovereign debt crisis, the buildup and slow resolution of NPLs was exacerbated by (i) demand- and supply-side impediments,<sup>58</sup> (ii) structural and regulatory

<sup>58</sup> These include, respectively, information asymmetry, inefficient and uncertain debt enforcement frameworks, licensing requirements, and restrictions on transferability of loans on the demand-side; and an unwillingness to realize losses, first-mover disadvantage, and the high cost of debt recovery not recognized in NPL book values on the supply side (Fell, Grodzicki, Martin, and O'Brien 2016; Martin 2017).

impediments (such as a lack of transnational supervisory structures in fiscal monitoring, bank supervision and resolution), and (iii) less-developed distressed asset markets in Europe compared with the US (to effectively and preemptively address the problem), among others. As the euro area experience shows, the negative impact of a high stock of distressed assets weighing on bank balance sheets is not confined to high-NPL economies, but can extend to the region as whole (see Martin 2017; Buckley, Avgouleas, and Arner 2017).

Through the various channels mentioned, increasing NPL levels could (i) negatively impact the flow of cross-border lending, (ii) damage market sentiment of the region as a whole, (iii) have negative wealth effects, and (iv) lead to a deterioration in affected countries' macroeconomic conditions, lowering import demand for others' exports (Martin 2017). The systemic implication of NPLs is a potential cause for concern.<sup>59</sup> One recent example in response includes policy discussions on a European blueprint for national asset management companies (AMCs).<sup>60</sup> In Asia—with ADB's support—the International Public Asset Management Company Forum (IPAF)<sup>61</sup> was established in 2013. IPAF members share knowledge and experience on how to best deal with distressed assets from both national and regional perspectives—with an emphasis on facilitating NPL markets as part of Asia's broader financial safety nets.

Broadly, the cross-border and systemic implication of NPLs underscores the need for policy makers to swiftly and effectively manage and respond to a buildup of distressed assets. The national and regional mechanisms underlying distressed asset resolution—in particular NPLs—are important for safeguarding financial stability. While it is critical to establish and strengthen national resolution mechanisms, regional cooperation can help advance more effective strategies for identifying and implementing national NPL resolution mechanisms and developing distressed asset markets.

## Conclusions and Policy Considerations

**Twenty years after the AFC, Asia stands strong—with more flexible exchange rates, healthier external and fiscal positions, stronger regulations, deeper capital markets, and better regional financial cooperation mechanisms.**

However, despite these visible improvements, the region was severely (if briefly) affected by the GFC 10 years later. This highlights the need for the region to identify and address the gaps between existing policies stemming from lessons learned from the AFC and emerging challenges since the AFC.

This thematic chapter has sought to identify and analyze both existing and newly emerging challenges that pose potential risks to financial stability in developing Asia, and to discuss lessons drawn from past crises. These lessons are distilled and briefly summarized below, complemented by possible policy considerations.

**Past financial crises highlighted financial sector weaknesses and served as the impetus for crisis-affected economies to undertake needed reforms.**

The AFC showed how a financial crisis can undercut economic development and how currency and maturity mismatches can lead to the buildup of troubled assets and disrupt financial systems. In response to the crisis, badly affected economies such as Indonesia, the Philippines, the Republic of Korea, and Thailand, undertook a wide array of reforms (Table 8.6). These included: (i) strengthening financial supervision and macroprudential regulations to address NPLs and restore banking sector confidence, (ii) adopting measures to stem short-term capital outflows and raising interest rates to reduce investor flight, (iii) establishing more flexible exchange rate regimes, and (iv) instituting a broader set of reforms to restructure the banking sector and develop and deepen capital markets.

<sup>59</sup> See presentation of Martin on 30 May 2017, <http://k-learn.adb.org/system/files/materials/2017/05/201705-resolution-nonperforming-loans.pdf>

<sup>60</sup> See the 3 February 2017 speech by ECB Vice President Vitor Constâncio, <https://www.ecb.europa.eu/press/key/date/2017/html/sp170203.en.html>. See also ESRB (2017) and Fell, Grodzicki, Martin and O'Brien (2017).

<sup>61</sup> See IPAF website: <https://ipaf.adb.org/>

**Table 8.6 Selected National and Regional Policy Responses to the Asian Financial Crisis and the Global Financial Crisis**

