

## 2. Navigating the Transition: Trade and Financial Spillovers from China

### Introduction and Main Findings

The Chinese economy is undergoing substantial structural change to a model driven increasingly by consumption and services (rather than public investment and exports), with growth gradually slowing to a more sustainable pace. This transition is a desirable outcome that is good for China and good for the world, benefiting global growth and reducing tail risks in the long term. In the short term, however, this shift will likely be bumpy—as exemplified by recent market turbulence—and is likely to entail substantial spillovers.

The rise of China—now the world’s second largest economy at market exchange rates—has been a key driver of global growth in recent years. During 2000–15, China accounted for nearly one-third of global growth (Figure 2.1). Over the same period, exports to China increased dramatically from 3 percent to 9 percent of world exports and from 9 percent to 22 percent of Asian exports.

Although China’s economy continues to make a leading contribution to global growth, the country’s size and integration into the global economy mean that its performance affects those around it. Spillovers from its economic rebalancing can be a concern, and recent experience suggests that spillovers to China’s neighbors in Asia might have become even larger lately, coming through not only trade but also financial linkages (IMF 2016d; Rhee 2015). These developments are occurring against the background of sluggish global trade, falling commodity prices, and elevated market volatility in the region since the summer of 2015 (Figure 2.2). In particular, China’s contribution to the global trade slowdown was unusually large in 2015: as shown in panel 1 of Figure 2.2, its large negative contribution to the global trade

slowdown (measured by import volume of goods) marked a clear contrast to the global financial crisis of 2008–09 when many economies other than China contributed to the global trade slowdown. It should also be noted that other emerging market economies made a larger negative contribution to import volume growth than China in 2015.

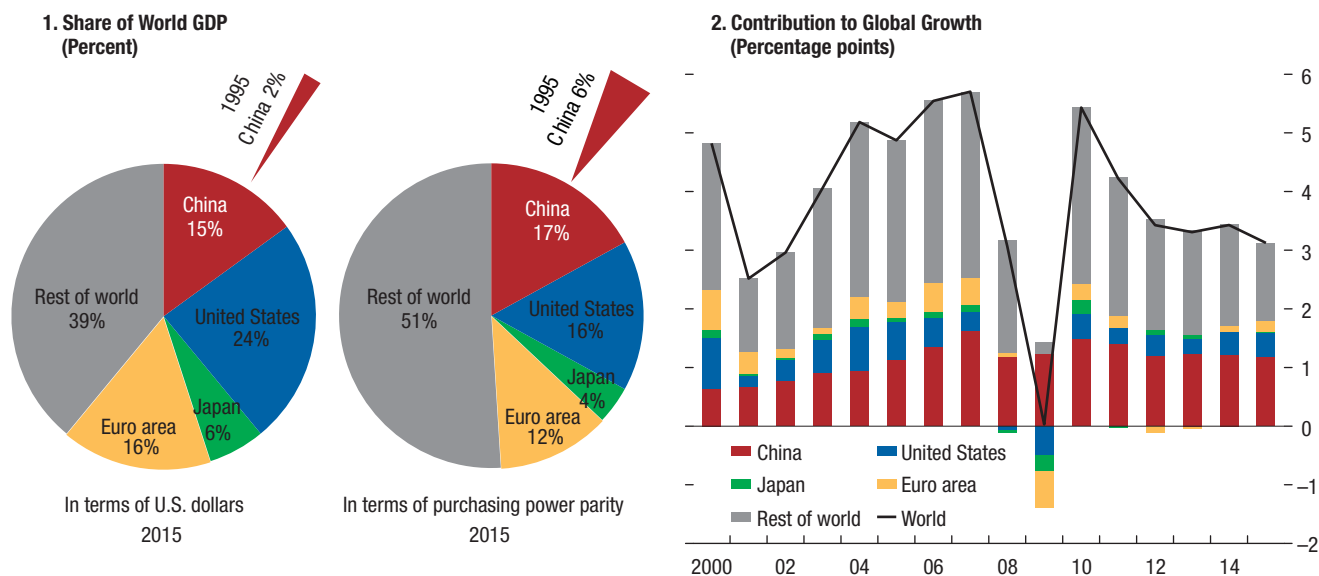
This chapter addresses in three stages the questions arising from these developments. First, it provides an overview of potential spillover channels from China’s growth slowdown and reviews several recent IMF estimates of their impact. Second, it explores growth and trade spillovers from China’s rebalancing from investment toward consumption. Third, it examines financial spillovers from China to regional markets. Separately, the next chapter (Chapter 3) discusses potential spillovers from China to commodity markets.

The main findings of this chapter are:

- Spillovers from China have increased over time, as China’s economy has grown in size and integrated more closely with the region and the world, both in trade and finance. Recent estimates suggest that a 1 percentage point slowdown in Chinese growth translates into a 0.15–0.30 percentage point decline in growth for other Asian countries in the short term (Box 2.1). At the same time, China’s reform and rebalancing are likely to bring about growth dividends for both China and its trading partners, with larger medium-term benefits for Asian countries with greater exposure to China than the rest of the world.
- Trade spillovers from China in the short term will vary with each country’s level and type of exposure to China. While ongoing rebalancing in China will weigh more heavily on Asian countries with higher exposure to China’s domestic investment, exposure to China’s consumption will provide a buffer and may

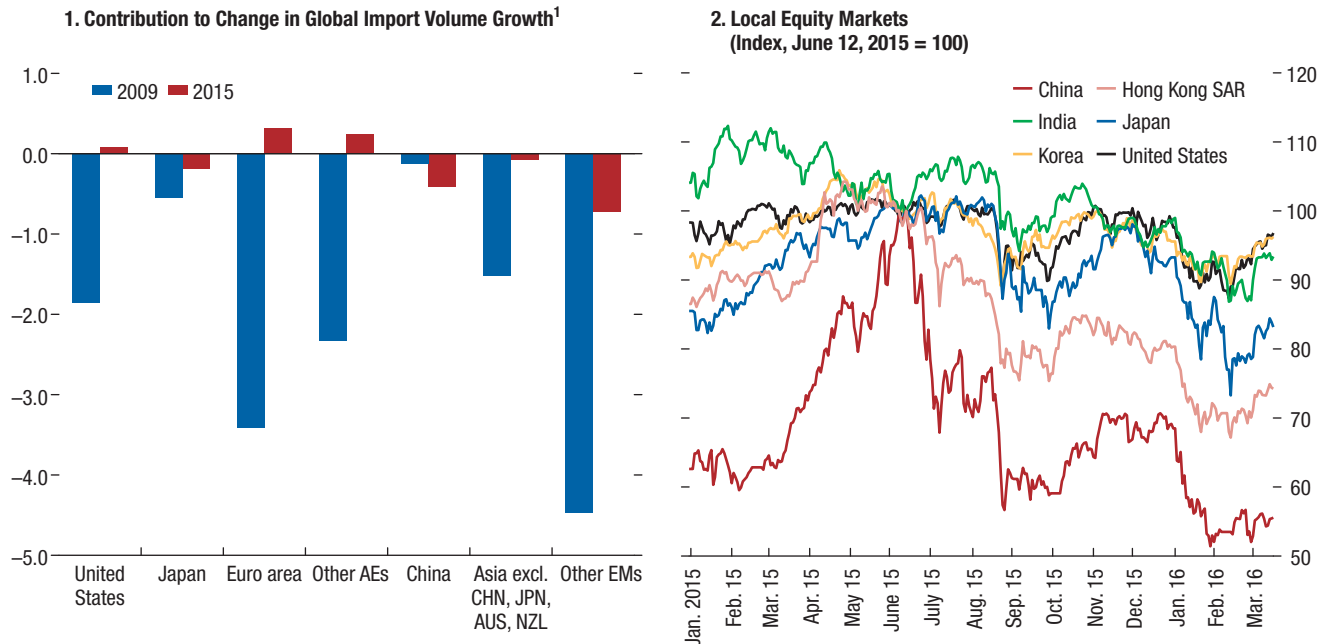
This chapter was prepared by Serkan Arslanalp and Jaewoo Lee (lead authors), Gee Hee Hong, Wei Liao, Shi Piao, and Dulani Seneviratne.

**Figure 2.1. China's Role in the Global Economy**



Sources: IMF, World Economic Outlook database; and IMF staff calculations.

**Figure 2.2. Recent Developments in Global Trade and Financial Markets**



Sources: Bloomberg, L.P.; IMF, World Economic Outlook database; and IMF staff calculations.

<sup>1</sup>AEs = advanced economies; AUS = Australia; CHN = China; EMs = emerging market economies; JPN = Japan; NZL = New Zealand.

boost exports of some countries. On average, Asia will sustain a larger short-term loss than other regions, and so will commodity exporters.

- Financial spillovers from China to regional markets are on the rise, in particular in equity and foreign exchange markets, and are stronger for those economies with greater trade linkages with China. They are likely to rise further with rapidly growing financial linkages with China, including through the ongoing internationalization of the renminbi and China's gradual capital account liberalization.

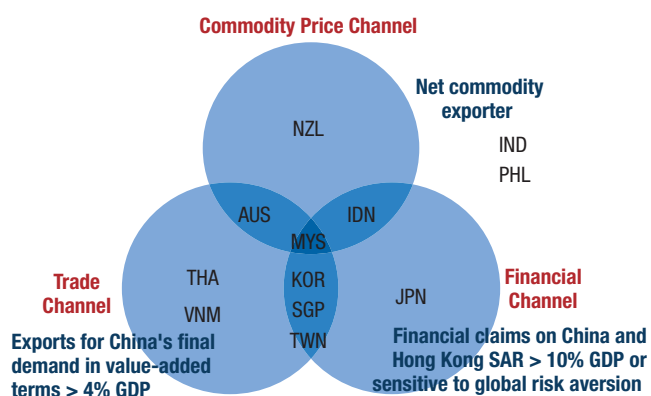
The main policy implications of these findings are as follows. China's economic transition and its rising influence on regional markets, while expected to bring long-term benefits, can pose challenges for Asian economies. For China, continued efforts to communicate its policy intentions clearly and effectively will be essential in managing the transition. For other countries, to mitigate risks and build resilience against shocks emanating from China, several policies can be adopted along the following principles, while considering individual circumstances as discussed in Chapter 1:

- Over the short term, the first recourse if downside risks materialize will be to use policy buffers, where available, and discharge macroeconomic support measures judiciously. Macroprudential policies can also be employed to safeguard financial stability, especially if volatile asset prices lead to substantial capital outflows or worsen existing corporate sector vulnerabilities.
- Over the long term, the broad structural reform agenda for the region remains valid, especially for diversifying sources of growth, including through promoting the growth of the services sector.

## Channels of Spillovers from China's Growth Slowdown

Overall, growth in China is evolving broadly as envisaged in the October 2015 *World Economic Outlook* (WEO), but with a faster-than-expected

**Figure 2.3. Channels of Spillovers from a Slowdown in China**



Source: IMF staff estimates.

Note: AUS = Australia; IND = India; IDN = Indonesia; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; SGP = Singapore; THA = Thailand; TWN = Taiwan Province of China; VNM = Vietnam.

slowdown in imports and exports, partly reflecting weaker investment and manufacturing activity (IMF 2016d). These developments, together with market concerns about the future performance of the Chinese economy, are resulting in spillovers to other economies through trade links, weaker commodity prices, and financial linkages, as shown in Figure 2.3. In particular, the spillovers include the following:

- Spillovers through trade.** Lower imports by China are weighing on growth in exporting countries, especially those that cater to China's final demand. The exposure to final demand in China has been increasing for nearly all Asian economies. This is a departure from the past, when exports of intermediates or export-related inputs dominated Asia's export product profile to China. According to the latest data, value added in exports embedded into final demand in China was relatively high (that is, more than 4 percent of GDP) for Australia, Korea, Malaysia, Singapore, Taiwan Province of China, Thailand, and Vietnam.<sup>1</sup>

<sup>1</sup>Kireyev and Leonidov (2016) investigate the network effects ("higher-round" effects) of a hypothetical drop in China's imports, using latest gross trade data. Based on their analysis, the countries with relatively high trade exposure to China are broadly the same.

- **Spillovers through commodity prices.** To the extent that China’s slowdown and rebalancing contribute to lower commodity prices, net commodity exporters in the region, such as Australia, Indonesia, Malaysia, and New Zealand, can also be affected. The next chapter (Chapter 3) describes the impact of China on commodity markets in more detail, including for commodity producers outside the region.
- **Spillovers through financial links.** Several economies, such as Korea, Singapore, and Taiwan Province of China, have substantial financial links with China, both directly and through Hong Kong Special Administrative Region (SAR). Moreover, several other countries, such as Japan, Indonesia, and Malaysia, are affected by episodes of global risk aversion (“risk-off” episodes).<sup>2</sup> To the extent that uncertainty about China’s growth and policy outlook contribute to global risk aversion episodes, these countries may also be affected.

Hence, although a gradual slowdown in China’s growth is a natural consequence of successful economic development, it is bound to have negative spillover effects in the short term on regional economies. According to several IMF studies, reviewed in Box 2.1, a 1 percentage point change in China’s real GDP growth is estimated to affect the real GDP growth of the median Asian economy by 0.15–0.30 of a percentage point. This statistical variation among spillover-effect estimates reflects differences in the sample and econometric methodology.

A few general patterns emerge. First, the spillover effects are generally found to be stronger for countries with stronger trade linkages with China. Similarly, the effects have been strengthening over time, reflecting rising trade links with China.

<sup>2</sup>These “risk-off” episodes have become more frequent and severe since 2007, with the last two happening in August 2015 and January 2016 (De Bock and de Carvalho Filho 2015). During these episodes, the Japanese yen tends to appreciate against the U.S. dollar, while emerging market currencies—notably the Malaysian ringgit and the Indonesian rupiah in the region—tend to depreciate.

Moreover, the negative growth spillovers from China can become more severe when global financial markets are under stress. These results beckon further investigation of trade and financial spillovers, as addressed in the rest of this chapter.

## Trade Spillovers from China’s Rebalancing

China has been rebalancing gradually on multiple and interrelated fronts: from exports to domestic demand, from manufacturing to services, and from investment to consumption (IMF 2015b). The gradual changes add up to a meaningful magnitude over a longer horizon, and have already played a substantial role in the slowdown of China’s imports (Box 2.2). The rebalancing will continue for some time, likely gaining speed if the authorities make headway on key structural reforms.

