

SPIILLOVER

NOTES

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of China's Slowdown for
International Trade

Patrick Blagrove and Esteban Vesperoni

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SPILLOVER IMPLICATIONS OF CHINA'S SLOWDOWN FOR INTERNATIONAL TRADE

We study spillovers from China's economic transition on export growth in 46 advanced and emerging market economies. Using a panel vector autoregression and a novel measure of export-intensity-adjusted final demand, our analysis suggests that a 1 percentage point shock to China's final demand growth would reduce export growth by about 0.1–0.2 percentage points for the average country. The impact is largest in Emerging Asia, where an export-growth accounting exercise suggests that China's economic transition has reduced average export growth rates by 1 percentage point since early 2014. Other countries linked to China's manufacturing sector, as well as commodity exporters, are also significantly affected. This suggests that trading partners need to adjust to an environment of weaker external demand as China completes its transition to a more sustainable growth model.

China's transition to a more sustainable growth path will benefit medium-term global prospects by reducing tail risks, but it comes at the short-term cost of lower demand for imports. China's rapid investment-driven growth of recent years fostered a remarkable expansion of global trade. However, growth has slowed as the economy rebalances from import-intensive investment to consumption. This transition is depressing trade, which stagnated in 2015 (Figure 1). The growing size and openness of the Chinese economy—which increased its share in global imports from 5 percent in 2005 to 10 percent in 2015—suggest that spillovers could be significant. China's transition will likely have a permanent impact on trade, with lower global demand and export prices in some markets—notably commodities.

This note focuses on the implications of China's economic transition for global trade. It analyzes the impact of China demand shocks on trading partners'

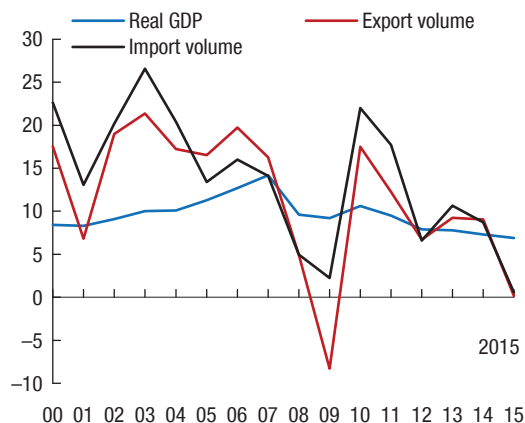
export growth, and quantifies their role in the global trade slowdown over the last two years.¹

The note addresses two empirical challenges. First, while China is a significant global source of final demand, its integration in global supply chains means that it can also *transmit* shocks from other countries. To capture the role of China as a potential source of shocks, we estimate a China demand shock that is not associated with external demand. A second issue is that China's economic transition involves rebalancing, which implies that spillovers to different countries depend on their exposure to different sectors of the Chinese economy—secondary sector (predominantly investment) against tertiary sector (more related to consumption). Hence, we use the Organisation for Economic Co-operation and Development's (OECD's) Trade in Value Added (TiVA) data to build country-specific China demand shocks. These data allow us to identify partners' exports that are directed to specific sectors in China's final demand.

The analysis uses a panel vector autoregression (PVAR) and in-sample projections for the period between the first quarter of 2014 and the third quarter of 2015. The sample includes 46 advanced and emerging market economies for which TiVA data are available, and the model is estimated using quarterly data starting in the first quarter of 2003, given the structural break in the Chinese economy after its accession to the World Trade Organization (WTO) in the early 2000s. The model includes the country-specific China demand shock and trading partners' export volumes, as well as exchange rates and country-specific external demand excluding China—which can also affect export growth in China's trading partners. We also conduct in-sample projections, which cover the period in which global trade decelerated sharply.

We are grateful to Chanpheng Fizarotti, Ava Hong, and Jeffrey Lam (all of the IMF's Research Department) for excellent research assistance. The note benefited from useful discussions with Michal Andrle, Helge Berger, Oya Celasun, Davide Furceri, Gian Maria Milesi-Ferretti (all Research Department), and Kadir Tanyeri. In addition, we also thank participants at the European Central Bank's Spillover Workshop, and the members of the IMF Spillover Task Force, for their insightful comments.