	Causes	Policy Responses	
		National	Regional
Asian Financial Crisis	<ul style="list-style-type: none"> <li>• <b>Trigger event:</b> currency devaluation in Thailand</li> <li>• <b>Causes:</b> nature of foreign borrowing (currency and maturity mismatches), structural financial sector weaknesses, de-facto dollar pegs, region-wide loss of confidence that triggered capital flow reversals, the collapse of asset prices, putting bank and corporate balance sheets in disrepair.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Monetary policy:</b> Intervention in the foreign exchange market to defend currency and avoid sharp loss of confidence (INO, KOR, MAL, PHI); transition to more flexible exchange rate regimes; open market sales of Central Banks to sterilize capital inflows (KOR, MAL, THA) (2005–2008); raising of reserve requirements (INO [2004], KOR [2000, 2006])</li> <li>• <b>Capital controls</b> to stem short-term capital flows (MAL [1998]), reserve requirements on foreign exchange transactions (THA [2006]), liberalization of resident outflows to counteract large capital inflows (KOR, MAL, PHI, THA, VIE) (2005–2007)</li> <li>• <b>Prudential policies:</b> caps on LTV ratio (HKG [2000–2001], KOR [2002–2006], PHI [2002], PRC [2004–2006], SIN [2005], THA [2003]); caps on DTI (HKG [2000], KOR [2005–2006], PRC [2004]); housing-related countercyclical capital requirements (IND [2004], KOR [2002], MAL [2005]); loan-loss provisioning (IND [2005–2006], KOR [2002], PHI [2000–2001]); consumer loan measures (THA [2004–2005]); limits to forward foreign currency contracts offered to nonresidents (INO [2001]); limits on net open currency position (KOR [2006]); limits to short-term borrowing by banks (INO [2005])</li> <li>• <b>Other policy measures:</b> strengthening financial supervision and resolution mechanisms: measures/mechanisms to resolve nonperforming loans (via AMCs) (INO, KOR, MAL, PRC, THA); capital account liberalization (KOR)—lifting regulations on capital inflows (1998–1999), developing local foreign exchange market (2002), relaxing controls on overseas investments (2005, 2006)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>ASEAN+3 Economic Review and Policy Dialogue (ERPDP)</b> established in 2000 to support joint regional economic surveillance through peer review and policy dialogue.</li> <li>• Regional mechanism for liquidity support and crisis management (<b>ASEAN+3 Chiang Mai Initiative 2000</b>)</li> <li>• Local currency bond market development (<b>ASEAN+3 Asian Bond Markets Initiative [2002]</b>)</li> </ul>
			<p style="text-align: center;"><b>Global</b></p> <ul style="list-style-type: none"> <li>• International regulatory response: <b>Financial Stability Forum, Group of Twenty (G-20) FMM, Basel II</b></li> </ul>
Global Financial Crisis	<ul style="list-style-type: none"> <li>• <b>Trigger event:</b> default of US subprime mortgages</li> <li>• <b>Causes:</b> Excessive borrowing and lending, poorly functioning credit markets, misaligned incentives, disconnect between regulatory structures and the financial system, international transmission of systemic risks</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Monetary policy:</b> Foreign exchange market intervention to soften currency volatility (INO, KOR, MAL, PHI) (2008); increasing reserve requirements (INO, PHI, TAP, THA)</li> <li>• <b>Capital flow management measures and capital controls:</b> limits on net open positions of banks (INO, THA); minimum holding periods for foreign ownership of government bonds (INO [2010]); liberalization of resident outflows to counteract large capital inflows (KOR, MAL, PHI, THA, VIE)</li> <li>• <b>Macroprudential policies:</b> caps on LTV ratio (HKG [2009–2013], IND [2010, 2013], INO [2012–2013], KOR [2008–2012], MAL [2011], PRC [2007–2011], SIN [2010–2013], TAP [2010], THA [2009]); caps on DTI (HKG [2010–2013], KOR [2007–2012], SIN [2013], TAP [2010, 2014]); special stamp duty on properties sold (HKG [2010], SIN [2010]); restrictions on foreign exchange derivatives (KOR [2010]); withholding tax on foreign investor’s interest income from bond investment (KOR [2011]); levy on noncore foreign currency liabilities to reduce capital flow volatility (KOR [2011]); housing-related countercyclical capital requirements (HKG [2013], IND [2010], MAL [2011], THA [2010–2012]); loan-loss provisioning (IND [2008–2010], PRC [2010]); consumer loan measures (INO [2012], SIN [2013], THA [2007]); countercyclical capital requirements (IND [2008], MAL [2011], PRC [2010]); minimum holding periods (INO [2010])</li> </ul>	<p style="text-align: center;"><b>Regional</b></p> <ul style="list-style-type: none"> <li>• Regional mechanism for liquidity support and macroeconomic and financial surveillance (<b>Chiang Mai Initiative Multilateralisation [CMIM] [2010], ASEAN+3 Macroeconomic Research Office [2011]</b>)</li> </ul>
			<p style="text-align: center;"><b>Global</b></p> <ul style="list-style-type: none"> <li>• International regulatory response: <b>Financial Stability Board (FSB), G-20 and FSB post-crisis regulatory reforms, Basel III;</b> Introduction of resolution standards or structural and resolution legislation by G-20 and FSB</li> </ul>

AMCs = asset management companies; DTI = debt to income; HKG = Hong Kong, China; IND = India; INO = Indonesia; KOR = Republic of Korea; LTV = loan to value; MAL = Malaysia; PHI = Philippines; PRC = People’s Republic of China; SIN = Singapore; TAP = Taipei, China; THA = Thailand; VIE = Viet Nam.

Sources: ADB compilation based on Akinci and Olmstead-Rumsey (2015); Arner (2011); Buckley, Avgouleas, and Arner (2017); Lee, Asuncion, and Kim (2015); Lee, Gaspar, and Villaruel (2017); Lee (2016); and Villafuerte (2017).

### The region's crisis experiences underscored the need for regional cooperation in risk identification, mitigation, and response.

Asian policy makers should remain vigilant and work collectively to enhance financial resilience and safeguard financial stability. The three financial disruptions led to tightened supervisory structures and augmented regulatory standards—such as higher levels of capital and liquidity reserves. Other financial reforms included an overhaul of banking governance and better risk management measures.

Regional responses to the AFC consisted of both bilateral and multilateral assistance to crisis-affected economies and the furthering of regional cooperation initiatives. Immediately following the crisis, leaders from ASEAN+3 held regional dialogues on the measures required to bolster stability of the region's financial systems. Several major regional initiatives were established to strengthen regional financial safety nets, enhance financial resilience, and develop capital markets in the region—including the ASEAN+3 Economic Review and Policy Dialogue, the ASEAN+3 CMI and its later Multilateralisation (CMIM), its associated ASEAN+3 Macroeconomic Research Office (AMRO), and the ASEAN+3 Asian Bond Markets Initiative (ABMI) (see Figure 8.15 for a chronological overview of Asia's financial integration initiatives).

### While crisis responses noticeably improved macroeconomic and financial management in the region, emerging Asia continues to face significant long-term challenges that could undermine regional financial stability.

The analyses in the preceding sections provided an overview for various pockets of financial fragility facing the region. Against the backdrop of increasing financial interconnectedness and procyclicality of financial cycles, recent trends of: (i) rising private sector debt and deteriorating asset quality, (ii) continued heavy reliance on foreign currency (particularly US dollar-) denominated debt, and (iii) limited domestic capital market-based financial solutions are among those vulnerabilities that could potentially destabilize Asia's financial systems and hinder long-term economic development.