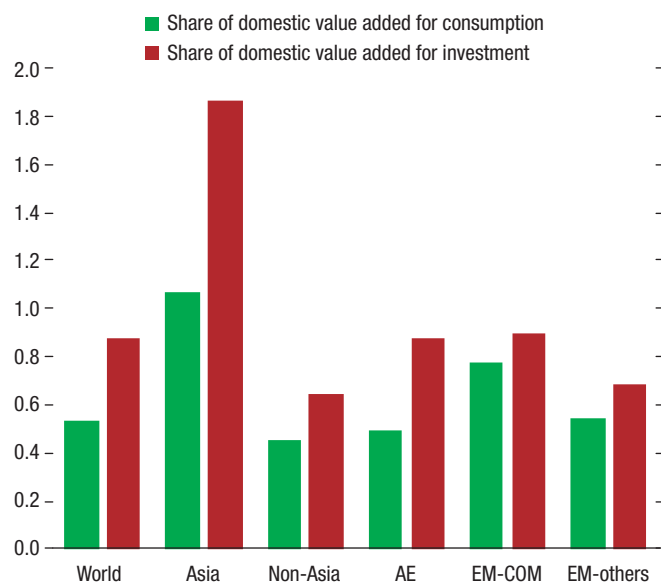
This section explores trade spillovers of rebalancing from investment to consumption—the core of the multifaceted rebalancing process—by addressing the following questions:<sup>3</sup>

- How big a role did rebalancing play in the recent slowdown in China’s import growth?
- What are the implications of rebalancing on exports to China and overall GDP growth of economies exposed to China through trade linkages?
- Which economies are likely to benefit or lose from that rebalancing process?

These questions can be answered by understanding the demand for imports for China’s final consumption and final investment.

<sup>3</sup>The three dimensions of rebalancing are interlinked: less exports, less manufacturing, and less investment will proceed simultaneously with a large overlap. By focusing on the rebalancing from investment to consumption, we incorporate a sizable portion of the other two dimensions of rebalancing. However, the overlap is not complete, and the effect of rebalancing will be larger if the nonoverlapping part of the other two dimensions are fully incorporated. For example, the rebalancing from exports to domestic (consumption) demand will have similar implications on partner-country exports, as exports and investment have similar values of import intensity (Figure 2.2.2 in Box 2.2).

**Fig 2.4. Share of Domestic Value Added Exported for China's Final Demand**  
(Percent of GDP)



Sources: Organisation for Economic Co-operation and Development and World Trade Organization, Trade in Value Added database; and IMF staff calculations. Note: AE = advanced economies; EM-COM = commodity-exporting emerging markets; EM-others = other emerging markets.

As investment usually has higher import intensity compared with consumption and government spending, countries with higher exposure to China's final investment are likely to be more adversely affected by China's rebalancing. Trade data in value-added terms enable us to estimate the sensitivity of exports to China's consumption and investment.

### Who Is More Exposed to China in Value-Added Trade?

Exposure to China's final demand is measured using the Trade in Value Added (TiVA) database of the Organisation for Economic Co-operation and Development (OECD) and World Trade Organization (WTO). The database covers 62 countries from 1995 to 2011. Each country's trade exposure is measured in terms of the domestic value-added content of its exports for China's final demand, including both goods and services trade (see Annex 2.1 for details). To elaborate, trade exposure measures value added embodied in: (1) direct exports of final goods and services to

China, and (2) exports of intermediate goods to a third country that will eventually be reexported to China for final demand.

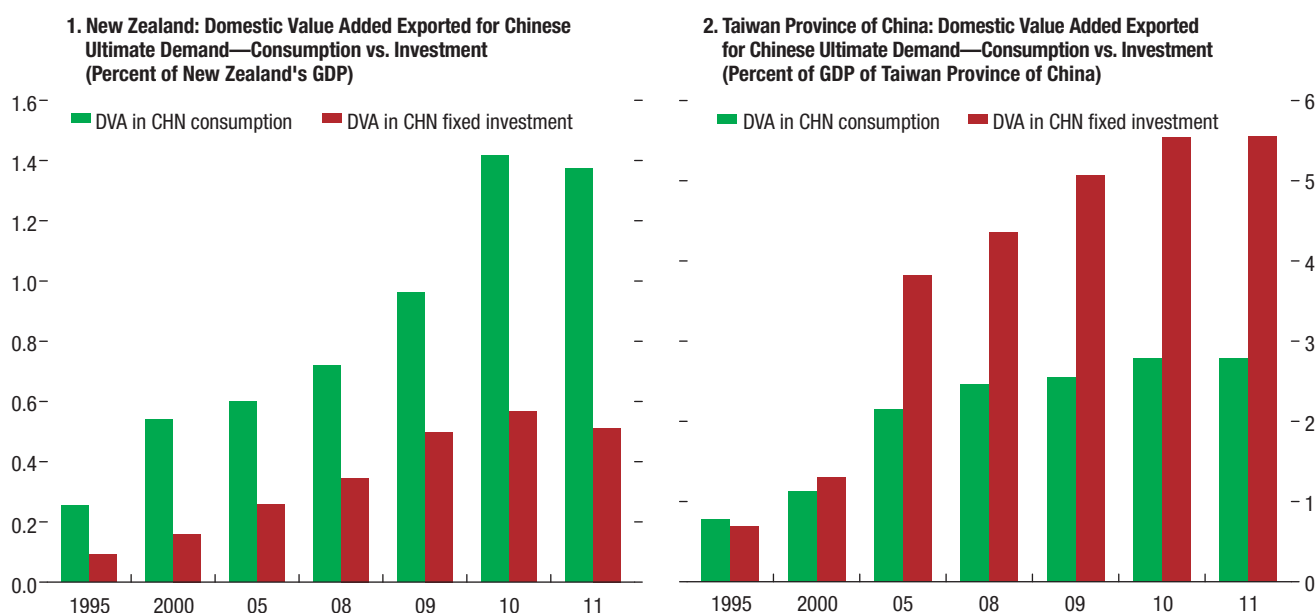
The exposure of Asian countries to China's final demand is higher than that of other countries or regions (Figure 2.4). Asian countries as a group also have a high *relative* exposure to China's investment (vis-à-vis consumption): Asia's exposure to China's investment is about 180 percent of its exposure to China's consumption, while non-Asia's exposure to China's investment is about 150 percent of its exposure to China's consumption.

Within Asia, there is a meaningful variation in the exposure to China, as showcased by a contrast between New Zealand and Taiwan Province of China. New Zealand has expanded its exports of consumption goods and services to China, while Taiwan Province of China has high exposure to China's investment (Figure 2.5). As such, based on current trends, New Zealand is likely to be in a better position than Taiwan Province of China to absorb spillovers from China's rebalancing.

### Whose Exports Gain or Lose from China's Rebalancing?

The first step in calculating spillovers on exports is to measure the sensitivity of a country's value-added exports to China's final demand. To be more exact, we estimate the elasticity of a country's domestic value-added exports (as a share of its own GDP) with respect to China's consumption or investment growth, from the annual data for 62 countries in the TiVA data. These estimates enable us to measure how each country's exports—for China's ultimate use—change when China's consumption and investment growth rates change as a result of rebalancing.

For the purpose of clarity, the spillover effects are calculated for a unitary rebalancing, defined as a shift of growth from investment to consumption in which the consumption growth rate increases by 1 percentage point and the investment growth rate decreases by 1 percentage point. Each country's exports to China for final consumption

**Figure 2.5. A Tale of Two Exporters to China, 1995–2011**

Sources: Organisation for Economic Co-operation and Development and World Trade Organization, Trade in Value Added database; and IMF staff calculations.  
Note: CHN = China; DVA = domestic value added.

and investment will change by the size of estimated elasticities, positively for consumption and negatively for investment. The effect of unitary rebalancing is then obtained by subtracting the elasticity for investment exports from the elasticity for consumption exports. To calculate the effect of a more general rebalancing in which consumption and investment growth rates change by different magnitudes, the elasticities for consumption and investment exports need to be multiplied by the corresponding changes in the growth rates (of consumption and investment), before investment exports are subtracted from consumption exports (Annex 2.2 contains further details of the calculation).

Figure 2.6 shows the effects on Asian countries' exports to China in value-added terms. Within Asia, most adversely affected economies are those that have been closely integrated with China through the global value chain, such as Korea and Taiwan Province of China, as these economies are heavily exposed to China's investment activity. In contrast, New Zealand will see an increase in its exports to China, as it benefits from the increase in China's consumption demand.

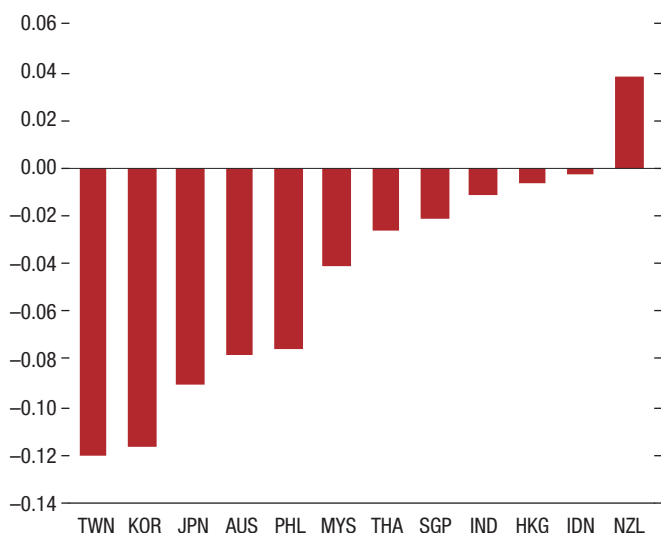
## Growth Effects over the Short and Medium Term

Although exports are the first point of contact with China's rebalancing, the eventual consequence will be felt on GDP growth of each country. This subsection estimates the spillover effects on each country's GDP growth through trade channels, first in the short term and then in the medium term. The estimation proceeds in two steps. The first step estimates the shocks to China's consumption and investment growth. The second step estimates the response of each country's GDP growth to those shocks separately—over two years after the shock—allowing the responses to vary with the strength of bilateral trade linkages with China (see Annex 2.2 for details). We then calculate the effects on GDP growth of a unitary rebalancing in China in the short term, as well as the effects of two counterfactual medium-term scenarios: one historical and the other forward-looking.

Estimating growth effects also takes a better account of global repercussions of China's rebalancing. The effects on domestic value-added

**Figure 2.6. Change in Value-Added Exports to China after China's Rebalancing**

(Impact in percentage points due to a 1 percentage point increase [decrease] in China's consumption [investment] growth)



Source: IMF staff estimates.

Note: AUS = Australia; HKG = Hong Kong SAR; IND = India; IDN = Indonesia; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippine; SGP = Singapore; TWN = Taiwan Province of China; THA = Thailand.

exports to China can be called the first-round effects of rebalancing, and will be followed by full propagation effects through the global economy. As China's rebalancing has an impact on all countries via trade, the overall economic activity of each country will be affected, in turn generating the second- and higher-round effects on trade and domestic demand among and within themselves.<sup>4</sup> During higher-round effects—which actually include multiple rounds until the additional effects dissipate—key global prices will keep adjusting, producing further repercussions on economic activity and trade.

The intra-Asia distribution of GDP growth spillovers is broadly consistent with that of export spillovers, while the magnitude of spillover effects is larger on GDP growth than on exports owing to the higher-round effects. Economies with a

<sup>4</sup>Kireyev and Leonidov (forthcoming) investigate the network effects (“higher-round” effects) of a hypothetical drop in China's imports, using gross trade data. They find that the network effects will likely be substantial in size while having lesser effects on the cross-country ordering of losses.

larger share of consumption exports experience smaller negative spillovers (Figure 2.7, panel 1).

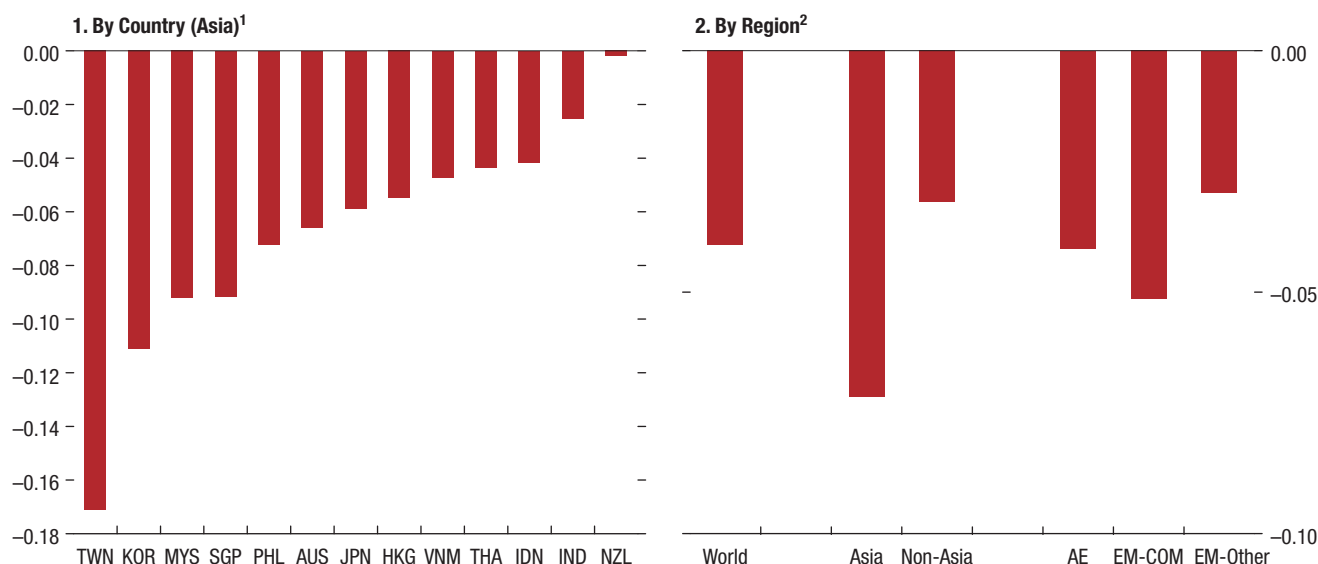
Figure 2.7 (panel 2) shows the average growth impact of a unitary rebalancing over the short term outside Asia, based on our sample of 62 countries. Asia will be more negatively affected by rebalancing than the rest of the world, reflecting higher exposure of Asia to China. Commodity-exporting emerging markets are also more adversely affected than other emerging market or advanced economies. Although our sample includes only emerging market and advanced economies (owing to the availability of the value-added trade data), commodity-exporting low-income countries will likely be more adversely affected than others, in line with Papageorgiou and Xie (forthcoming).<sup>5</sup>

Our results indicate that a broadly growth-neutral rebalancing in China—from unitary shifting of composition of demand—is likely to have negative spillovers to trading partners, especially those that are more exposed to China's investment than to its consumption. The unitary rebalancing will have little effect on China's GDP growth itself because the shares of consumption and investment are about the same in real terms in China. Nevertheless, the rebalancing will adversely affect GDP growth of the average economy in the short term, reflecting relatively higher exposure to China's investment in most countries.