¹An extended version of this note will be issued as an IMF Working Paper—see Blagrove and Vesperoni (forthcoming). The note looks at China's slowdown, but it does not disentangle the impact of rebalancing per se. For a discussion of rebalancing, see Dizioli, Hunt and Maliszewski (forthcoming), Hong, Liao, and Seneviratne (2016), and IMF (2016).

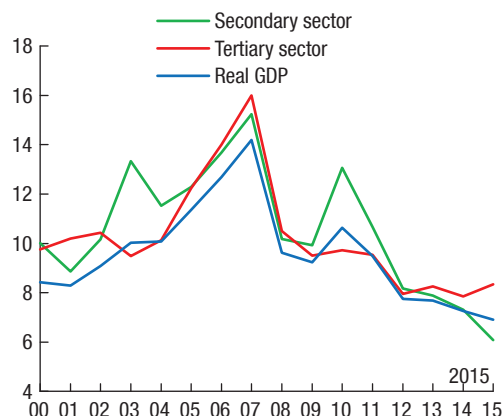
Figure 1. China: GDP and Trade GrowthSource: IMF, *World Economic Outlook*.

Our results suggest that China's transition has played a significant role in the recent slowdown in global exports, and that its impact has differed across countries. PVAR estimates show that for a country with an average trade exposure to China, a 1 percentage point negative shock to China's final demand growth reduces export growth by 0.1–0.2 percentage points. Estimated impacts differ across countries, with those in Emerging Asia most affected—exports in these countries are almost 1 percent lower after a year, following a 1 percent level shock to China's final demand (lasting one year). Commodity exporters and countries exposed to China's manufacturing sector are also significantly affected, suggesting that shocks to demand in China have economically meaningful spillovers. In line with these results, in-sample projections suggest that about one-sixth of Emerging Asia's recent export-growth slowdown could be associated with China's transition, with smaller impacts elsewhere.

The remainder of the note proceeds as follows. The next section presents stylized facts of the recent global trade slowdown and countries' trade exposures to China's final demand. The third section documents the construction of the export-intensity-adjusted China demand shock. The fourth section describes the PVAR estimation. The fifth section presents the in-sample forecasting exercise, and the final section gives conclusions and discusses policy issues.

Stylized Facts

This section describes stylized facts of China's economic transition, the recent slowdown in global trade,

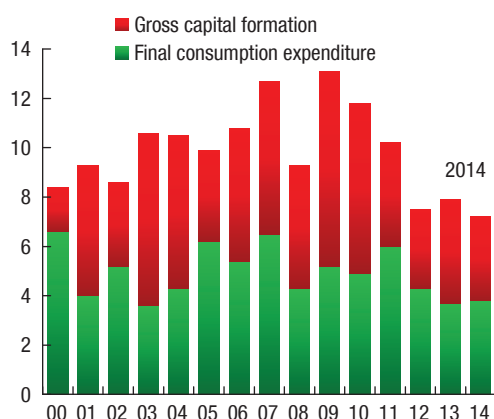
Figure 2. China: GDP Growth by Sector

Source: Haver Analytics.

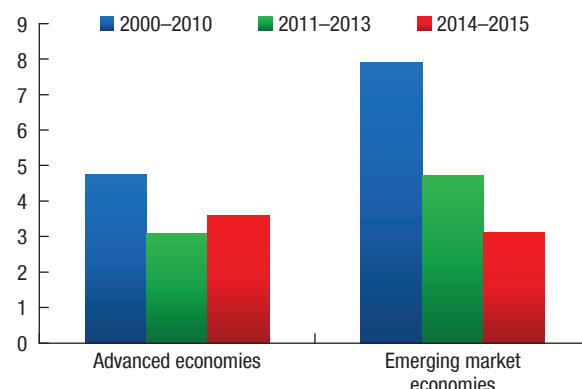
and countries' exposures to China's final demand. This will inform our analysis of the role played by China in the recent trade slowdown.