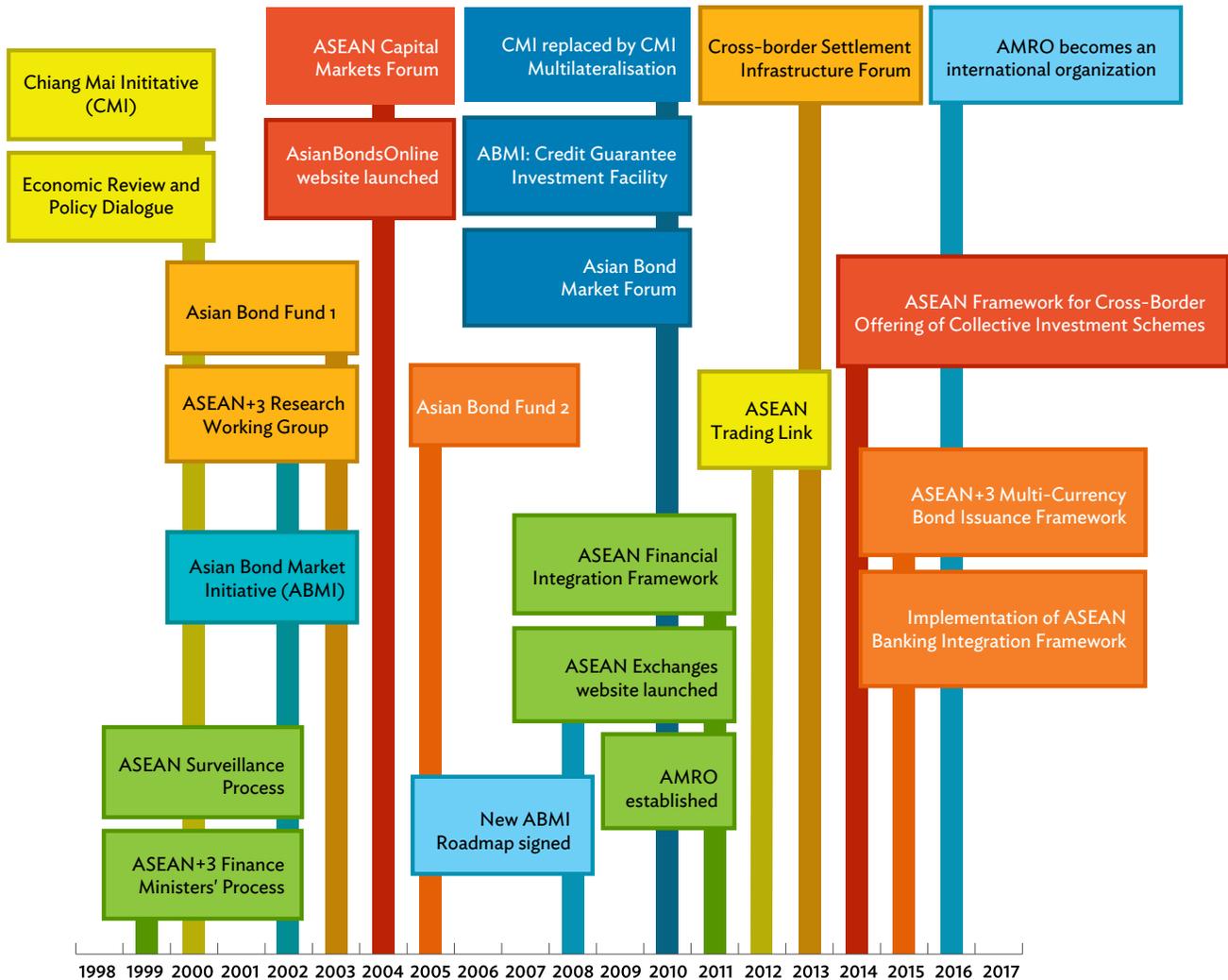
The empirical exercises conducted underscore the challenges to Asia's financial stability. There are several important findings: (i) over the past 20 years, Asian financial markets have grown more interconnected both

within the region and across the globe; (ii) growing financial interconnectedness can increase vulnerabilities to external shocks, financial contagion, or liquidity risks stemming from cross-border bank lending; (iii) continued high reliance on US dollar-denominated funding has significant implications for the transmission of global financial conditions to domestic financial and macroeconomic conditions; and (iv) a sustained increase in NPLs can lead to a reduction in credit supply and slowdown in overall economic activity.

Lessons drawn from the crises and the results of empirical analyses highlight the importance of enhancing financial market resilience to safeguard Asia's financial stability. This can only work through the interplay between adequate national policies/frameworks and efforts to continue and facilitate regional cooperation. In an increasingly interconnected global financial network, financial resilience cannot be achieved in isolation; it requires cross-border cooperation.

### Maintaining sound macroeconomic fundamentals is a strong prerequisite for financial stability and resilience.

Sound macroeconomic conditions—healthy external and fiscal positions, exchange rate flexibility, a well-regulated and strong financial system, and adequate foreign exchange reserves—are central to financial resilience and economic growth. These also serve as a buffer against future crises and help soften the impact of external shocks. Targeted microprudential and macroprudential policies to curb financial excess are also needed to maintain financial stability and fiscal sustainability. Given the rapidly globalizing financial landscape, important considerations for prudential supervision include: (i) strengthening bank capacity to manage foreign currency liquidity risk—for example, through monitoring and implementing a foreign currency liquidity coverage ratio; (ii) consolidating supervision; (iii) ensuring adequate communication between central banks and other financial supervisors; and (iv) regulating SIFIs.

**Figure 8.15: Asia's Financial Integration Initiatives—Chronology**

AMRO = ASEAN+3 Macroeconomic Research Office, ASEAN = Association of Southeast Asian Nations.  
Source: Park et al. (2017)

### Asian policy makers need to further strengthen their national regulatory and supervisory frameworks, along with their institutional capacities.

Regulatory policy gaps and weaknesses in financial markets and systems leave room for excessive leverage and risk-taking—often through off-balance sheet activities—leading to the buildup of systemic risk. Thus, strengthening and broadening the scope of regulation and oversight is essential. While the AFC triggered the emergence of micro-prudential regulation—ensuring the safety and soundness of each significant financial institution in the system—the GFC highlighted the importance of a comprehensive macroprudential policy framework. The GFC exposed the possible

buildup of systemic risk stemming from SIFIs in tightly interconnected financial systems.