To put the magnitudes in context, we consider two counterfactual scenarios, one historical, the other forward-looking. The historical scenario is based on actual developments during the pre- and postcrisis periods: 2001–07 and 2011–15. Over these two periods, China's GDP growth rate declined by 3 percentage points. Let us assume that a counterfactual “nonrebalancing” scenario during 2011–15 would have entailed China's consumption and investment growth also declining by the same 3 percentage points as the aggregate GDP growth rate. In contrast, what happened in China is a 0.1 percentage point increase in consumption growth and a 5.5 percentage point

<sup>5</sup>Ikeda, Tumbarello, and Wu (forthcoming) find that Pacific island countries are influenced on their exports by China not only directly but also indirectly via Australia.

**Figure 2.7. Estimated Impact of China Rebalancing on Partner-Country Growth Transmitted Through the Trade Channel**  
(Impact in percentage points, due to a 1 percentage point increase [decrease] in China's consumption [investment] growth)



Source: IMF staff estimates.

<sup>1</sup>AUS = Australia; HKG = Hong Kong SAR; IND = India; IDN = Indonesia; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; SGP = Singapore; THA = Thailand; TWN = Taiwan Province of China; VNM = Vietnam.

<sup>2</sup>AE = advanced economies; EM-COM = commodity-exporting emerging markets; EM-Other = other emerging markets.

decline in investment growth. We can then assume the following rebalancing effect in China between the 2001–07 and 2011–15 periods: consumption growth increased by 3.1 percentage points [ $0.1 - (-3) = 3.1$ ], and investment growth declined by 2.5 percentage points [ $-5.5 - (-3) = -2.5$ ].

We then estimate the effects of this rebalancing—relative to the historical counterfactual—on trade-partner growth, instead of a unitary rebalancing that has been considered so far. Applying our estimates of growth sensitivity, this rebalancing in China would have led GDP growth to decline by 0.06 percentage point for the world, and 0.12 percentage point for Asia, as shown in panel 1 of Figure 2.8. Another counterfactual calculation enables us to put these numbers into context. The 3 percentage point decline in China's growth between 2001–07 and 2011–15 periods would have resulted in a 1 percentage point decline in Asia's growth, using the spillover estimates of Box 2.1 (Figure 2.1.1). That is, the rebalancing effect accounted for about 12 percent of overall spillovers from China's growth slowdown on Asia's growth over the same period.

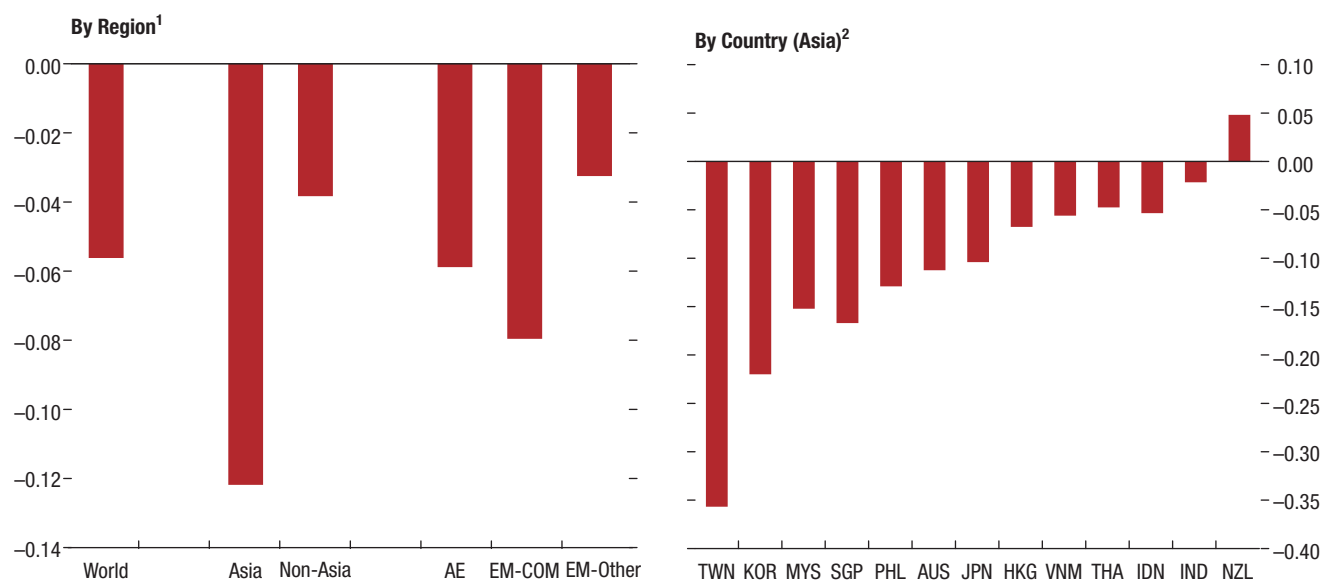
Panel 2 of Figure 2.8 shows the results for individual Asian economies, with larger effects for economies exposed to China's investment demand such as Korea and Taiwan Province of China. In contrast, the effect on New Zealand's growth is positive owing to its high exposure to China's consumption demand, as the rebalancing increased the consumption growth rate more than it decreased the investment growth rate between the 2001–07 and 2011–15 periods.

The forward-looking medium-term benefits of reform and rebalancing in China are presented in Figure 2.9, on the basis of an illustrative contrast between reform-with-rebalancing scenario and nonreform scenario. In the short term (until 2018), costs of reform and rebalancing are projected to pull down China's GDP growth rate below the nonreform growth rate. Over the medium term (in 2019), however, China's growth slows in the nonreform scenario, but picks up in the reform scenario as rebalancing from investment to consumption puts the economy on a more sustainable growth model. As the result, spillovers from rebalancing in China are negative for most



**Figure 2.8. Impact of Historical Rebalancing on GDP Growth**

(Impact in percentage points, due to a 3.1 percentage point increase in Chinese consumption growth and 2.5 percentage point decrease in Chinese investment growth over nonrebalancing scenario)



Source: IMF staff estimates.

<sup>1</sup>AE = advanced economies; EM-COM = commodity-exporting emerging markets; EM-Other = other emerging markets.

<sup>2</sup>AUS = Australia; HKG = Hong Kong SAR; IND = India; IDN = Indonesia; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; SGP = Singapore; THA = Thailand; TWN = Taiwan Province of China; VNM = Vietnam.

countries in the short term, but turn positive over the medium term when reform and rebalancing bring about growth dividends for China and the world. While Asia incurs a larger cost in the short term owing to its greater exposure to China (both in total and in investment), Asia also reaps a larger benefit in the medium term for the same reason of a greater exposure to China. Medium-term calculations, however, are subject to large uncertainty, not least because the estimated elasticities can change substantially and growth can take different paths from the projections.

## China's Financial Spillovers to Regional Markets

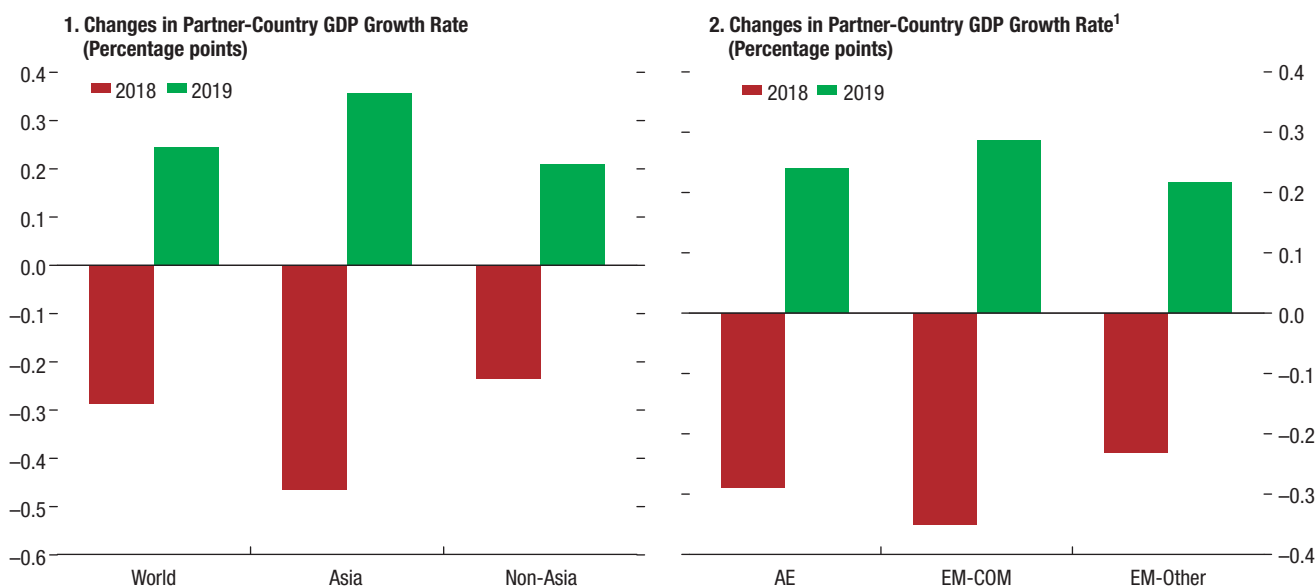
Developments in China are likely to weigh on regional markets, given its sheer size as well as strong trade and rapidly rising financial linkages with the region (Box 2.3). In fact, even before the recent bout of volatility, the comovement of Asian and Chinese markets was rising (Figure

2.10). Compared with the period prior to the global financial crisis, the region's asset return correlations with China have increased in both equity and foreign exchange markets. Similarly, Asia's asset return correlations with the United States have remained high.<sup>6</sup>

These findings are in line with the region's growing business cycle synchronization with China and the United States (Figure 2.11, panel 1). In fact, countries with a higher degree of business cycle synchronization with China have, on average, seen their equity markets move more closely with China (Figure 2.11, panel 2).<sup>7</sup>

<sup>6</sup>In contrast, Asia's bond markets have remained relatively uncorrelated with the Chinese bond market, likely reflecting the relatively isolated nature of the Chinese bond market and preeminence of global factors in driving global bond markets (see the April 2014 *Regional Economic Outlook: Asia and Pacific*).

<sup>7</sup>Similarly, Guimarães-Filho and Hong (2016) investigate the connectedness between Chinese and other equity markets, using the Diebold and Yilmaz (2012) connectedness index. Their analysis confirms the growing importance of China as a source of financial shocks, showing that China's equity returns contributed to a larger share of the movements of other countries' equity returns, partic-

**Figure 2.9. Impact on GDP Over the Medium Term: By Region**

Source: IMF staff estimates.

<sup>1</sup>AE = advanced economies; EM-COM = commodity-exporting emerging markets; EM-Other = other emerging markets.

But are these market comovements specifically related to China? In line with IMF (2016a), financial spillovers are defined in this chapter as the impact of changes in domestic asset price movements on asset prices in other economies. The concept excludes comovement across markets driven by common factors. Hence, the next sections explore the extent of financial spillovers directly from China to regional markets by examining the following questions:

- Are China-related shocks affecting regional markets more?
- What explains China's financial spillovers to the region (trade or financial linkages)?

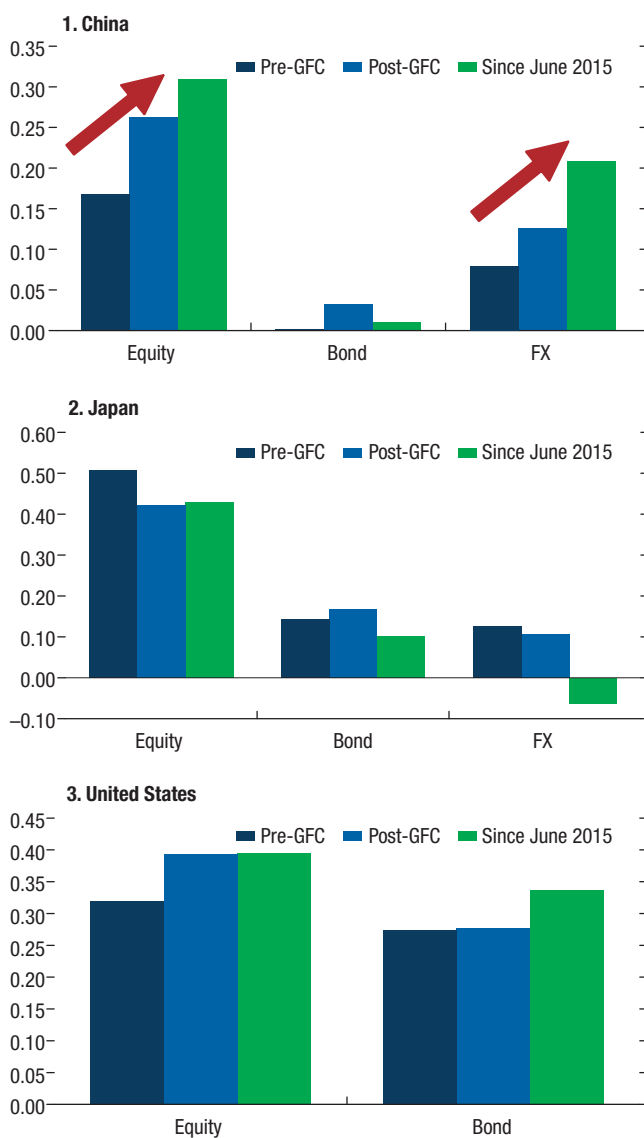
### Impact of China-Related Shocks on Regional Markets: Event Study

Over the last year, Asian markets have been hit hard when Chinese markets have experienced

ularly from 2015 and into early 2016. In contrast, they find that Japan's contribution to other equity markets has declined since the launch of Abenomics in 2012. Despite portfolio rebalancing effects of Japan's new macroeconomic policies under Abenomics, this may reflect the increasing role of the yen in driving local stock market valuations in Japan.

substantial volatility, especially during three episodes: on August 11, 2015, following China's announcement of a change to its exchange rate regime; on August 24, 2015, when the Chinese stock market fell by more than 8 percent in one day (known as Black Monday), and on January 4, 2016, when the Chinese market volatility resurfaced. During each of the events, stock markets and exchange rates of the largest economies in the region moved in the same direction as China. Furthermore, countries with strong trade linkages with China, on average, experienced larger stock market and exchange rate movements than those with moderate trade linkages (Figure 2.12).