Since reaching a peak of just over 14 percent in 2007, economic growth rates in China have been slowing steadily. The first phase of this slowdown coincided with the global financial crisis and its aftermath—this period was characterized by an increase in public spending on infrastructure and a housing-market boom, with growth rates in the range of 9–10 percent during 2008–11.² Since then, GDP growth has slowed further, reaching 6.9 percent in 2015. The adjustment of GDP growth differs by sector and by expenditure component (see Figures 2 and 3). GDP data by industry suggest that China's secondary sector has exhibited a more marked reduction—activity growth has slowed from more than 10 percent during 2008–11 to 6.0 percent in 2015—while its tertiary sector has shown a more muted deceleration—from about 10 percent during 2008–11 to 8.3 percent in 2015. On the expenditure side, the contribution of investment activity has slowed more than the contribution of consumption expenditure in recent years, though both have slowed relative to the highs reached in previous years. In growth-rate terms, investment slowed to just over 3 percent in 2015, from an average of more than 17 percent in 2000–12, while private consumption was about 9 percent in 2015, only slightly weaker than its 2000–12 average (about 13 percent).

²See the 2011 China Article IV Report (IMF 2011) for a more thorough discussion of China's post-crisis growth.

Figure 3. China: Contributions to GDP Growth

Source: Haver Analytics.

Figure 4. Average Export Volume Growth
(Percent; quarter over quarter, SAAR)Sources: IMF, *World Economic Outlook*; and IMF staff calculations.
Note: SAAR = seasonally adjusted annualized rate.

China's importance in the global economy—about 15 percent of global GDP—and regional differences in the trade slowdown suggest that its transition may be having a significant impact on global trade. The observed slowdown in export volume growth rates has been most significant in emerging markets—growth rates have averaged almost 2 percentage points lower in 2014–15 as compared to 2011–13, and 5 percentage points lower compared to 2000–10 (Figure 4). Although advanced economies have also seen some deterioration in export growth rates since 2000–10 (a slowdown of about 1 percentage point in 2014–15), growth has not decelerated relative to the more recent benchmark period of 2011–13. Much of the emerging markets slowdown in 2014–15 compared to 2000–10 is driven by Emerging Asia, and indeed all of the slowdown relative to 2011–13 is Emerging Asia specific (Figure 5).³ This heterogeneity suggests that to understand China's role in driving the observed slowdown in global export growth, we need to analyze countries' trade exposure to China's final demand.

Total trade exposure to China differs across countries, and gross bilateral trade data may be misleading in assessing it. Exposure to China's final demand can be large either because large country exports of final goods to China directly and/or because exports of intermediate goods to other countries that are embodied in final goods consumed in China. To quantify the direct impact on partner-country export growth of the recent China slowdown, we need to examine

the trade linkages between China and its partners. In principle, this can be done in at least two different ways—using a country's *direct* trade with China (exports to China as a share of its total exports), or calculating a country's exposure to China's final demand (exports used for China's final consumption, as a share of total exports) as is done in the OECD's TiVA database. The second metric is more appropriate for the analysis of China as a possible source of shocks, since it *excludes* processing-trade exports sent to China that will ultimately be consumed elsewhere (and thus should not be influenced by China-demand shocks) and *includes* intermediate-goods exports sent

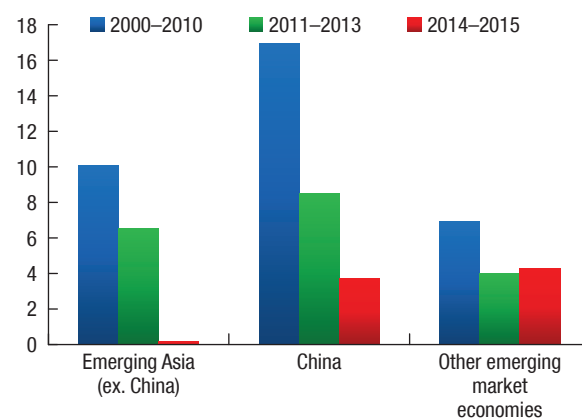
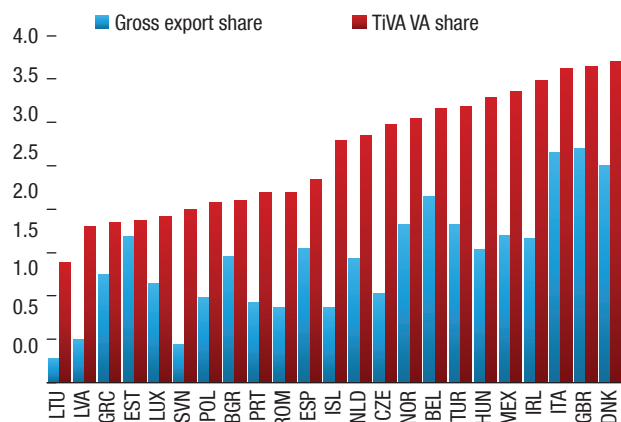
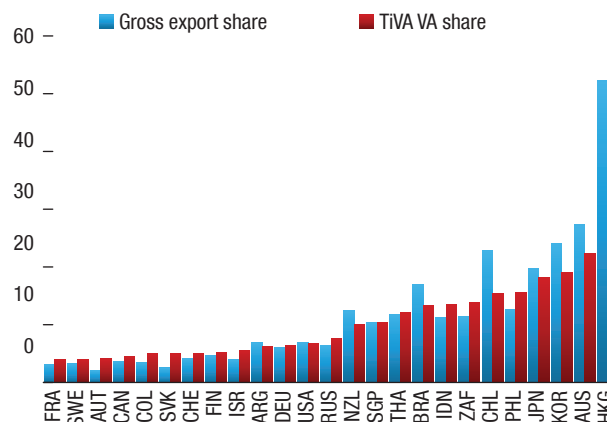
Figure 5. Average Export Volume Growth
(Percent; quarter over quarter, SAAR)Sources: IMF, *World Economic Outlook*; and IMF staff calculations.
Note: SAAR = seasonally adjusted annualized rate.³These stylized facts are taken from our sample of 46 countries.