### A key crisis lesson is the urgent need to strengthen macroprudential regulation and supervision in the region.

Authorities should consider establishing and implementing an effective macroprudential policy framework to address two dimensions of system-wide risks: (i) a buildup of a systemic risk over time (the “time dimension”) and (ii) a spillover and contagion of risk across different financial sectors and systems (the “cross-sectional dimension”). Macroprudential policies can be useful in dampening the procyclicality of the financial system. Countercyclical provisions, capital and

liquidity buffers, and balance sheet instruments such as leverage ratios, limits on debt-to-income and loan-to-value ratios are good examples.

Past crises have furthermore underscored the need for a foreign currency funding condition to macroprudential policies. As the AFC demonstrated, currency mismatches are a major source of risk. Given Asia's heavy reliance on US dollar-denominated debt, the region could augment existing macroprudential policy tools with, for example, a foreign currency liquidity coverage ratio. This policy tool could help the banking sector strengthen resilience against external shocks, especially during times of financial distress.

### **More developed and regionally integrated banking sectors and financial markets can improve the efficiency of resource allocation to the real economy.**

Asia's funding limitations—due to insufficient capital market-based financing solutions and reliance on US dollar funding—suggests that its vast amounts of regional savings could be better channeled into more productive investments. For example, there is about \$4.4 trillion invested in Asia's pension funds, \$5.1 trillion with insurers, and several large social security and public pension reserve funds. Yet, potential investors must often restrain investments due to concerns over political risk, weak regulatory systems, the legal environment, governance standards, and undeveloped capital markets. More developed and regionally integrated banking and financial markets can improve the efficiency of resource allocation to the real economy.

While local currency bonds outstanding in ASEAN+3 increased threefold—from \$6.6 trillion in 2002 to \$19.8 trillion by the end of 2016—challenges remain. To meet the region's financing needs, local currency bond markets must improve market efficiency, broaden their investor base, deepen secondary markets, and integrate more regionally. Developing local currency bond markets will also help diversify funding sources, reduce concentrated funding risks, and provide long-term finance opportunities for investors—vital for financing long-term infrastructure projects. Regional efforts like the ABMI continue to help promote the development of regional capital markets, which can help avoid maturity and currency mismatches.

### **Strengthening policy dialogue and cooperation both globally and regionally is essential for enhancing Asia's financial resilience.**

Asia's financial markets are increasingly open, interconnected, and vulnerable to external shocks. Approaching the challenges from a regional perspective helps build financial resilience. For example, a regional cooperation mechanism on macroprudential policy frameworks could be valuable for safeguarding financial stability in the region. Existing high-level policy forums—such as ASEAN, ASEAN+3, or the Asia-Pacific Economic Cooperation forums—are useful venues for regional dialogue. Strengthening the CMIM and its AMRO surveillance unit should also be considered to help monitor potential liquidity risks and slow the spread of shocks across the region's economies.

Several options can be considered to strengthen the CMIM and AMRO to bolster financial safety nets: (i) the CMIM's operability needs to be enhanced and clearly communicated to members; (ii) current callable capital can be complemented by paid-in capital to improve market sentiment over members' CMIM commitments; (iii) paid-in capital could be further leveraged by issuing bonds, thereby increasing CMIM capacity and enabling it to respond to financial crises affecting the region's larger economies; (iv) increased capacity could also offer scope for widening the CMIM's mandate—in particular, CMIM resources could be utilized to recapitalize systemically important banks in the region; and (v) strengthening AMRO's role as regional macroeconomic surveillance unit and enhancing CMIM efficacy by increasing the IMF de-linked portion can be considered.

### **Regional cooperation to develop effective resolution mechanisms for distressed assets of cross-border financial institutions is an important part of broader financial safety net arrangements.**

With greater financial integration, banks increasingly operate internationally. Growing regional banking activities and institutions—possibly of systemic importance—underpin the need to discuss regional regulatory cooperation, including resolution mechanisms for interconnected regional banks—such as Qualified Asian Banks. In this highly interconnected environment, the failure of a single regional bank could have a

considerable negative impact on economies in emerging Asia. Measures that identify and effectively deal with vulnerabilities in SIFIs would thus be key to reducing systemic risk and their associated moral hazards. Regional cooperation to develop effective resolution mechanisms for distressed assets of cross-border financial institutions can also complement national efforts to address NPLs efficiently and sustainably. In addition, developing both distressed asset markets and market infrastructure nationally can deepen financial markets and enhance market resilience, thereby contributing to strengthening multilayered financial safety nets.

**Supervisory colleges for regionally active foreign banks can be an effective regional cooperation tool to strengthen cross-border supervision in Asia.**

As highlighted above, the systemic importance of foreign banks in Asia is growing. Stable funding through foreign bank credit supply channels to a host economy remains a key issue for financial stability. Supervisory colleges for regionally active foreign banks can be an effective regional cooperation tool to strengthen cross-border supervision in Asia. They can enhance understanding and oversight of the sources and transmission channels of systemic risks and shocks.

**Continued improvement of Asia's financial market infrastructure by establishing cross-border collateral arrangements could strengthen the region's multilayer financial safety nets and bolster financial market development.**

Appropriate risk mitigation measures and multilayer regional financial safety nets are needed to adequately respond to heightened cross-border banking activity. In particular, cross-border collateral arrangements are needed to supply regional banks with liquidity from their home central banks by pledging assets held by branches in another economy. These measures have been discussed by the Cross-Border Settlement Infrastructure Forum under ASEAN+3. Proposals have been raised concerning the establishment of linkages among central securities depositories (CSD) and central banks (CSD-

RTGS<sup>62</sup> Linkages) in the region. CSD-RTGS Linkages are expected to support the routinization of cross-border collateral arrangements and the efficient use of the region's high-quality government bonds as collateral. This will help reduce local currency liquidity risks among cross-border banks in the region and develop local currency bond markets, thereby promoting the region's financial development and resilience (see Box 4.1, page 47).