Is this a recent phenomenon? A historical event study provides a more systematic way to help answer this question. We identify 30 episodes during which China experienced outsized stock market movements, defined as a change in the Shanghai Composite Index by more than 5 percent. To make sure these were unrelated to global events, we exclude the days when the U.S. stock market moved by more than one standard deviation just before the Chinese market opened.

**Figure 2.10. Asian Market Correlations with China, Japan, and the United States**

Sources: Bloomberg, L.P.; and IMF staff estimates.

Note: Simple average of correlations for Asian economies including Australia, India, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan Province of China, and Thailand. FX = foreign exchange; GFC = global financial crisis. Correlations are reported excluding the GFC period (2008–09). Pre-GFC = January 2001–December 2007; Post-GFC = January 2010–June 2015. The latest data are as of end-January 2016.

We also conduct historical news searches to ensure China-specific events happened during the identified days (see Annex 2.3 for details). Based on this sample, we find that the average impact of China-related shocks on regional stock markets rose after the global financial crisis and further

after June 2015 (Figure 2.13). Moreover, markets with strong trade links with China were affected more, both during the period after the global financial crisis period and further after June 2015 (Figure 2.14).

Similarly, foreign exchange markets seem to be increasingly affected by China-related shocks. We identify 14 episodes since July 2005 (when China announced the adoption of a managed floating exchange rate regime) during which the onshore renminbi-dollar exchange rate moved by more than 0.5 percent in a given day. The average impact on regional foreign exchange markets was relatively muted until June 2015 but has become substantial since then (Figure 2.15). Moreover, markets with strong trade links with China were affected more (Figure 2.16). These findings suggest that financial spillovers from China to regional markets are on the rise, both in equity and foreign exchange markets.<sup>8</sup>

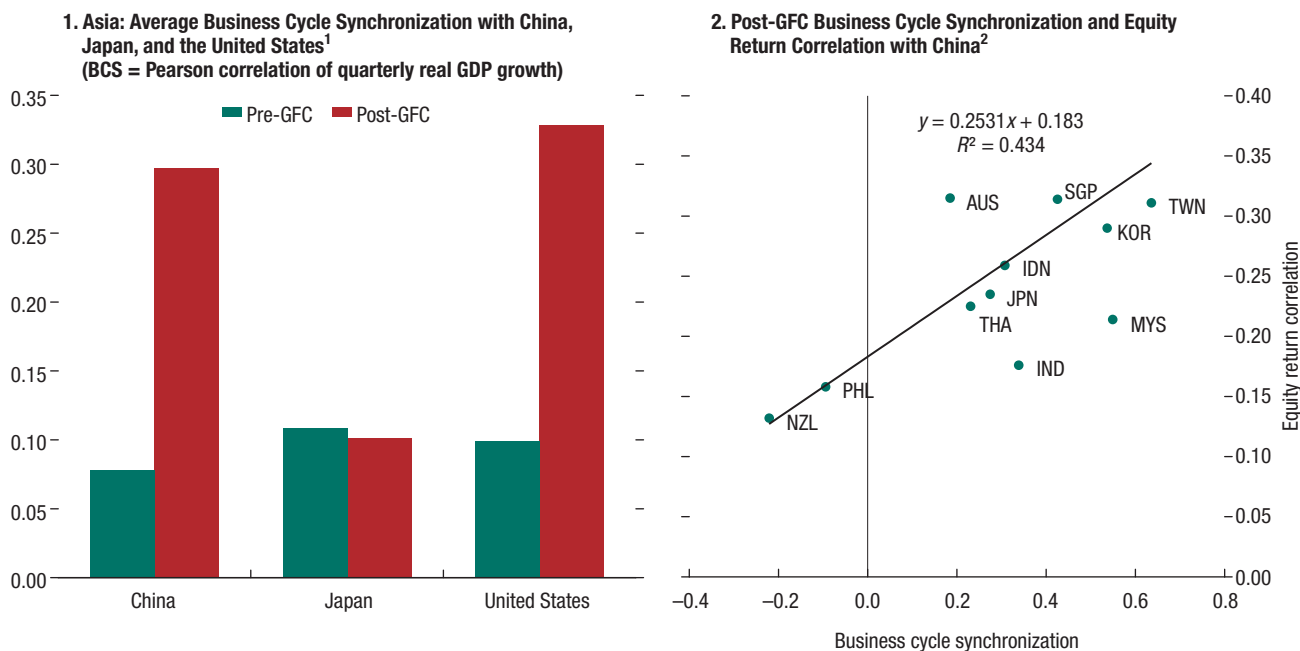
### What Explains China's Financial Spillovers into Regional Markets?

But what explains China's rising financial spillovers to the region? The section uses a model proposed by Forbes and Chinn (2004) that can be used to decompose a country's stock market returns into global, sectoral, and cross-country (that is, returns in systemic economies) factors (see Annex 2.4). We use this model to estimate Asian market sensitivities ("betas") to systemic economies (that is, China, the euro area, Japan, and the United States) during 2001–14 and then uncover their key determinants, which include trade and financial linkages.<sup>9</sup> The approach provides three general results.

<sup>8</sup>The equity market shocks over the three periods were similar in magnitude (6.8, 6.2, and 6.4 percent, respectively). Similarly, the exchange rate shocks over the two periods were comparable (0.85 and 0.86 percent, respectively).

<sup>9</sup>The approach involves a two-stage panel regression. In the first stage, cross-country factor loadings ("betas") for each systemic economy are estimated, controlling for global, sectoral, and country-specific factors. In the second stage, the factor loadings estimated in the first stage are used to decompose the market sensitivities to systemic economies into trade and financial linkages. Trade linkages include trade exposure and trade competition, while financial linkages

**Figure 2.11. Asia: Business Cycle Synchronization with China**



Source: IMF staff calculations.

<sup>1</sup>Pre-GFC = 2001–07; Post-GFC = 2010–15.

<sup>2</sup>AUS = Australia; IND = India; IDN = Indonesia; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; SGP = Singapore; THA = Thailand; and TWN = Taiwan Province of China.

First, in line with China’s growing role in the region, we find that Asian financial sensitivities to China have increased, in particular since the global financial crisis (Figure 2.17). Regional market sensitivities to China are positive and statistically significant for all economies in the region. In contrast, regional markets’ sensitivity to Japan has declined since the crisis, although it remains comparable to that of China.<sup>10</sup> Meanwhile, the sensitivity to the United States has continued to rise, highlighting the steady integration of Asia with the rest of the world.

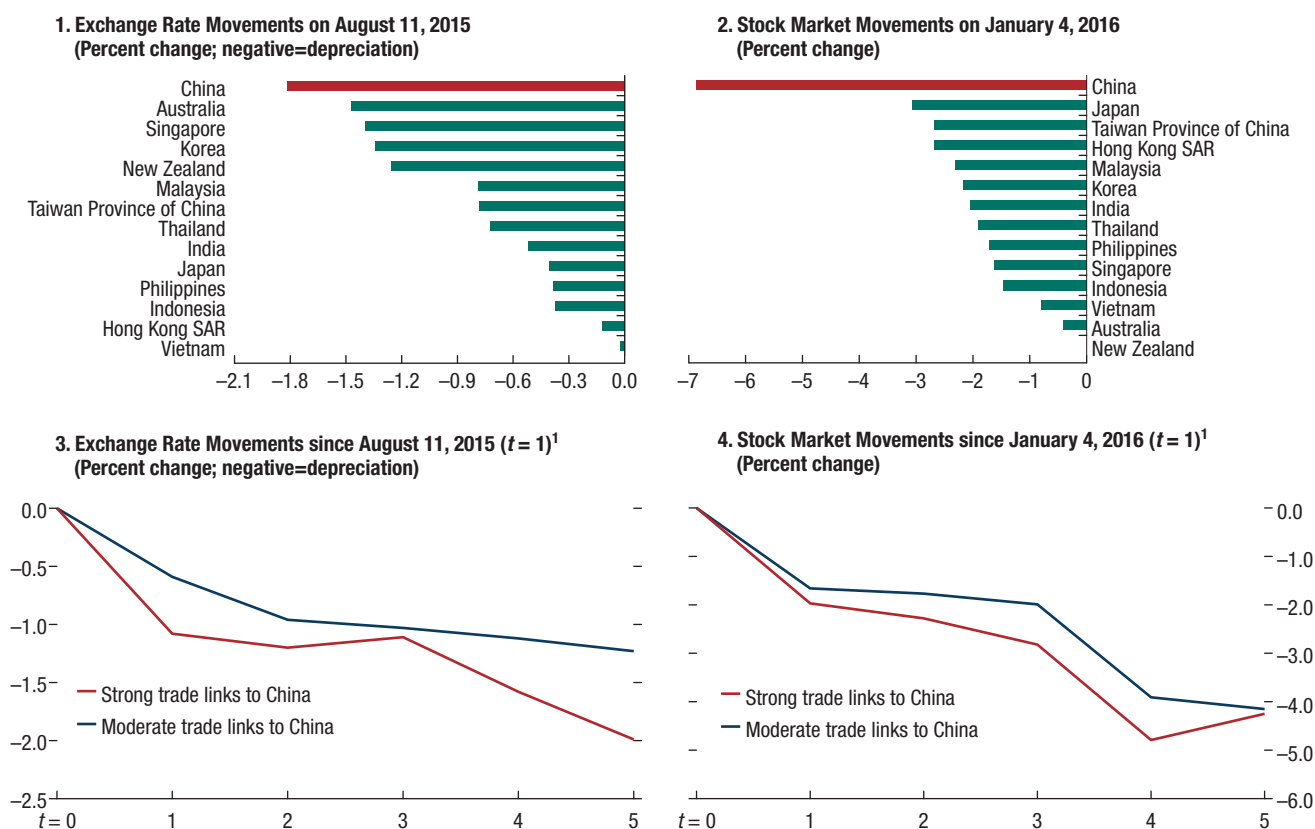
include cross-border foreign direct investment, bank, and portfolio exposures. Financial linkages with China are estimated including exposures to both China and Hong Kong SAR given that Hong Kong SAR serves as a financial gateway to China (Box 2.3).

<sup>10</sup>Asian equity markets’ sensitivity to Japanese equity markets appears to have declined following the launch of Abenomics in 2012, as the correlation of the local stock market and the Japanese yen increased sharply. However, in absolute terms, the sensitivity of Asian markets to Japan remains statistically significant and still somewhat higher than that of China.

Second, we find that trade linkages are the main transmission channel for spillovers from China to Asian equity markets (Figure 2.18). At the same time, the relative contributions of trade and financial linkages in explaining the variation in equity market spillovers from China have changed since the global financial crisis. In particular, while trade linkages explained more than 90 percent of the variance before the global financial crisis, they now explain around 60 percent due to rapidly rising financial linkages after the crisis (Figure 2.19).

Third, the impact of China on regional markets can be even larger than estimated on the basis of direct trade and financial linkages. In particular, China may affect regional markets more, if a China-related shock leads to global risk aversion and affects other systemic markets (Japan, the euro area, and the United States). In that case, China can affect regional markets by more than twice as much based on the estimated sensitivities

Figure 2.12. Regional Equity and Foreign Exchange Markets During China-Related Shocks



Sources: Bloomberg, L.P.; and IMF staff calculations.

<sup>1</sup>Countries with strong trade links to China are shown in Figure 2.3.

of those markets to other systemic economies (Figures 2.20 and 2.21).<sup>11</sup>

In summary, our findings suggest that financial spillovers from China to regional markets have increased, and exposure to China's final demand through the trade channel remains an important determinant in explaining spillovers. However, the importance of the financial channel began to increase strongly after the global financial crisis. While Asian equity markets' susceptibility to spillovers from China has risen, spillovers from Japanese equity prices have declined; on the other hand, spillovers from the United States remain high and have increased in the aftermath of the global financial crisis. These developments suggest

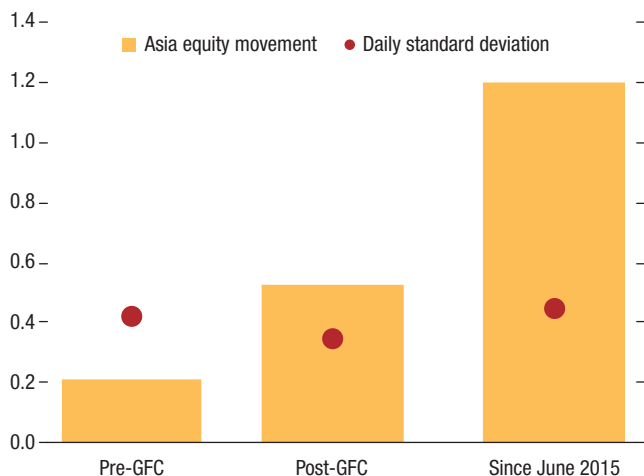
that equity returns in the region are driven by global factors and, increasingly, by developments in China.

## Policy Implications

China's gradual slowdown and rebalancing and its rising influence on regional markets, while expected to bring long-term benefits, are likely to remain headwinds for Asian economies in the short term. Economies most adversely affected by trade spillovers are those that have been closely integrated with China through the global value chain, such as Korea, Malaysia, and Taiwan Province of China, as these economies are heavily exposed to China's investment activity. In contrast, New Zealand will be least negatively affected, as its exports to China will benefit from the increase in China's consumption demand.