Figure 6. Exposure to China Demand: VA Shares versus DOTS shares



Sources: IMF, *Direction of Trade Statistics* (DOTS); and Organisation for Economic Co-operation and Development, Trade in Value Added (TiVA) database. Note: Data labels in the figure use International Organization for Standardization (ISO) country abbreviations.

Figure 7. Exposure to China Demand: VA Shares versus DOTS shares

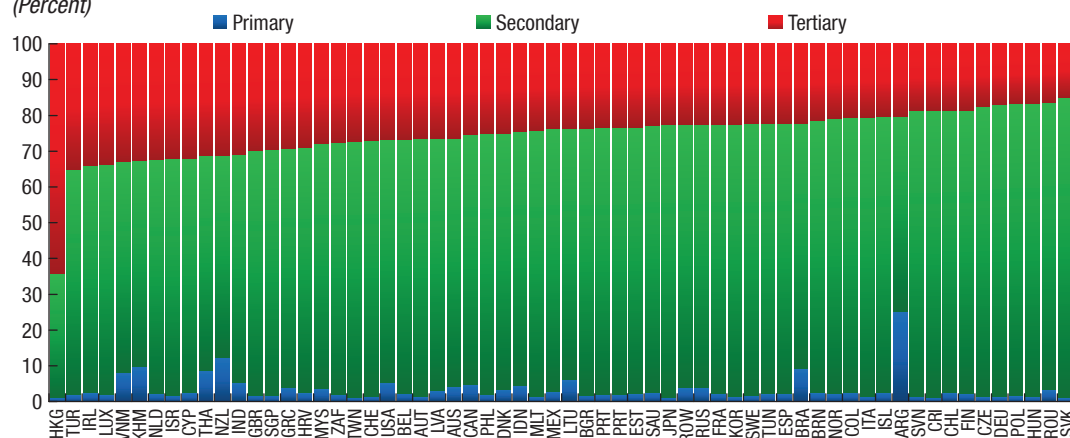


Sources: IMF, *Direction of Trade Statistics* (DOTS); and Organisation for Economic Co-operation and Development, Trade in Value Added (TiVA) database. Note: Data labels in the figure use International Organization for Standardization (ISO) country abbreviations.

to other countries that will ultimately be embodied in final goods consumed in China. Indeed, other studies have found that using TiVA exposures in place of bilateral trade exposures yields more plausible estimates of the importance of trade linkages in explaining business-cycle synchronicity (see Bussière and others 2013, Duval and others 2016). We show that for some countries the “true” exposure to China’s final demand given by TiVA weights differs significantly from the measure obtained using bilateral trade exposures (Figures 6 and 7).