## Background Papers

- R.P. Buckley, E. Avgouleas, and D.W. Arner. 2017. Twenty Years of International Financial Crises: What Have We Learned and What Still Needs to Be Done? Background paper for Asian Economic Integration Report 2017 Theme Chapter on "The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?" Manuscript.
- S. Claessens. 2017. Financial Cycles and Crises in Asia. Background paper for Asian Economic Integration Report 2017 Theme Chapter on "The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?" Manuscript.
- M. Dungey, B. Chowdhury, M. Kangogo, M.A. Sayeed, and V. Volkov. 2017a. The Changing Network of Financial Market Linkages: The Asian Experience. Background paper for Asian Economic Integration Report 2017 Theme Chapter on "The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?" Manuscript.
- J. Lee and P. Rosenkranz. 2017. Nonperforming Loans in Asia: Determinants and Macro Financial Linkages. Background paper for Asian Economic Integration Report 2017 Theme Chapter on "The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?" Manuscript.
- C.Y. Park and K. Shin. 2017. A Contagion through Exposure to Foreign Banks during the Global Financial Crisis. *ADB Economics Working Paper*. No. 516. Manila: Asian Development Bank.

<sup>62</sup> A "CSD-RTGS Linkage" connects national CSDs and real time gross settlement (RTGS) systems operated by central banks.

J. Villafuerte. 2017. Managing Capital Flows to Emerging Asia. Background paper for Asian Economic Integration Report 2017 Theme Chapter on “The Era of Financial Interconnectedness: How Can Asia Strengthen Financial Resilience?” Manuscript.

## References

M.R.M. Abrigo and I. Love. 2015. Estimation of Panel Vector Autoregression in Stata: A Package of Programs. <http://paneldataconference2015.ceu.hu/Program/MichaelAbrigo.pdf>

ADB. 2014. *Asian Economic Integration Monitor April 2014*. Manila.

———. Climate Change Resilience in Asia’s Cities (infographic). <https://www.adb.org/news/infographics/climate-change-resilience-asias-cities>

O. Akinci and J. Olmstead-Rumsey. 2015. How Effective are Macroprudential Policies? An Empirical Investigation. *International Finance Discussion Papers*. No. 1136. Washington, DC: Board of Governors of the Federal Reserve System.

N. Ananchotikul, S. Piao, and E. Zoli. 2015. Drivers of Financial Integration—Implications for Asia. *IMF Working Papers*. No. 15/160. Washington, DC: International Monetary Fund.

T. Anderson and C. Hsiao. 1982. Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics*. 18 (1). pp. 47–82.

D.W.K. Andrews and B. Lu. 2001. Consistent Model and Moment Selection Procedures for GMM Estimation with Application to Dynamic Panel Data Models. *Journal of Econometrics*. 101 (1). pp. 123–164.

D.W. Arner. 2009. The Global Credit Crisis of 2008: Causes, Consequences, and Implications for International Finance. *The International Lawyer*. 43 (91). pp. 91–136.

———. 2011. Adaptation and Resilience in Global Financial Regulation. *North Carolina Law Review*. 109 (89). pp. 1579–1627.

D.W. Arner, E. Avgouleas, and E.C. Gibson. 2017. Overstating Moral Hazard: Lessons from Two Decades of Financial Crises. *University of Hong Kong Faculty of Law Research Paper*. No. 2017/003. Hong Kong, China: University of Hong Kong.

S. Arslanalp, W. Liao, S. Piao, and D. Seneviratne. 2016. [People’s Republic of] China’s Growing Influence on Asian Financial Markets. *IMF Working Paper*. No. 15/173. Washington, DC: International Monetary Fund.

E. Avgouleas. 2012. *Governance of Global Financial Markets: The Law, the Economics, the Politics*. UK: Cambridge University Press.

Bank for International Settlements. 2016. *BIS Statistical Bulletin*. Basel.

K. Beaton, A. Myrvoda, S. Thompson. 2016. Nonperforming Loans in the ECCU: Determinants and Macroeconomic Impact. *IMF Working Paper*. No. 15/229. Washington, DC: International Monetary Fund.

R. Beck, P. Jakubik, and A. PiloIU. 2013. Nonperforming Loans: What Matters in Addition to the Economic Cycle? *European Central Bank Working Paper*. No. 1515. Frankfurt: European Central Bank.

S. Bhattarai, A. Chatterjee, and W.Y. Park. 2015. Effects of US Quantitative Easing on Emerging Market Economies. *Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute Working Paper*. No. 255. Dallas: Federal Reserve Bank of Dallas.

M. Billio, M. Getmansky, A.W. Lo, and L. Pelizzon. 2012. Econometric Measures of Connectedness and Systemic Risk in the Finance and Insurance Sectors. *Journal of Financial Economics*. 104 (3). pp. 535–559.

O. Blanchard, R. Rajan, K. Rogoff, and L. H. Summers, eds. 2016. *Progress and Confusion: The State of Macroeconomic Policy*. Cambridge, MA: MIT Press.

C. Borio and P. Lowe. 2002. Assessing the Risk of Banking Crises. *BIS Quarterly Review*. December. pp. 43–54. Basel.

E. Cerutti, S. Claessens, and D. Puy. 2015. Push Factors and Capital Flows to Emerging Markets: Why Knowing Your Lender Matters More Than Fundamentals. *IMF Working Paper*. No. 15/127. Washington, DC: International Monetary Fund.

R. Chang and A. Velasco. 2001. A Model of Financial Crises in Emerging Markets. *The Quarterly Journal of Economics*. 116 (2). pp. 489–517.