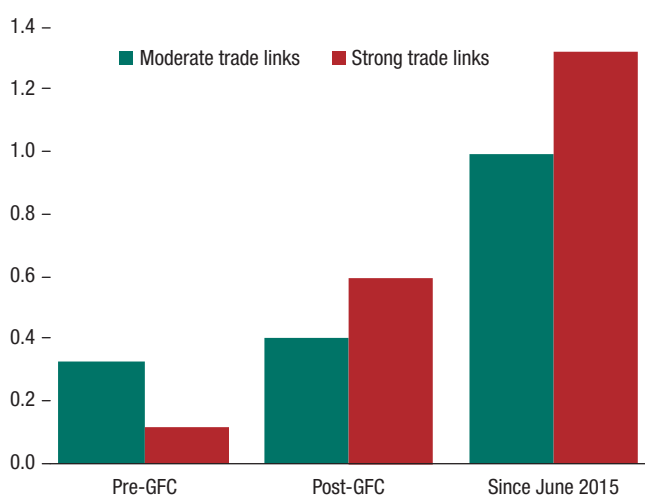
<sup>11</sup>The estimates for the alternative scenario are obtained by using the coefficients for other systemic economies estimated in the first-stage regression (see Annex 2.4).

**Figure 2.13. Event Study: Stock Market Movements Due to Shocks from China**  
(Percent change)



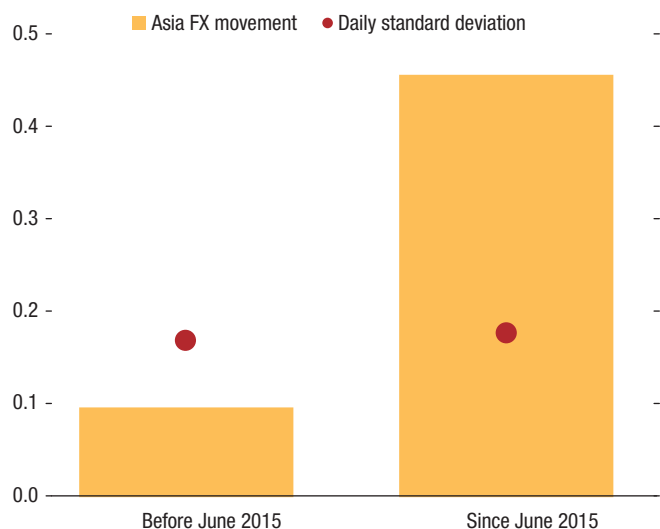
Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Based on 30 episodes during which China experienced outsized stock market movements unrelated to global events. During these episodes, the average daily change in the Chinese stock market was 6.8 percent, 6.2 percent, and 6.4 percent, respectively, for each time period. Pre-GFC = January 2001–December 2007; Post-GFC = January 2010–June 2015; Since June 2015 = July 2015–January 2016.

**Figure 2.14. Event Study: Stock Market Movements Due to Shocks from China, by Trade Links with China**  
(Percent change)



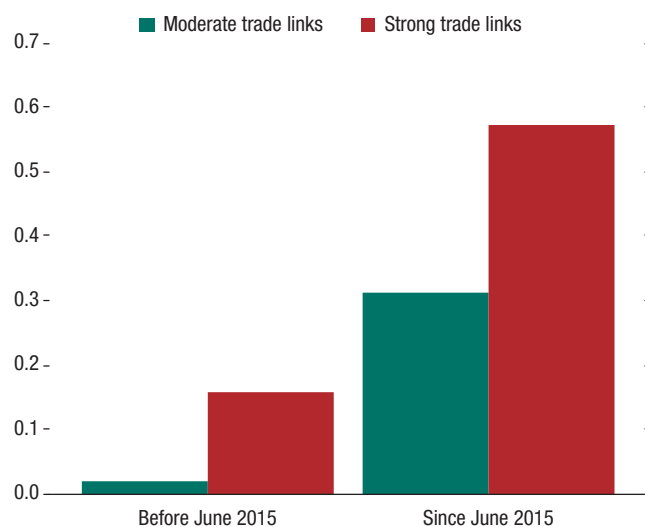
Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Based on 30 episodes during which China experienced outsized stock market movements unrelated to global events. During these episodes, the average daily change in the Chinese stock market was 6.8 percent, 6.2 percent, and 6.4 percent, respectively, for each time period. Pre-GFC = January 2001–December 2007; Post-GFC = January 2010–June 2015; Since June 2015 = July 2015–January 2016.

**Figure 2.15. Event Study: Exchange Rate Movements Due to Shocks from China**  
(Percent change)



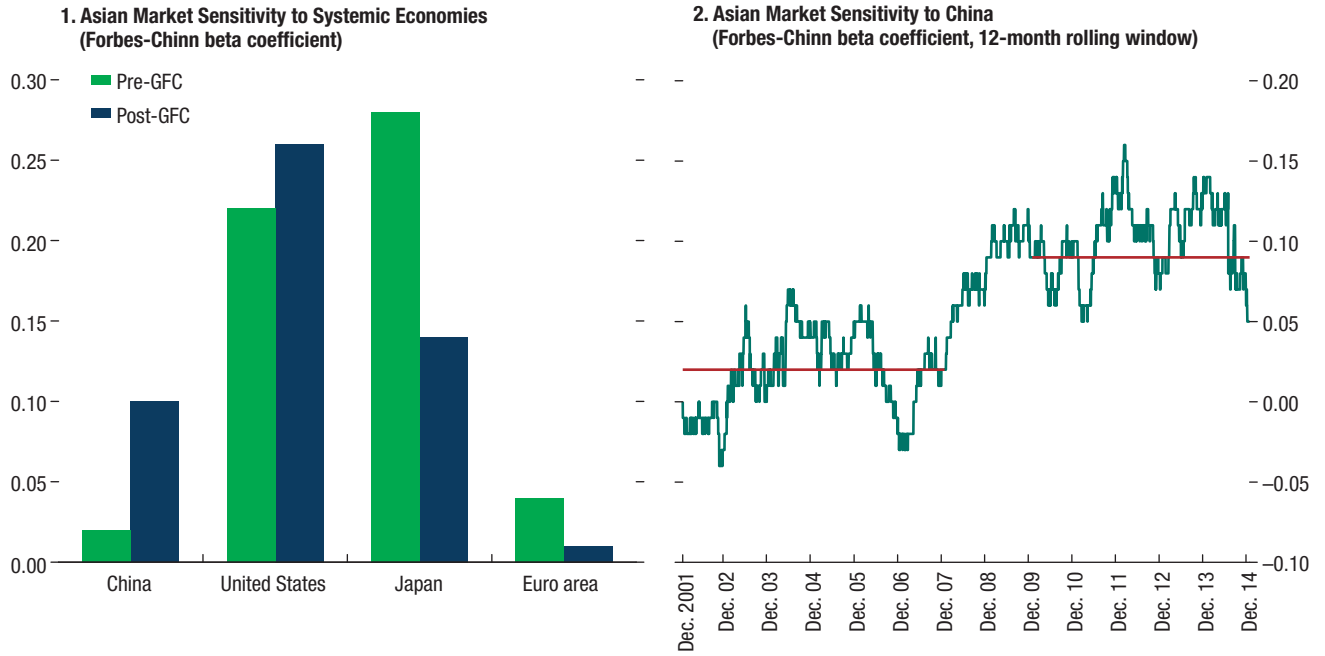
Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Based on 14 episodes of outsized changes of the onshore renminbi-dollar exchange rate. During these episodes, the average daily change in the renminbi-dollar exchange rate was 0.85 percent and 0.86 percent, respectively, for each time period. Before June 2015 = July 2005–December 2007 and January 2010–June 2015; Since June 2015 = July 2015–January 2016. FX = foreign exchange.

**Figure 2.16. Event Study: Exchange Rate Movements Due to Shocks from China, by Trade Links with China**  
(Percent change)



Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Based on 14 episodes of outsized changes of the onshore renminbi-dollar exchange rate. During these episodes, the average daily change in the renminbi-dollar exchange rate was 0.85 percent and 0.86 percent, respectively, for each time period. Before June 2015 = July 2005–December 2007 and January 2010–June 2015; Since June 2015 = July 2015–January 2016.

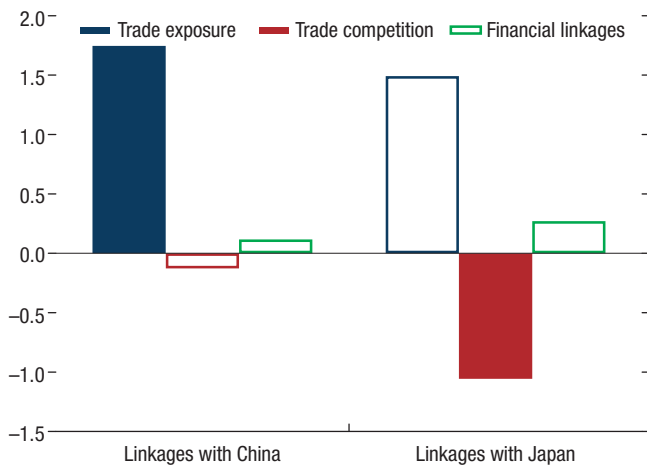
**Figure 2.17. Equity Market Spillover**



Sources: IMF staff estimates.

Note: Average sensitivity for Asian countries defined in Annex 2.4. GFC = global financial crisis; Pre-GFC = 2000–07; Post-GFC = 2010–14.

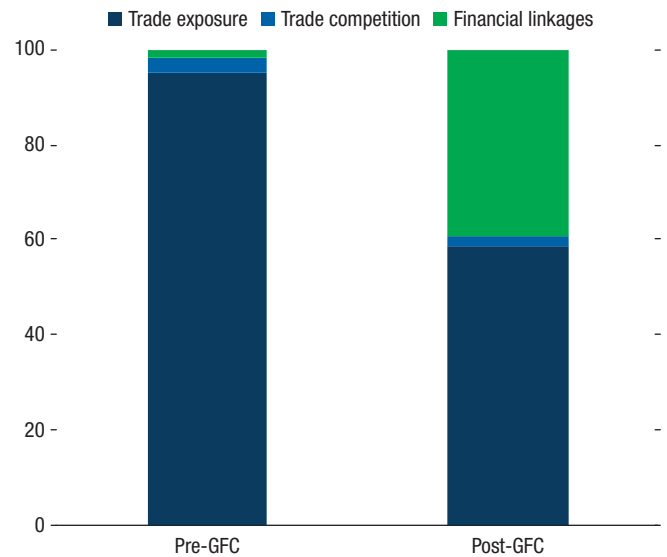
**Figure 2.18. Determinants of Market Sensitivity to China and Japan (Coefficient)**



Source: IMF staff estimates.

Note: Average sensitivity for Asian countries defined in Annex 2.4. The shaded bars denote variables that are statistically significant.

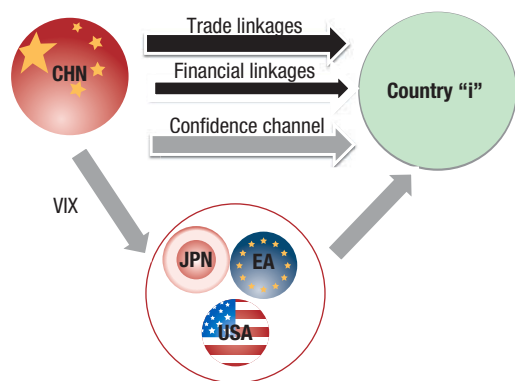
**Figure 2.19. Contribution to Explained Variance in Market Sensitivities to China (Percent)**



Source: IMF staff estimates.

Note: Average sensitivity for Asian countries defined in Annex 2.4. GFC = global financial crisis; Pre-GFC = 2001–07; Post-GFC = 2010–14. The decomposition follows the commonality coefficients approach described in Nathans, Oswald, and Nimon (2012).

**Figure 2.20. Scenario Analysis: Transmission of Shocks**



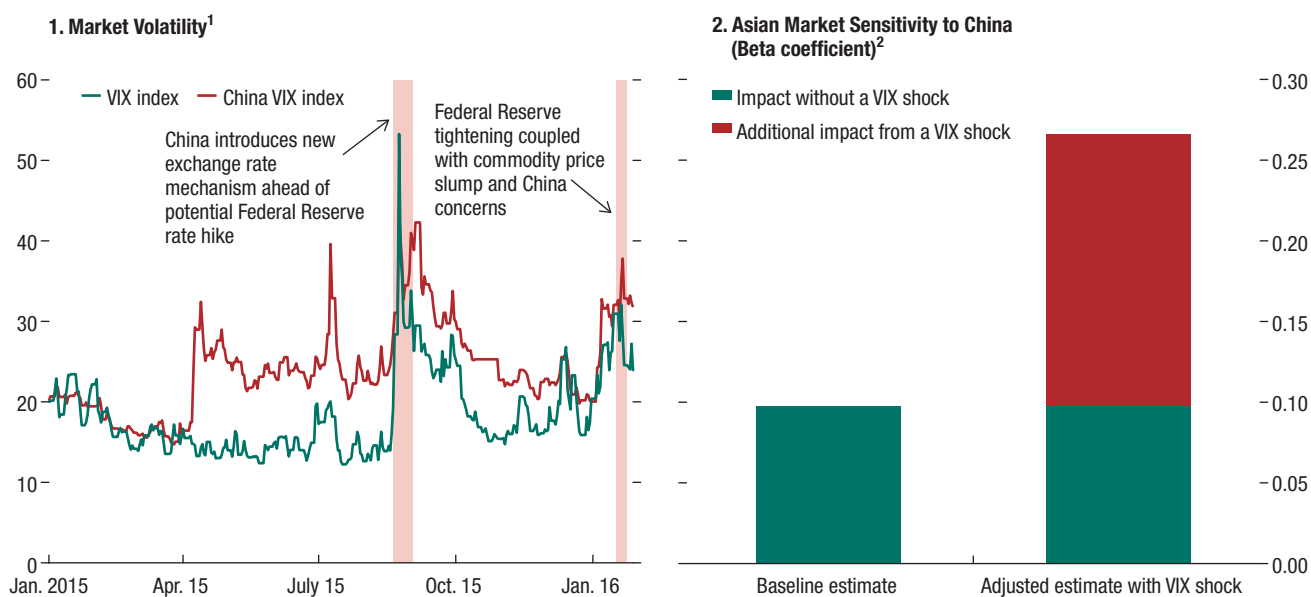
Source: IMF staff illustration.  
 Note: CHN = China, EA = euro area, JPN = Japan, USA = United States. VIX = Chicago Board Options Exchange Volatility Index. Country "i" stands for either Australia, India, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Taiwan Province of China, or Thailand.

Economies most sensitive to further volatility in Chinese markets are those with strong trade links with China (ASEAN-5, Korea, and Taiwan Province of China), as well as Hong Kong SAR owing to strong financial linkages with China.