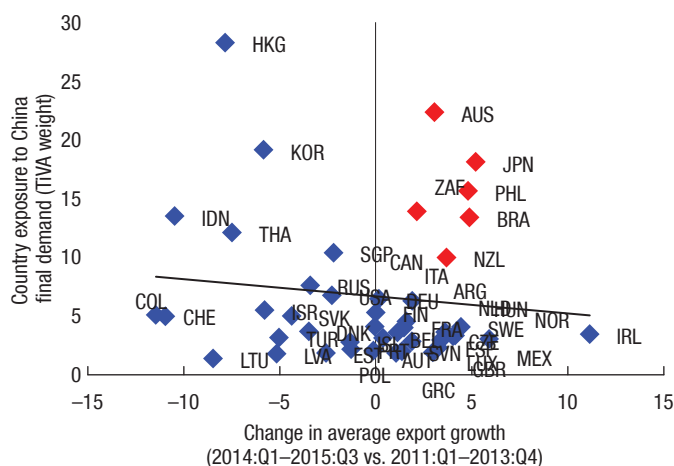
In addition, countries have exposures to different sectors of the Chinese economy. Some countries are most exposed to secondary-sector activity, whereas others are more linked to the tertiary sector (Figure 8). These differences in sector-by-sector exposure are potentially important given that, as discussed, these sectors have fared differently in recent years and have different marginal propensities to import. As an example, a country like Hungary—which is strongly exposed to the secondary sector—has likely faced a sharper slowdown in its external demand conditions

Figure 8. Contribution to China's Final Demand (Percent)



Source: Organisation for Economic Co-operation and Development, Trade in Value Added (TiVA) database. Note: Data labels in the figure use International Organization for Standardization (ISO) country abbreviations.

Figure 9. Change in Export Growth (vs. 2011–13) versus Exposure to China
(Percent)

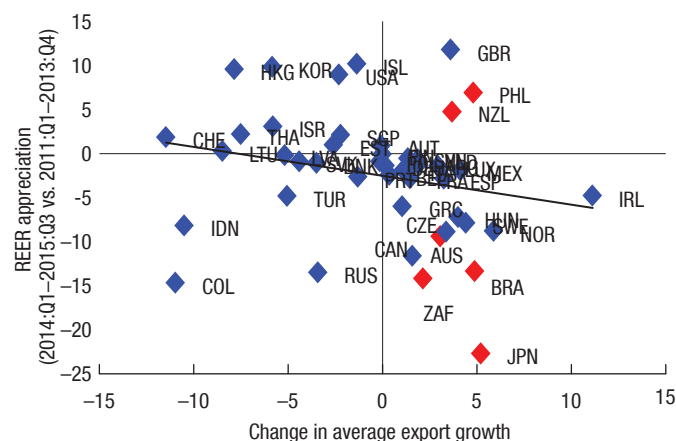


Sources: IMF, *World Economic Outlook*; Organisation for Economic Co-operation and Development, Trade in Value Added (TVA)
Note: Data labels in the figure use International Organization for Standardization (ISO) country abbreviations.

(from China) than a country like Turkey—which is more exposed to the tertiary sector—despite these two countries having similar value-added shares in China's final demand. This is because the secondary sector has slowed more sharply, and because it relies more heavily on imported goods.

Countries with the highest exposure to China have experienced a stronger slowdown in exports. For each of the 46 countries in our sample, we compare exposure to China's final demand to the observed export-growth adjustment by comparing average growth rates in 2014:Q1–2015:Q3 with those in 2011:Q1–2013:Q4. This comparison suggests that countries more exposed to China have seen larger export slowdowns (Figure 9). Some countries do not easily fit this characterization—colored in red—which, despite significant trade exposures to China, have actually seen increases in their export growth rates in 2014:Q1–2015:Q3. For this group of countries, other factors have likely dominated export volume growth dynamics in recent years—most notably, many of these economies have benefitted from a substantial exchange-rate depreciation, which may be boosting export growth despite weaker demand from China (Figure 10). It will thus be important to control for external (non-China) demand conditions as well as exchange-rate dynamics in the analysis to be presented in the following sections.

Figure 10. Change in Export Growth (vs. 2011–13) versus REER Appreciation



Sources: IMF, *Information Notice System*; and IMF, *World Economic Outlook*.
Note: Data labels in the figure use International Organization for Standardization (ISO) country abbreviations.