- Q. Chen, A. Filardo, D. He and F. Zhu. 2011. International Spillovers of Central Bank Balance Sheet Policies. Contributed paper for the Joint Bank of Thailand and the Bank for International Settlements Conference on “Central bank balance sheets in Asia and the Pacific: the policy challenges ahead”. Chiang Mai. 12-13 December.
- M. Čihák, S. Muñoz, and R. Scuzzarella. 2011. The Bright and the Dark Side of Cross-Border Banking Linkages. *IMF Working Paper*. No. 11/186. Washington, DC: International Monetary Fund.
- S. Claessens, M.A. Kose, and M. Terrones. 2011. How Do Business and Financial Cycles Interact? *Journal of International Economics*. 87 (1). pp.178–90.
- J.C. Cuaresma and T. Slacik. 2007. On the Determinants of Currency Crises: The Role of Model Uncertainty. *Working Papers in Economics and Statistics*. No. 2008-03. Innsbruck: University of Innsbruck.
- R.D. De Bock and A. Demyanets. 2012. Bank Asset Quality in Emerging Markets: Determinants and Spillovers. *IMF Working Paper*. No. 12/71. Washington, DC: International Monetary Fund.
- P. De Grauwe. 2011. The Governance of a Fragile Eurozone. *CEPS Working Document*. No. 346. Brussels: Centre for European Policy Studies.
- D.W. Diamond and P.H. Dybvig. 1983. Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*. 91 (3). pp. 401-419.
- F.X. Diebold and K. Yilmaz. 2009. Measuring Financial Asset Return and Volatility Spillovers, with Application to Global Equity Markets. *The Economic Journal*. 119 (534). pp. 158-171.
- . 2014. On the Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms. *Journal of Econometrics*. 182 (1). pp. 119-134.
- M.H. Dungey, R. Fry, and V.L. Martin. 2006. Correlation Contagion, and Asian evidence. *Asian Economic Papers*. 5 (2). pp. 32-72.
- M.H. Dungey, G. Milunovich, S. Thorp, and M. Yang. 2015. Endogenous Crisis Dating and Contagion Using Smooth Transition Structural GARCH. *Journal of Banking and Finance*. 58. pp. 71-79.
- M.H. Dungey, D.J. Harvey, and V. Volkov. 2017b. The Changing International Network of Sovereign Debt and Financial Institutions. *Discussion Paper Series*. No. 2017-04. Hobart, TAS: University of Tasmania.
- B. Eichengreen and P. Gupta. 2015. Tapering Talk: The Impact of Expectations of Reduced Federal Reserve Security Purchases on Emerging Markets. *Emerging Markets Review*. 25 (C). pp. 1-15.
- R. Espinoza and A. Prasad. 2010. Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects. *IMF Working Paper*. No. 10/224. Washington, DC: International Monetary Fund.
- G.B. Estrada, M. Noland, D. Park, and A. Ramayandi. 2015. Financing Asia's Growth. *ADB Economics Working Paper*. No. 438. Manila: Asian Development Bank.
- European Systemic Risk Board. 2017. Resolving Nonperforming Loans in Europe. *ESRB Reports*. No. 2017. Frankfurt: European Systemic Risk Board.
- J. Fell, M. Grodzicki, R. Martin, E. O'Brien. 2016. Addressing Market Failures in the Resolution of Nonperforming Loans in the euro area. *Financial Stability Review November 2016*. Frankfurt: European Central Bank.
- J. Fell, M. Grodzicki, R. Martin, and E. O'Brien. 2017. A Role for Systemic Asset Management Companies in Solving Europe's Nonperforming Loan Problems. *European Economy: Banks, Regulation, and the Real Sector*. pp. 71-85.
- Financial Stability Board. 2015. *Global Shadow Banking Monitoring Report 2015*. Basel.
- Financial Stability Board. 2017. *Global Shadow Banking Monitoring Report 2016*. Basel.
- J. M. Fleming. 1962. Domestic Financial Policies under Fixed and under Floating Exchange Rates. *IMF Staff Papers*. 9 (3). pp. 369-380.
- Financial Times*. 2017. New Delhi Under Pressure for Bolder Action on Bad Loan Malaise. 15 May.
- R.P. Flood and P.M. Garber. 1984. Collapsing Exchange-rate Regimes: Some Linear Examples. *Journal of International Economics*. 17 (1-2). pp. 1-13.
- A.R. Ghosh, M.S. Qureshi, N. Sugawara. 2014. Regulating Capital Flows at Both Ends: Does It Work? *IMF Working Paper*. No. 14/188. Washington, DC: International Monetary Fund.

- M. Goswami and S. Sharma. 2011. The Development of Local Debt Markets in Asia. *IMF Working Paper*. No. 11/132. Washington, DC: International Monetary Fund.
- J.H. Hahm, H.S. Shin, and K. Shin. 2013. Noncore Bank Liabilities and Financial Vulnerability. *Journal of Money, Credit, and Banking*. 45 (1). pp. 3–36.
- B. Hoffmann, I. Shim, and H.S. Shin. 2017. Sovereign Yields and the Risk-taking Channel of Currency Appreciation. *BIS Working Papers*. No. 538. Basel: Bank for International Settlements.
- International Monetary Fund. 2015. *Regional Economic Outlook: Asia and the Pacific – Stabilizing and Outperforming Other Regions*. Washington, DC.
- G.L. Kaminsky and C.M. Reinhart. 1999. The Twin Crises: The Causes of Banking and Balance-of-Payments Problems. *American Economic Review*. 89 (3). pp. 473–500.
- J.I. Kim. 2014. The International Transmission of Monetary Policy: [Republic of] Korea’s Experience. Contributed paper for the Bank for International Settlements Meeting of Senior Officials from Central Banks on the Transmission of Unconventional Monetary Policy to the Emerging Markets. Basel. 6–7 March.
- N. Klein. 2013. Nonperforming Loans in CESEE: Determinants and Impact on Macroeconomic Performance. *IMF Working Paper*. No. 13/72. Washington, DC: International Monetary Fund.
- P. Krugman. 1979. A Model of Balance-of-Payments Crises. *Journal of Money, Credit and Banking*. 11(3). pp. 311–325.
- . 1999. Balance Sheets, the Transfer Problem, and Financial Crises. *International Tax and Public Finance*. 6 (4). pp. 459–472.
- M. Lee, R.C. Asuncion, J. Kim. 2015. Effectiveness of Macroprudential Policies in Developing Asia: An Empirical Analysis. *ADB Economics Working Paper*. No. 439. Manila: Asian Development Bank.
- J.J. Lim, S. Mohapatra, and M. Stocker. 2014. Tinker, Taper, QE, Bye? The Effect of Quantitative Easing on Financial Flows to Developing Countries. *Policy Research Working Paper*. No. 6820. Washington, DC: World Bank.
- V. Makri, A. Tsagkanos, and A. Bellas. 2014. Determinants of Nonperforming Loans: The Case of Eurozone. *Panoeconomicus*. 2. pp. 193–206.
- R. Martin. 2017. The Resolution of Nonperforming Loans. Presentation at the International Public Asset Management Company Forum Research Dissemination Workshop. Manila. 30 May.
- A. Mian, A. Sufi, E. Verner. 2017. Household Debt and Business Cycles Worldwide. *The Quarterly Journal of Economics*. 132 (4). pp. 1755–1817.
- S. Morris and H.S. Shin. 1998. Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks. *American Economic Review*. 88 (3). pp. 587–597.
- R.A. Mundell. 1963. Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science*. 29 (4). pp. 475–485.
- M. Nkusu. 2011. Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies. *IMF Working Paper*. No. 11/161. Washington, DC: International Monetary Fund.
- M. Obstfeld. 1994. The Logic of Currency Crises. *NBER Working Paper*. No. 4640. Cambridge, MA: National Bureau of Economic Research.
- . 1996. Models of Currency Crises with Self-Fulfilling Features. *European Economic Review*. 40. pp.1037–1047.
- C.Y. Park. 2017. Decoupling Asia Revisited. *ADB Economics Working Paper*. No. 506. Manila: Asian Development Bank.
- C.Y. Park, J. Lee, J. Villafuerte, and P. Rosenkranz. 2017. 20 Years after the Asian Financial Crisis: Lessons Learned and Future Challenges. *ADB Briefs*. No. 85. Manila: Asian Development Bank.
- D. Park, A. Ramayandi, and K. Shin. 2016. Capital Flows During Quantitative Easing and Aftermath: Experiences of Asian Countries. *Emerging Markets Finance and Trade*. 52 (4). pp. 886–903.
- M. Pesaran and C. Yang. 2016. Econometric Analysis of Production Networks with Dominant Units. *CESifo Working Paper*. No. 6141. Munich:CESifo Group Munich.
- J. Lee. 2016. Recent Developments in Capital Flows and Policy Challenges. Presentation at the ADB-BSP Inception Workshop. Manila. 12 April.