Furthermore, China-related shocks, to the extent they lead to "risk-off" episodes, can also affect Japan through safe haven flows. Indian markets, on the other hand, are better placed to weather China-related shocks, given the relatively limited trade and financial links with China.

The high vulnerability reflects the region's large exposure to China, especially to its final investment demand. It also reflects the fact that China's impact on regional markets is likely to grow further with the ongoing process of internationalization of the renminbi, the country's gradual capital account opening, and further regional trade integration. For China, clarity and communication on policies will be essential in managing the transition to a model increasingly driven by consumption and services. It will also help moderate the perceived uncertainty for neighboring countries, especially when combined with clarity on the exchange rate regime and consistency in its implementation. For other countries to mitigate these risks and build resilience, they should adopt measures in

**Figure 2.21. Asian Market Sensitivity to China under Different Scenarios**



Sources: Bloomberg, L.P.; and IMF staff estimates.  
 Note: VIX = Chicago Board Options Exchange Volatility Index.  
<sup>1</sup>The shaded bars represent global risk aversion episodes as defined by De Bock and de Carvalho Filho (2015) based on the daily high of the VIX.  
<sup>2</sup>Average sensitivity for Asian countries defined in Annex 2.4. Post-GFC sample is shown. GFC = global financial crisis.



both the short and long term along the following general principles, while considering individual circumstances as discussed in Chapter 1.

### Short-Term Measures

- **Macroeconomic response.** The first recourse if downside risks materialize will be to discharge macroeconomic stimulus measures judiciously. In economies with adequate fiscal space, fiscal stimulus could help smooth the adjustment, especially if targeted to sectors that are hit most by the spillovers. The use of monetary policy can be considered as long as it is consistent with price, financial, and external stability. Flexible exchange rates can provide an effective cushion, barring a trade-off with external stability.
- **Macroprudential policies** can be employed to safeguard financial stability and avoid systemic risks, especially if volatile asset prices and exchange rate movements may

worsen corporate sector vulnerabilities (IMF 2014, 2015c). These may also include capital flow management measures to guard against sudden and large-scale cross-border capital flows associated with large external shocks (IMF 2012b).

### Long-Term Measures

- **Diversification and structural transformation.** The broad structural reform agenda for the region remains important, especially for diversifying sources of growth. Countries in the region should continue efforts to improve competitiveness, diversify their economies, and look for new engines of growth, including through deeper trade integration. Promoting the growth of the services sector can help, both as a response to China's rebalancing toward consumption and as a new source of growth while the region reduces its reliance on manufacturing and exports.

## Box 2.1. Regional Consequences of a Growth Slowdown in China

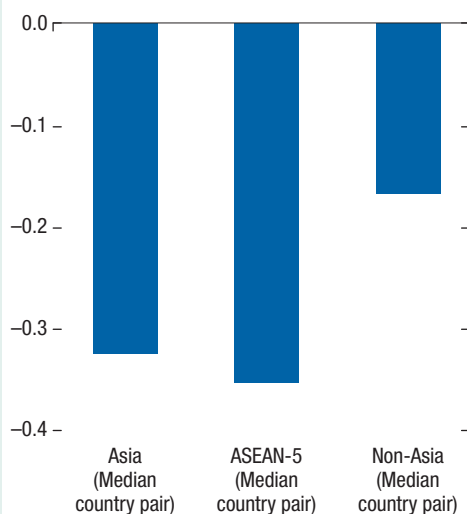
*Spillovers from China have intensified over time, as linkages with China strengthen in both trade and financial terms. Growth spillover effects are estimated to be 0.15–0.30 of a percentage point for each percentage point change in China's growth, applying to both a possible slowdown in the short term and the post-reform growth dividend over the medium term.*

Duval and others (2014) estimate the growth spillover effect of about 0.3 of a percentage point for the median Asian economy, in line with the estimates in Ahuja and Nabar (2012), based on a macro panel approach (Figure 2.1.1).<sup>1</sup> Duval and others (2014) also find that each country's sensitivity to China increases with its exposure to China in terms of value-added trade.

Cashin, Mohaddes, and Raissi (2016) obtain spillover estimates, based on a global vector autoregression (GVAR) model for 26 countries and/or regions during 1981–2013, that are similar to the estimates above for the five largest economies in the Association of Southeast Asian Nations, Indonesia, Malaysia, the Philippines, Singapore, and Thailand—ASEAN-5, but smaller for a median Asian economy. The estimates for the median Asian and ASEAN-5 economies are presented in Figure 2.1.2, while individual country results can be found in Cashin, Mohaddes, and Raissi (2016). The implications of China's slowdown and rebalancing for the ASEAN-5 are also discussed in Dizioli and others (forthcoming).

To gauge the effects of the changing trade relationship between China and individual countries, Cashin, Mohaddes, and Raissi (2016) estimate a GVAR model with time-varying weights, with the earliest in 1982

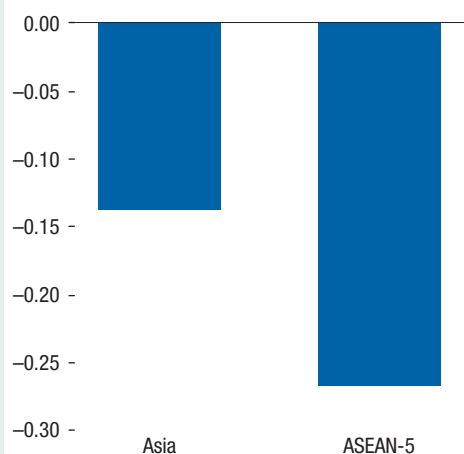
**Figure 2.1.1. Effect of a 1 Percent Growth Surprise in China**  
(Median GDP growth impact after one year, in percentage points)



Source: IMF staff estimates.

Note: Estimates based on column (3) of Table 5 in Duval and others (2014); ASEAN-5 = Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

**Figure 2.1.2. Effect of a 1 Percent Negative GDP Shock in China**  
(Percent change in GDP after one year for a median country)



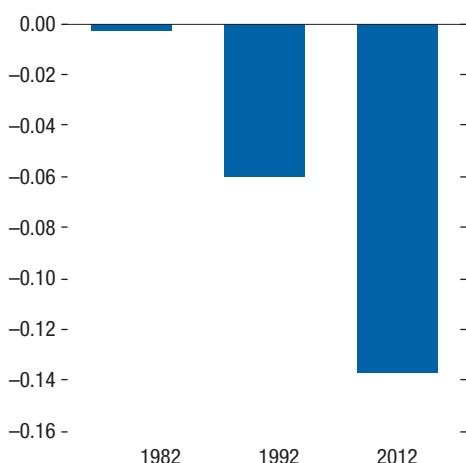
Source: IMF staff estimates based on Cashin, Mohaddes, and Raissi (2016).

Note: Depicts percent change in GDP of a given country after one year associated with a 1 percent permanent decline in China's GDP (equivalent to a one-off 1 percent shock to GDP growth in China) using the 2012 bilateral trade weights; ASEAN-5 = Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

The authors of this box are Sohrab Rafiq and Dulani Seneviratne.

<sup>1</sup>Estimates by Duval and others (2014) are based on a panel estimation for 62 countries during 1995–2011, linking each country's GDP growth to a shock to China's GDP growth.

## Box 2.1 (continued)

**Figure 2.1.3. Effect of a 1 Percent Negative GDP Shock in China***(Percent change in GDP after one year for a median country)*

Source: IMF staff estimates based on Cashin, Mohaddes, and Raissi (2016).

Note: Using time-varying weights. See Figure 2.1.2.

**Table 2.1.1. Time-Varying Elasticity of ASEAN Growth on China's Economic Activity**

	Effect in	
	Jul-06	Jun-15
Cambodia	0.07	0.17
Lao P.D.R.	0.03	0.21
Vietnam	0.04	0.13
<i>FDE average</i>	<i>0.05</i>	<i>0.16</i>
Malaysia	0.12	0.28
Indonesia	0.11	0.23
Philippines	0.10	0.26
Thailand	0.06	0.24
<i>EME average</i>	<i>0.10</i>	<i>0.26</i>

Source: IMF staff estimates based on Rafiq (forthcoming).

Note: Elasticity values are expressed in terms of 1 percent change in China's economic activity. ASEAN = Association of Southeast Asian Nations; EME = emerging market economies; FDE = frontier and developing Asia.

country, the growth spillover effects increased twofold between 1992 and 2012. In addition, negative growth spillovers from China become more severe when global financial markets are under stress.

Rafiq (forthcoming) finds similar growth spillover effects on four ASEAN emerging markets (Indonesia, Malaysia, the Philippines, and Thailand), but somewhat smaller spillover effects on ASEAN frontier economies (Cambodia, Lao P.D.R., and Vietnam—Table 2.1.1). Growth spillovers from China to these countries rose after the global financial crisis, more than doubling in many cases. Moreover, financial conditions in the four ASEAN emerging market economies are found to tighten in response to a growth slowdown in China, as reflected in declining equity prices.<sup>2</sup>

<sup>2</sup>Rafiq (forthcoming) uses a state-dependent structural factor model to capture the time-varying relationship between a panel of ASEAN countries and China real and financial variables.

and the latest in 2012 (Figure 2.1.3). The effects increase substantially over time, reflecting the rising weight of China in the trade of each country. To take the median

## Box 2.2. China's Import Slowdown

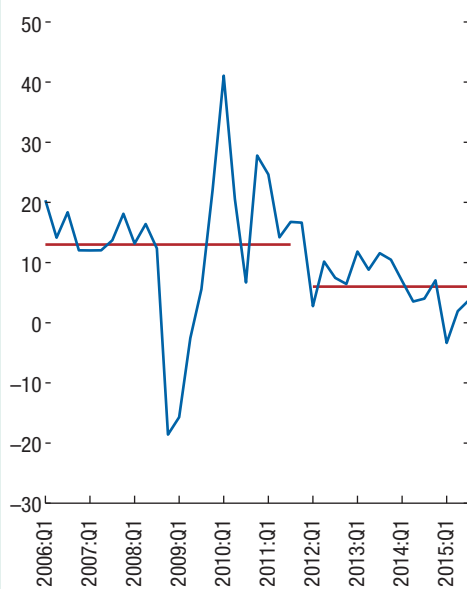
*Rebalancing may explain about a half of China's import slowdown over the past decade, where weak investment and external demand were primary drivers of the overall slowdown in import growth.*

Growth in China's real goods imports slowed since 2012, to 6 percent during 2012–15 from about 13 percent during 2006–11 (Figure 2.2.1). The slowdown was particularly stark in 2014–15, as import growth slowed substantially to below 4 percent on average after strong double-digit growth during 2006–13.

The slowdown reflects a soft global recovery, weak Chinese demand, China's rebalancing, and onshoring (substituting imports with domestically produced goods). Our empirical findings attribute the decline in China's import growth to these four causes, with the first two primarily associated with the level of demand and the latter two associated with the composition of demand. First, weak global demand reduces China's exports and imports of inputs, reflecting the critical role of shock transmitter that China has played as the key downstream leg in global value chains. Second, soft domestic activity in China also suppresses imports. Third, China is shifting away from exports toward domestic demand, and within the latter from investment to consumption, a less import-intensive sector (Figure 2.2.2). On the production side, the transition includes switching from the import- and investment-intensive manufacturing sector to a more domestic-demand-oriented services sector. Lastly, onshoring continues as China's production technology becomes more

sophisticated and more energy efficient. Such structural changes will lower import growth even without a change in the level of domestic economic activity.

**Figure 2.2.1. China: Real Import Growth**  
(Year-over-year; percent)



Source: IMF staff estimates.

Rebalancing may explain about half of China's import slowdown since 2012. Our analysis is based on the conventional trade regression. Following Bussière and others (2013), domestic activity is measured by the import-adjusted demand (IAD), which is a geometric average of GDP components, weighted by their import intensities calculated from input-output tables. The ratio of processing imports to gross exports is used as a proxy for onshoring, and external demand is measured by China's exports. The average growth rate of goods imports during 2012–15 declined by 6.8 percentage points compared with the average for 2006–11 (Table 2.2.1). External demand dragged import growth down by 1.5 percentage points, and weaker investment reduced import growth by 3.9 percentage points.<sup>1</sup> However, this is a mixture of demand slowdown and rebalancing. To separate the effect of rebalancing, we create a counterfactual scenario assuming that the growth rates of consumption, investment, and exports had all declined at the same pace as GDP growth since 2012.<sup>2</sup> As presented in the second column of

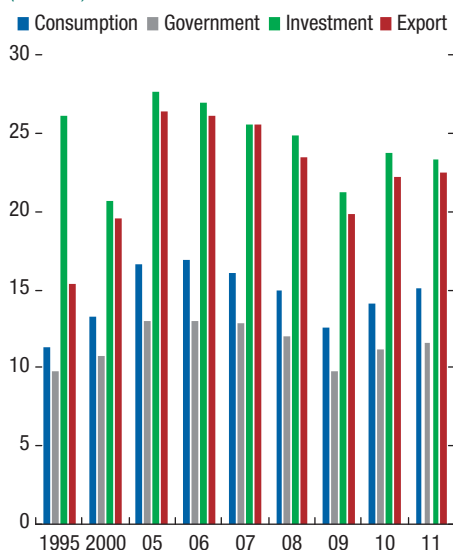
The author of this box is Wei Liao. The analysis is based on Hong and others (forthcoming).

<sup>1</sup>We find the real effective exchange rate had a very limited impact on China's import growth. This is consistent with the literature (Ahmed 2009; Cheung, Chinn, and Qian 2012), and is regarded to reflect China's role as the assembly hub—the impact of the real effective exchange rate on imports could be offset by its impact on exports, as a large share of imports is used for producing exports. We also find that the pace of onshoring flattened over the 2012–15 period on average, while it reaccelerated in 2015.

<sup>2</sup>Technically, there is some uncertainty about the impact of rebalancing on a slowdown in imports owing to difficulties in identifying the counterfactual nonrebalancing path. Therefore, the results should be read as illustrative.

## Box 2.1 (continued)

**Figure 2.2.2. Import Intensity in GDP Components**  
(Percent)



Sources: World Input-Output Database; and IMF staff estimates.