- C.M. Reinhart. Dates for Banking Crises, Currency Crashes, Sovereign Domestic or External Default (or Restructuring), Inflation Crises, and Stock Market Crashes (Varieties). <http://www.carmenreinhart.com/data/browse-by-topic/topics/7/> (accessed July 2016).
- C.M. Reinhart and V. R. Reinhart. 2009. Capital Flow Bonanzas: An Encompassing View of the Past and Present. *NBER Working Paper Series*. No. 14321. Cambridge, MA: National Bureau of Economic Research.
- E. Remolona and I. Shim. 2015. The Rise of Regional Banking in Asia and the Pacific. *BIS Quarterly Review*. September 2015. pp. 119-134.
- V. Constâncio. 2017. Resolving Europe's NPL Burden: Challenges and Benefits. Speech at Bruegel's event on "Tackling Europe's Nonperforming Loans Crisis: Restructuring Debt, Reviving Growth". Brussels. 3 February.
- H. Rey. 2013. Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence. In *Proceedings of the 2013 Federal Reserve Bank of Kansas City Economic Symposium at Jackson Hole*. pp. 285-333.
- P.L. Shimpalee and J.B. Breuer. 2006. Currency Crises and Institutions. *Journal of International Money and Finance*. 25 (1). pp. 125-145.
- H.S. Shin. 2009. Reflections on Northern Rock: The Bank Run that Heralded the Global Financial Crisis. *Journal of Economic Perspectives*. 23 (1). pp. 101-119.
- C. Shu, D. He, J. Dong, and H. Wang. 2016. Regional Pull vs. Global Push Factors: China and US Influence on AsiaPacific Financial Markets. *BIS Working Papers*. No. 579. Basel: Bank for International Settlements.
- K. Slowikowski. 2016. ggrepel: Repulsive Text and Label Geoms for 'ggplot2'. R package version 0.6.5. <https://CRAN.R-project.org/package=ggrepel>.
- S. Sugisaki. 1998. Economic Crises in Asia. Address at the 1998 Harvard Asia Business Conference, Harvard Business School. Cambridge, MA. 30 January.
- A. Swiston and T. Bayoumi. 2008. Spillovers across NAFTA. *IMF Working Paper*. No. 08/3. Washington, DC: International Monetary Fund.

A.M. Taylor. 2015. Credit, Financial Stability, and the Macroeconomy. *Annual Review of Economics*. 7 (1). pp. 309-339.

H. Wickham. 2009. *ggplot2: Elegant Graphics for Data Analysis*. New York: Springer-Verlag.

World Bank. 1998. *Global Development Finance 1998: Analysis and Summary Tables*. Washington, DC.

## Annex

### Annex 8.1: Chronology of Financial Crises, Theories, and Policy Advice

Financial crises can be classified into three main types. The first, sovereign debt crises, are rooted in the inability to repay sovereign (or government) debt owed to foreign creditors. Examples include the Latin American debt crisis of the early 1980s or the more recent debt crises in Europe, particularly Greece, which started toward the end of 2009, intensifying in 2010. The second, balance of payments (or currency) crises, occur due to an unsustainable balance of payments deficit with a drop in foreign exchange reserves—often followed by devaluation in a fixed exchange rate regime. Examples include India's 1991 currency crisis, Mexico's Tequila crisis in 1994, and the 1997/98 Asian financial crisis (AFC). The last type, banking crises, emerge more frequently and are due to bank runs and panics that affect banking activity. The most prominent examples include the United States savings and loan crisis in the 1980s and 1990s, the AFC and 1998 banking crisis in the Russian Federation.

Theories of currency crises fall under four generations, and highlight respectively weak macrofundamentals, self-fulfilling expectations, structural imbalances, and institutional factors. First generation models of currency crises are motivated by a series of events where fixed exchange rate regimes collapsed following speculative attacks—as occurred during the breakdown of the Bretton Wood global system in the early 1970s or the Latin American debt crisis in the 1980s. These crises were often preceded by excessive credit expansions, ongoing fiscal deficits, rising debt levels, or falling reserves as governments tried to maintain a fixed exchange rate regime. Seminal authors include Krugman

(1979) and Flood and Garber (1984), who introduced a “shadow floating exchange rate” to extend the basic model by Krugman.

Second generation models were pioneered by Obstfeld (1994, 1996) following the collapse of the European Exchange Rate Mechanism in the early 1990s. These crises followed from speculative attacks and self-fulfilling expectations in multiple equilibria—as speculators forced the government to abandon an existing fixed-exchange rate regime by attacking its foreign currency reserves—maintaining the fixed exchange rate becomes too costly. Extensions of this model were undertaken by Morris and Shin (1998) and De Grauwe (2011).

While the first and second generation currency crisis literature focused on the government alone, third generation models connect currency crises to models of banking crises and credit friction. The AFC largely motivated this generation of models, spurring extensive research on how the rapid deterioration of balance sheets from asset price fluctuations (or banking crises) can precipitate currency crises—hence “twin crises” (Kaminsky and Reinhart 1999). A clear feature of these crises is the combination of a collapse of fixed exchange rate regimes, capital flow reversals, bankruptcies of financial institutions, and credit crunches. Relevant references include Krugman (1999), who models balance sheet effects of devaluation due to a currency mismatch; and Chang and Velasco (2001), who consider

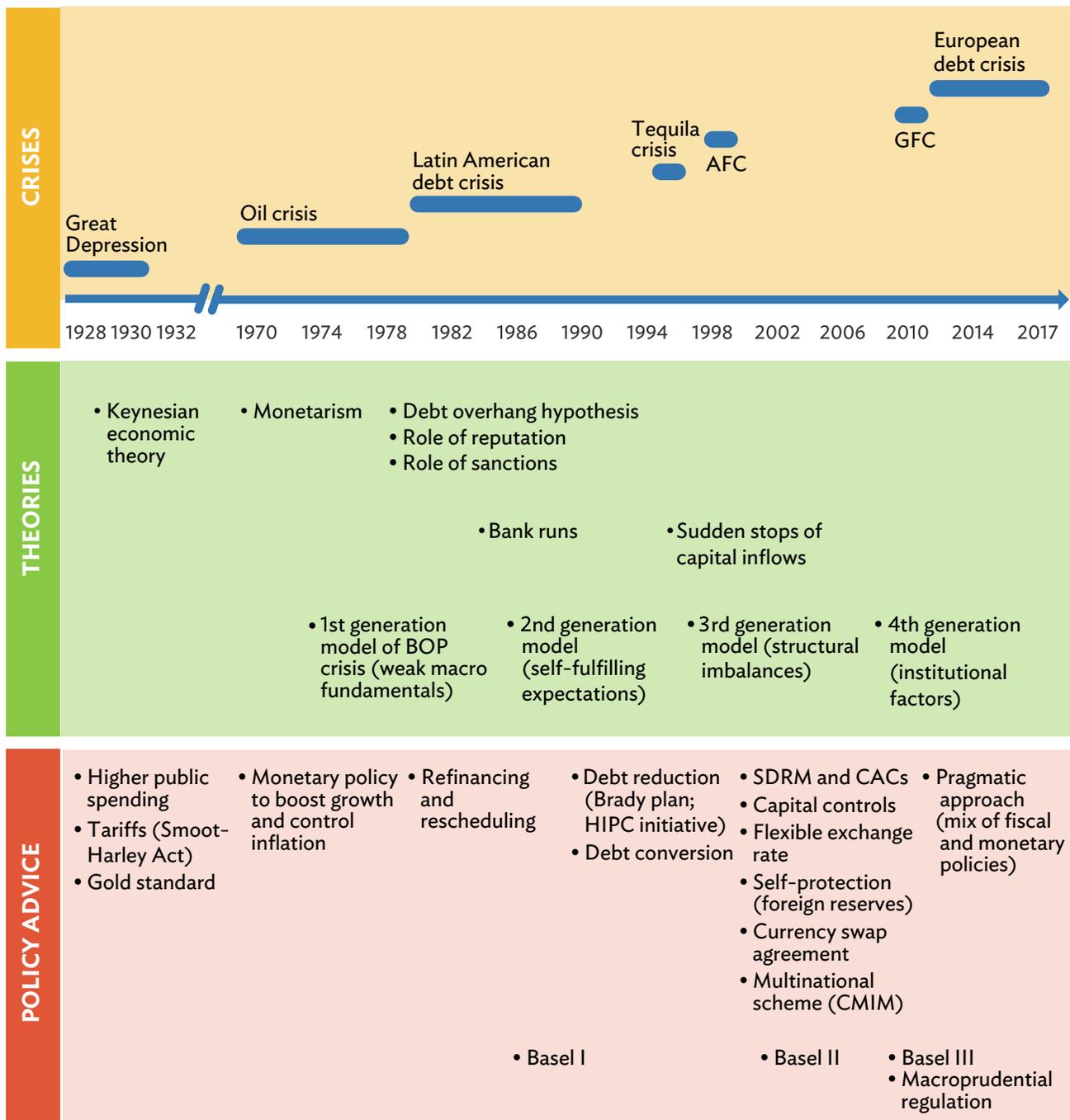
double mismatches of currency and liquidity exposures as per the Diamond and Dybvig (1983) bank run model.

In the fourth generation of models, currency crises are said to be defined by institutional factors (Cuaresma and Slacik 2007, Shimpalee and Breuer 2006). The models identify features of the institutional environment that set the stage for the buildup of macroeconomic imbalances, which subsequently give rise to crises. They also highlight the roles of rule of law and contract enforcement, protection of shareholder and creditor rights, regulatory frameworks, and the socioeconomic environment.

Policy responses are largely a function of crisis type. Measures to respond to sovereign debt crises include debt restructuring and relief initiatives involving refinancing and rescheduling, debt reduction, and debt conversion. Balance of payments or currency crisis responses include the adoption of flexible exchange rates, creation of foreign reserve buffers, and currency swap arrangements. Policy pronouncements following banking crises have included capital adequacy ratios (Basel I, 1988), prudential regulation and supervision (Basel II, 2004), and systemic risk and macroprudential policies (Basel III, 2010).

A summary of financial crises including a timeline along with the corresponding financial theories and policy advice is illustrated in Figure 8A.1.

**Figure 8A.1: Chronology of Financial Crises, Theories, and Policy Advice**



AFC = Asian financial crisis, BOP = balance of payments, CACs = collective action clauses, CMIM = Chiang Mai Initiative Multilateralisation, GFC = global financial crisis, HIPC = heavily indebted poor countries, SDRM = sovereign debt restructuring mechanism.  
 Source: Park et al. (2017)