**Table 2.2.1. China: Import Growth Decomposition (Percentage points)**

	2012-2015 over 2006-2011	If no Rebalancing	Effect of Rebalancing
Imports	-6.8		
Import-adjusted demand	-7.2		
Domestic demand	-5.8		
Consumption	-0.7	-1.3	0.6
Government	-1.2		
Investment	-3.9	-1.3	-2.6
External demand	-1.5	0.1	-1.6
Onshoring	0.5		
Residual	-0.1		
		Net effect	-3.6

Source: IMF staff estimates.

Table 2.2.1, had there been no rebalancing, consumption would have made a larger negative contribution of -1.3 percentage points, while the negative contribution of investment and exports would have been smaller (-1.3 and 0.1 percentage points only, respectively). The difference between the contributions obtained using actual data and using a nonrebalancing scenario is the net effect of rebalancing (the third column).

### Box 2.3. China Opening Up: The Evolution of Financial Linkages

*China's financial links with the rest of the world are already sizable and set to grow further with the internationalization of the renminbi and gradual capital account liberalization.*

Despite capital controls, China is rapidly integrating with the global financial system. Foreign claims on China now approach \$5 trillion, with bank and portfolio claims accounting for \$1 trillion each (Figure 2.3.1). These figures are larger than for any other emerging market, suggesting that global investors' exposure to a repricing of Chinese assets is substantial. China also accounts for a large share of emerging market capital flows. In 2015, almost all of the capital outflows from emerging markets were accounted for by China (IIF 2016).

The region's financial links with China increased in general, both through direct links and through Hong Kong SAR (Figure 2.3.2). As a global financial center and hub for offshore renminbi clearing and settlement, Hong Kong SAR intermediates funds from other countries to China.<sup>1</sup> Financial claims on China and Hong Kong SAR combined (including portfolio, bank, and foreign direct investment exposures) were more than 10 percent of GDP for Korea, Singapore, and Taiwan Province of China at the end of 2014.

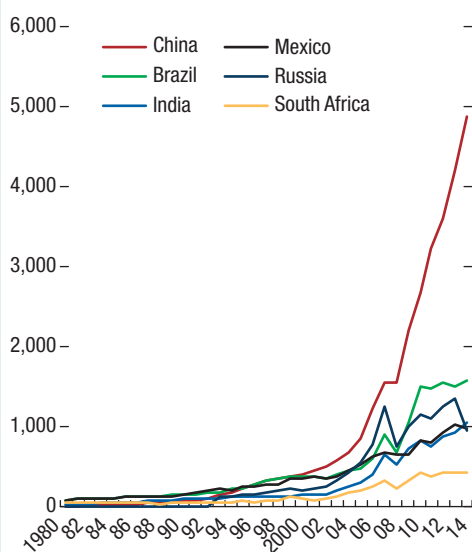
Cross-border bank exposures to China expanded quickly but remain concentrated in a few economies. According to Fitch estimates, banks in the Asia-Pacific region accumulated about \$1.2 trillion of China-related exposures by the end of 2014, driven by closer economic ties with China and a booming offshore renminbi

business.<sup>2</sup> In particular, at the end of 2014 cross-border loans to China accounted for 32 percent of banking system assets in Hong Kong SAR, followed by Singapore (12 percent), and Taiwan Province of China (8 percent).

In addition, China has been a source of substantial foreign direct investment, overseas bank lending, and reserve arrangements. China's outward direct investments reached \$1 trillion at the end of 2015, of which an estimated \$300 billion went to Asia, representing 6.5 percent of recipient-country GDP on average (Figure 2.3.3). Similarly, China's five largest banks' overseas loans increased by more than \$400 billion since 2010 to reach \$677 billion at the end of 2014, and is likely to grow further with the government's support for companies' "go global" policies, accelerating internationalization of the renminbi, and new policy initiatives such as "One Belt, One Road." Meanwhile, China has launched more than 30 bilateral currency swap agreements since 2008, with an outstanding amount of \$500 billion at the end of 2015 (Figure 2.3.4). At the same time, China's (nonreserve) overseas portfolio investments have remained broadly unchanged at about \$250 billion, and are mainly related to its sovereign wealth fund.

The adjustment in China's gross investment position could potentially be very large. Bayoumi and Ohnsorge

**Figure 2.3.1. Major Emerging Markets: Total External Liabilities**  
(Billion U.S. dollars)



Source: Updated and extended version of the Lane and Milesi-Ferretti (2007) dataset.

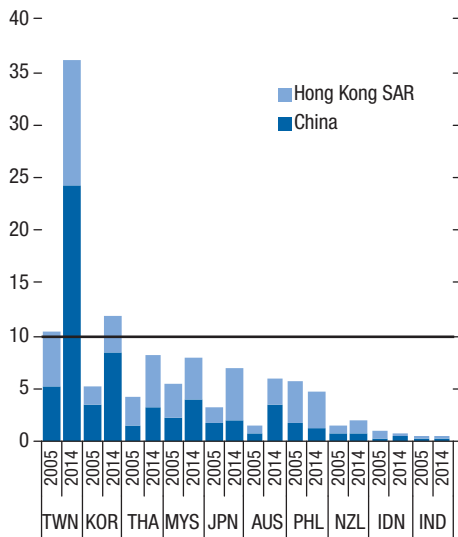
The author of this box is Wei Liao. The analysis is based on Arslanalp and others (forthcoming).

<sup>1</sup>Hong Kong SAR accounted for nearly half of China's external liabilities at the end of 2014. About 50–60 percent of the Hang Seng Index is comprised of mainland companies listed in Hong Kong SAR.

<sup>2</sup>The development of offshore renminbi centers, of which eight are in the region, has supported the growth of cross-border bank linkages. About RMB 2 trillion of deposits was estimated to be held outside of China at the end of 2014.

Box 2.3 (continued)

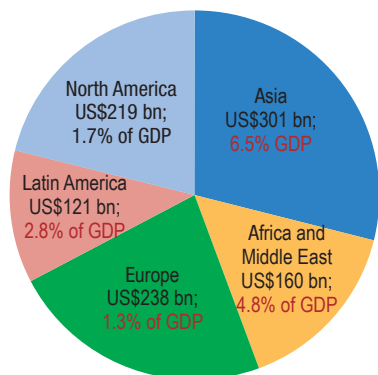
**Figure 2.3.2. Asia: Financial Claims on China and Hong Kong SAR**  
(Portfolio, bank, and foreign direct investment claims; percent of GDP)



Sources: Bank for International Settlements; IMF, Coordinated Direct Investment Survey and, World Economic Outlook database; and IMF staff estimates.  
Note: AUS= Australia; IND = India; IDN = Indonesia; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; THA = Thailand; TWN = Taiwan Province of China. Financial claims of Singapore on China and Hong Kong SAR are not reported but exceed 10 percent of GDP.

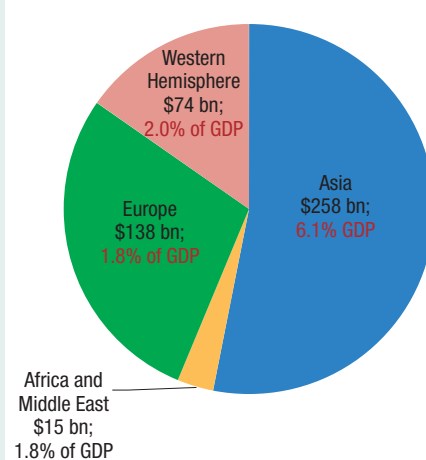
(2013) estimate that capital account liberalization in China may be followed by a stock adjustment of *Chinese assets* abroad on the order of 15–25 percent of GDP and a smaller stock adjustment for *foreign assets* in China on the order of 2–10 percent of GDP. China has recently taken an important step to open up its bond market to foreign investors, and thus inflows to bond market may increase soon. If China were included in global equity indices such as the Morgan Stanley Capital International (MSCI) Index, the initial portfolio rebalancing by global investment funds could also be large.

**Figure 2.3.3. China: Outward Direct Investment, end-2015**  
(Billions of U.S. dollars; percent of GDP)



Sources: China Global Investment Tracker; national sources; and IMF staff estimates.  
Note: Figures in red indicate the average size of Chinese outward direct investment in each region as a percent of recipient-country GDP.

**Figure 2.3.4. China: Bilateral Currency Swap Agreements, end-2015**  
(Billions of U.S. dollars; percent of GDP)



Source: IMF staff estimates.  
Note: Figures in red indicate the average size of swap lines in each region as a percent of recipient-country GDP.

## Annex 2.1. Measures of Trade and Financial Linkages and Financial Market Data

### Measures of Trade and Financial Linkages

The data span the period from 2001 to 2014 and include nine Asian economies (Australia, India, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Taiwan Province of China, and Thailand) and four “center” economies (China, Japan, the euro area, and the United States). The regional economies are denoted by  $i$  and the center economies are denoted by  $c$ .

- *Trade exposure.* Trade exposure between country  $i$  and country  $c$  is measured by the domestic value added produced by country  $i$  and embodied in the final demand by country  $c$ , capturing both direct and indirect trade linkages. Specifically, this measure includes two types of value added embodied in (1) direct exports of final goods and services from country  $i$  to country  $c$  and (2) exports of intermediate goods from country  $i$  to other countries that will eventually be re-exported to country  $c$  for final demand. The data are sourced from the OECD-WTO TiVA database covering the years 1995, 2000, 2005, and 2008–11. A continuous time series through 2014 is constructed by following as closely as possible the OECD-WTO methodology but using the United Nation’s Comtrade data and national income accounts statistics. The methodology is explained in detail in Appendix A of a recently published *Journal of International Economics* article on value-added trade and business cycle synchronization (Duval and others 2015); furthermore, the approach of using Comtrade data along with national accounts data to separate intermediate inputs trade from final goods trade is also similar to Johnson and Noguera (2012a; 2012b) and Timmer (2012).

The main author of this annex is Dulani Seneviratne. The analysis is based on Arslanalp and others (forthcoming).

- *Trade competition.* Trade competition is proxied by constructing the export similarity index (ESI) at the five-digit level, as in:  $ESI_{i,c} = \sum_k [\min(X_{i,k}, X_{c,k})]$ , where  $X_{i,k}$  and  $X_{c,k}$  are industry  $k$ ’s export shares in country  $i$ ’s and country  $c$ ’s exports. Product-level data for ESI calculations are obtained from the UN Comtrade database. For instance, if markets are pricing in downside risks in country  $c$  corresponding to a depreciation of country  $c$ ’s exchange rate, this could improve country  $c$ ’s trade competitiveness; hence, yielding a negative effect on asset price returns of country  $i$  that are important trade competitors. All in all, this variable allows us to look into modalities of trade in addition to the degree of trade captured by the trade exposure variable.
- *Direct financial linkages.* Financial linkages include portfolio investment, cross-border bank lending, and foreign direct investment by country  $i$  in country  $c$  (in percent of country  $i$ ’s GDP) to capture exposure to losses that may arise from a repricing of assets in country  $c$ . Data on stock of bilateral portfolio investment positions are obtained from the IMF’s Coordinated Portfolio Investment Survey database and data on stock of bilateral direct investment positions subsequent to 2009 are obtained from the IMF’s Coordinated Direct Investment Survey database. Direct investment series prior to that are constructed by using data from databases from the United Nations Conference on Trade and Development. Bilateral cross-border lending data are based on unpublished bilateral locational banking statistics from the Bank for International Settlements. Direct financial linkages with China are estimated including exposures to both China and Hong Kong SAR given that Hong Kong SAR serves as a financial gateway to China.

### Financial Market Variables

Our data set includes daily data from January 2001 to January 2016 covering nine Asian economies



(Australia, India, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Taiwan Province of China, and Thailand) and four “center” economies (China, Japan, the euro area, and the United States).

- *Asset market returns.* Equity market returns are measured by the first differences in local-currency national equity indices in logs.<sup>1</sup> Foreign exchange returns are measured by the change in the local currency against the dollar (first differences in logs). Bond market returns are measured by the 10-year local-currency government bond yield (first differences in percentage points). The data are sourced from Bloomberg, L.P.<sup>2</sup>
- *Global risk appetite* is measured by the Chicago Board Options Exchange Volatility Index (VIX).
- *The world interest rate* is measured by the U.S. “shadow” policy rate, which takes into account unconventional monetary policies. The data come from Wu and Xia (2015).
- *Commodity prices* are measured by the Bloomberg Commodity Index. This is a comprehensive commodity index covering 22 commodities in seven sectors.
- *Country risk* is measured by the country credit default swap spreads and, if not available, by the J.P. Morgan Emerging Market Bond Index-Global (EMBIG) sovereign spread.

<sup>1</sup>The specific stock indices in the analysis are the Shanghai Composite Index (China), NIKKEI 225 (Japan), ASX 200 (Australia), NZX 50 (New Zealand), KOSPI (Korea), TWSE (Taiwan Province of China), Jakarta Composite (Indonesia), FTSE/KLCI (Malaysia), PSE Composite Index (the Philippines), SET Index (Thailand), and BSE SENSEX 30 (India).

<sup>2</sup>One issue to address in calculating the returns is the different time zones of the Asian financial markets, euro zone, and United States. As Asian trading is ahead of the United States, shocks from Asian markets are always incorporated into U.S. asset prices, while shocks to U.S. markets can only affect Asian trading on the next trading day. Following the practice in the literature (Forbes and Rigobon 2002), we use two-day rolling average returns in the analysis.

## Annex 2.2. Estimating Spillovers from Rebalancing to Exports and Growth

### From Rebalancing to Exports

The baseline country-specific regression is the following ordinary least square regression:

$$DVA_{i,t}^D/GDP_{i,t} = \alpha_i + \beta_i^D D_{CHN,t} + \varepsilon_{i,t}$$

where  $i$  refers to a country,  $t$  to time, and  $D$  to China's consumption or investment in log.  $DVA_{i,t}^D/GDP_{i,t}$  is the ratio of domestic value-added exports to China to a country's GDP, also in log. Coefficient  $\beta_i^D$  is the elasticity of the DVA/GDP ratio to a 1 percent change in China's consumption (or investment).

Winners and losers from rebalancing can be calculated as follows. Assume a rebalancing scenario in which China's consumption grows by  $x^{c,R}\%$  and investment by  $y^{c,R}\%$ . Also, let China's consumption and investment growth under the no-rebalancing scenario be  $x^{c,N}\%$  and  $y^{c,N}\%$ . Let  $x^{c,R} > x^{c,N}$  and  $y^{c,R} > y^{c,N}$ . So, the net change in the exports to China from each country will be

$$\Delta_i = (x^{c,R} - x^{c,N}) * \beta_i^C * \frac{DVA_{i,t}^C}{GDP_{i,t}} + (y^{c,R} - y^{c,N}) * \beta_i^I * \frac{DVA_{i,t}^I}{GDP_{i,t}}$$

If net change  $\Delta_i > 0$ , the country gains from rebalancing. If negative, the country loses from rebalancing.

### From Rebalancing to Growth

Shocks to China's consumption and investment growth are estimated on the basis of a four-variable vector autoregression where shocks are identified by Cholesky decomposition with the following ordering:

$$Q_t = [Y_{WLD,t}, Y_{CHN,t}, C_{CHN,t}, I_{CHN,t}]^1 \text{ and} \\ Q_t = \Phi Q_{t-1} + u_t$$

where  $t$  is year. Shocks estimated above are used to calculate the growth effect of shocks to consumption and investment as follows, allowing for two-year lagged effects:

$$g_{i,t} = \alpha_i + \beta_t + \Phi_1(1) shock_{CHN,t}^D \\ + \Phi_2(1) shock_{CHN,t}^D TradeExp_{CHN,t-1}^D \\ + \Phi_a(1) TradeExp_{CHN,t-1}^D + \gamma X'_{it} + u_{i,t}$$

where  $g_{i,t}$  stands for GDP growth of country  $i$  at time  $t$ , superscript  $D$  stands for China's consumption or investment demand;  $shock_{CHN,t}^D$  denotes shocks to growth in China's  $D$  (consumption or investment); and  $X'_{it}$  denotes other controls including the VIX to control for global financial uncertainty and global commodity prices.  $TradeExp_{CHN,t-1}^D$  captures direct and indirect bilateral trade exposure to China measured as domestic valued added of country  $i$  exported for Chinese final consumption/investment, in percent of country  $i$ 's GDP in the previous year.

The propagation of investment/consumption growth shocks originating from China to each country's growth incorporates the interaction term between the demand shock and trade exposure:

$$\varphi_1(1) + \varphi_2(1) TradeExp_{CHN,t-1}^D$$

The net effect of rebalancing on GDP growth is constructed in the equivalent way as in the effects on exports, by applying the growth rate differentials to the estimated growth effects of shocks to  $D$ .

The authors of this annex are Gee Hee Hong and Dulani Seneviratne. The analysis is based on Hong and others (forthcoming)

<sup>1</sup>  $Y_{WLD,t}$  = global GDP;  $Y_{CHN,t}$  = GDP growth;  $C_{CHN,t}$  = Consumption growth;  $I_{CHN,t}$  = Investment growth. To test for robustness, we also used shocks estimated using different ordering, and results remain broadly unchanged.

## Annex 2.3. Event Study

The event study used in the chapter is implemented by identifying outsized movements (shocks) in the Chinese stock market. We then explore how these shocks were transmitted to other markets, especially to countries with strong trade links with China (the treatment group) versus others (the control group).

Chinese market shocks are defined as days when the movement in the Shanghai Composite Index was more than 5 percentage points (either up or down). From this sample, we exclude days that were likely driven by global events happening outside of China by taking out days when the U.S. stock market closed substantially higher or lower (by one standard deviation) before the Chinese market opened. Finally, for the remaining sample (of 30 episodes), we conduct a thorough news search to link the Chinese stock market movements to specific news or policy actions happening during that day (Annex Table 2.3.1).

The main author of this annex is Shi Piao. The analysis is based on Arslanalp and others (forthcoming).

**Annex Table 2.3.1 Event Study: Significant Changes in the Chinese Stock Market**

Periods	Date	Chinese stock return (percent)	Event
Pre-GFC (2001:M1–2007:M12)	7/30/2001	-5.3	Regulators issue rules ordering listed firms to sell state shares in IPOs. The order sparks a four-year market slump in which the index loses half its value.
	1/23/2002	6.3	Stock market rises sharply on news that the selling of state shares may be delayed.
	1/28/2002	-6.3	CSRC issues a draft rule that the market interprets as a sign that the government will soon resume the sell-off of state shares.
	1/31/2002	6.8	CSRC issues a clarification emphasizing that the provisional draft was posted for comments and no final decision had been made.
	6/24/2002	9.3	Chinese markets rally after the government acts to stem a prolonged slump in 2002 by scrapping a plan to sell further shares of state-owned enterprises.
	1/14/2003	5.8	Continued market volatility due to prospective sale of state shares.
	2/2/2005	5.3	Continued market volatility due to prospective sale of state shares.
	6/8/2005	8.2	China's stock markets rebound from an 8-year low, as markets see an end to the regulators' plans to sell government-owned shares.
	2/27/2007	-8.8	The Chinese government imposes controls to curb speculation in overheating stock markets, triggering a 9 percent drop in the domestic stock market and worldwide losses of around 2 percent.
	5/30/2007	-6.5	The Ministry of Finance announces at midnight an immediate rise in China's stock trading tax to 0.3 percent from 0.1 percent to cool the market, which rose more than 50 percent since the beginning of 2007. The index falls 21 percent by June 5.
	6/4/2007	-8.3	The market continues to slide following the Ministry of Finance decision.
	7/5/2007	-5.2	Chinese stocks down sharply after Premier's comments, which suggest that China has the ability to deal with economic risks but do not specifically mention the country's embattled stock market.
	Post-GFC (2010:M1–2015:M6)	11/12/2010	-5.2
6/24/2013		-5.3	The PBoC tells the country's largest banks to rein in risky loans and improve their balance sheets; fears of a credit crunch in China unsettles global markets.
12/9/2014		-5.4	China's share prices dropped by the most in 5 years, after regulators tighten repo collateral rules.
1/19/2015		-7.7	Chinese equities fall sharply near 8%, following tighter rules for margin lending. Local media reports that the PBoC is continuing to inject liquidity through banks by rolling over and increasing access to the medium-term lending facility (MLF).
5/28/2015		-6.5	China's sovereign wealth fund confirmed to have sold over US\$ 500 million of domestic bank stocks earlier in the week.
6/19/2015		-6.4	Shanghai Composite Index falls 6.4% as analysts warn of potential bubble in the stock market
6/26/2015		-7.4	Chinese equities sharply lower as Morgan Stanley joined the list of investment banks warning that Chinese shares are overvalued, citing increased equity supply, weak earnings growth and the surge in margin debt. It warned that the Shanghai Composite index may fall as much as 30% through mid-2016.
6/30/2015		5.5	Chinese share prices remained volatile and rebounded after the government confirmed plans to increase the equity allocation of public pension fund portfolios to 30%. The securities regulator commented that the rapid corrections of share prices may harm economic and social development.
Since June 2015 (2015:M1–2016:M1)	7/1/2015	-5.2	Chinese equities sell-off sharply again as Chinese manufacturing PMI in June comes in below expectations.
	7/3/2015	-5.8	The Shanghai Composite Index plunges as leveraged investors pull back. The China Financial Futures Exchange denies rumors that foreign institutions had engaged in "massive" short-selling of mainland A-shares using index futures.
	7/8/2015	-5.9	Chinese equities continue to fall despite official efforts; The PBoC commits to "stabilize the stock market and avoid systemic risk and local financial risks" by providing "ample liquidity" to the CSFC; China slump spills over to other Asian equities; FTSE Asia (ex Japan) hits 16 month low.
	7/9/2015	5.8	China stocks rebound but half of all stocks still suspended from trading; China's bank regulator encourages lending to finance share buybacks.
	7/27/2015	-8.5	Chinese stocks plunge 8.5 percent, the biggest daily drop since 2007 after data show industrial profits fall in June and a government think-tank estimates that local government debt reached RMB 30 trillion (US\$ 4.9 trillion) at end-2014.
	8/18/2015	-6.1	Shanghai stocks plummet 6 percent amid worries about a possible withdrawal of stock market support by the government and worries about continued yuan depreciation against the dollar following the introduction of the new exchange rate regime a week earlier.
	8/24/2015	-8.5	"Black Monday" in China sees equities tumble 8.5 percent, erasing gains for the year; investors ignore the government's latest decision to allow pension funds to buy equities. U.S. equity volatility surges, VIX quotations suspended in early Monday session
	11/27/2015	-5.5	The Shanghai Composite tumbles 5.5 percent, the most since August, as three of the largest Chinese securities firms announce that they are the subject of new investigation of alleged violations of margin and short-selling rules.
	1/4/2016	-6.9	Chinese stocks fall sharply by 7 percent triggering circuit breakers.
	1/11/2016	-5.3	Chinese equities fall sharply as offshore CNH interbank rate spikes to 13 percent amid possible offshore intervention to squeeze liquidity.

Sources: Bloomberg L.P.; and news reports.

Note: CFSC = China Securities Finance Corporation; CSRC = China Regulatory Commission; GFC = global financial crisis; IPO = initial public offering; MLF = medium-term lending facility; PBoC = People's Bank of China; PMI = Purchasing Managers Index.

## Annex 2.4. Decomposing Drivers of Financial Spillovers Using the Forbes-Chinn (2004) Approach

The Forbes and Chinn (2004) approach involves a two-stage panel regression. In the first stage, we estimate country-specific “betas” (or factor loadings) to systemic economies (that is, “center” economies—China, the euro area, Japan, and the United States), controlling for global, sectoral, and country-specific factors (see equation 1). In the second stage, we use the factor loadings estimated

the effect of stock market returns in the center economies on equity returns of the nine Asian economies (Australia, India, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Taiwan Province of China, and Thailand).

Equation 1 is essentially based on an international capital asset pricing model (ICAPM) of the expected return of each country’s stock market, allowing for the influence of global and regional stock markets on local returns. For conceptual discussions of the ICAPM, see Frankel (1994), Kho, Lee, and Stulz (2000), and Stulz (1999).

**Annex Table 2.4.1 Panel Regression: First-Stage Results—Estimated Cross-country Factor Loadings**

	Systemic Economy/Region (i.e. Centers)				N	R <sup>2</sup>
	China	United States	Japan	Euro area		
Australia	0.050***	0.265***	0.241***	0.045***	2,676	0.519
India	0.080***	0.162***	0.213***	-0.055**	2,522	0.165
Indonesia	0.075***	0.198***	0.241***	-0.047**	2,520	0.236
Korea	0.038***	0.099***	0.464***	0.026	2,608	0.442
Malaysia	0.049***	0.106***	0.133***	0.033**	2,568	0.229
New Zealand	0.022***	0.213***	0.068***	0.029***	2,649	0.304
Philippines	0.040***	0.305***	0.129***	0.067***	2,546	0.260
Taiwan Province of China	0.060***	0.181***	0.352***	-0.002	2,631	0.315
Thailand	0.073***	0.116***	0.200***	-0.014	2,468	0.177

Note: Only the factor loadings for the full sample are shown for illustrative purposes.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: IMF staff estimates.

in the first stage to decompose the spillovers into trade linkages (measured by both trade exposure and trade competition), and financial linkages (see equation 2).

### First-stage regressions (equation 1):

$$R_{i,t} = \alpha + \beta_{i,t}^C R_{s,t} + \gamma_1 X_t + \delta_1 Y_{i,t} + \epsilon_{i,t}$$

where  $R_{i,t}$  is the equity return in country  $i$  at time  $t$ ;  $X$  includes global factors, in particular global risk appetite, world interest rates, and commodity prices; and  $Y$  reflects country-specific risk factors. The coefficient  $\beta_{i,t}^C$  can be interpreted as country-specific factor loadings. Specifically, this captures

The main author of this annex is Dulani Seneviratne. The analysis is based on Arslanalp and others (forthcoming).

### Second-stage regressions (equation 2):

$$\beta_{i,t}^c = \alpha + \gamma_1 \text{Trade Linkages}_{i,c,t} + \gamma_2 \text{Financial Linkages}_{i,c,t} + \gamma_a \text{GFC} + \epsilon_{i,t}$$

where  $\beta_{i,t}^c$  are the country-specific factor loadings that come from the first-stage regression above; *Trade linkages* capture trade exposure and trade competition (see Annex 2.1); *Financial linkages* include direct financial linkages—cross-border lending, portfolio investment, and direct investment (see Annex 2.1); and *GFC* is a dummy that takes the value one for the period from 2008 to 2009.

The results of the first-stage regression are shown in Annex Table 2.4.1, while the second-stage regression results are shown in Annex Table

**Annex Table 2.4.2. Panel Regression: Second-Stage Results—Determinants of Equity Market Spillovers**

	Linkages with China	Linkages with Japan
Trade exposure	1.746* (2.058)	1.492 (0.799)
Trade competition	-0.128 (-0.251)	-1.057*** (-3.590)
Financial linkages	0.117 (0.542)	0.271 (0.313)
Number of observations	126	126
R-squared	0.241	0.588

Robust t-statistics in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ 

Source: IMF staff estimates.

2.4.2. It is worth noting that trade competition is statistically and economically significant in the case of Japan. Hence the falling market correlations with Japan while trade exposure remains large may be driven by the modalities of trade such as trade competition. On the contrary, due to China's dominance as a hub for global-value-chain-related trade, driven by complementarities, trade exposure remain statistically and economically significant. Arslanalp and others (forthcoming) provide further details on these results, including robustness checks such as using alternative definitions of asset returns (that is, excess returns, or dollar returns). Summary statistics on the variables used in the regression are provided in Annex Tables 2.4.3 and 2.4.4.

**Annex Table 2.4.3 Correlation between the Variables in First Stage**

	SMI <sub>CHN</sub>	SMI <sub>USA</sub>	SMI <sub>JPN</sub>	SMI <sub>EA</sub>	VIX	Commodity Prices	Country Risk	Shadow Federal Funds Rate
SMI <sub>CHN</sub>	1							
SMI <sub>USA</sub>	0.169	1						
SMI <sub>JPN</sub>	0.241	0.495	1					
SMI <sub>EA</sub>	0.143	0.597	0.402	1				
VIX	-0.072	0.096	-0.141	0.031	1			
Commodity prices	0.109	0.109	0.156	-0.015	-0.239	1		
Country risk	-0.091	-0.125	-0.195	-0.064	0.234	-0.153	1	
Shadow federal funds rate	0.010	0.040	0.045	0.030	-0.074	0.050	-0.059	1

**Annex Table 2.4.4 Correlation between the Variables in Second Stage**

	Trade Linkages	Trade Competition	Financial Linkages
Trade linkages	1		
Trade competition	0.159	1	
Financial linkages	0.286	0.011	1