An Export-Intensity-Adjusted China Demand Shock

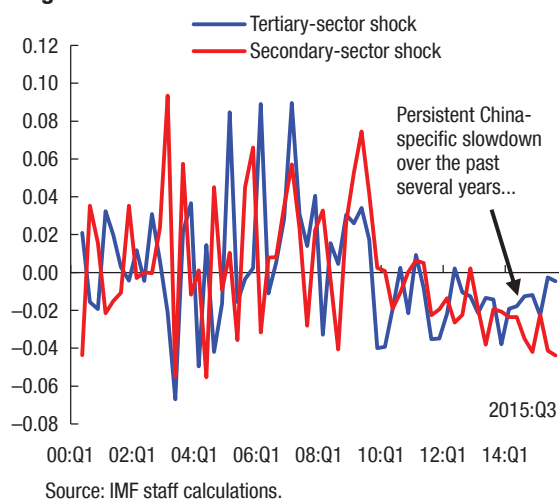
The estimation of export-intensity-adjusted China demand shocks involves two steps: isolating China's specific shocks and scaling them to reflect different country exposures to China's final demand.

China-specific demand shocks—associated with its own final demand—are constructed for both the secondary and tertiary sectors according to the following regression equation:

$$Y_t^{\text{sec/tert}} = \alpha + \beta Y_t^{\text{Global}} + \varepsilon_t \quad (1)$$

in which $Y_t^{\text{sec/tert}}$ is either secondary or tertiary sector quarterly growth (quarter over quarter, seasonally adjusted annualized rate), and Y_t^{Global} is global growth at market rates, excluding China. This approach is similar to the one taken in IMF (2013) and Morgan, Rime, and Strahan (2004), and the resulting residuals (ε_t) are robust to a number of alternate specifications.⁴ Shown in Figure 11, the estimated residuals—or demand shocks—suggest a significant and persistent

⁴Robustness checks, including the addition of other control variables such as emerging-market growth, global domestic demand growth, and the inclusion of several lags of the dependent and independent variables, as well as the use of time fixed effects (by extending this analysis to a panel context), have little impact on the pattern, size, and variances of the shocks.

Figure 11. China Demand Shocks

reduction in China's demand growth starting in mid-2013.

The next step involves the calibration of the estimated China-specific final demand shocks for each country in our sample. This is done based on a country's exposure to final demand in China's secondary and tertiary sectors:

$$\varnothing_t^i = \omega_t^{i,S}(\varepsilon_t^S) + \omega_t^{i,T}(\varepsilon_t^T), \quad (2)$$

in which

$$\omega_t^{i,S} = \frac{VA_{t,i}^{\text{China},S}}{VA_{t,i}^{\text{Total}}} \quad (3)$$

Each country's export-intensity-adjusted China demand shock (\varnothing_t^i) is simply a weighted sum of the two China demand shocks for secondary and tertiary sectors (ε_t^S and ε_t^T), in which weights are given by each country's export linkages to those sectors ($\omega_t^{i,S}$ and $\omega_t^{i,T}$). These weights are calibrated based on the OECD's TiVA data, and correspond to country i 's share of value added in China's final demand in a given sector, as a share of country i 's total foreign value added in final demand.⁵ As will become apparent when we present the structure of the PVAR, this weighting of China demand shocks helps ensure consistency in estimates across the sample period—as China's

⁵Specifically, this is variable *FFD_DVApSH* from the TiVA database, which corresponds to a given country's value added embodied in China's final demand, as a share of all of that country's foreign value added embodied in the demand of all its partner countries. Since TiVA data are only available periodically, and until 2011, we interpolate for missing years and extrapolate using 2011 values for periods beyond 2011:Q4.

economy and its share of partner countries' export demand grows larger, it is important that our shock accounts for these facts, otherwise we would need to find another way to account for the structural break(s) associated with China's expanding role.

To illustrate the importance of calibrating the estimated China shock to each country, consider the cases of Indonesia and Turkey. Both countries are similar in size (average GDP about 900 and 800 billion U.S. dollars, respectively, during 2011–15) and trade openness (exports plus imports about 50 and 60 percent of GDP, respectively). However, these two countries have very different trade relationships with China—China's final demand, using TiVA weights, accounted for 13.5 percent of Indonesia's value-added exports in 2011, but only 3.2 percent of Turkey's. In addition, Indonesia is somewhat more exposed to final demand in China's secondary sector (45 percent of value-added exports to China, against 40 percent for Turkey). Absent any conditioning information on trade linkages with China, a reduced-form analysis which included the same China demand shock for each country would be unable to differentiate between spillovers to these two countries.

Estimation of the Panel Vector Autoregression

China's accession to the World Trade Organization (WTO) in July 2001 marked a structural change in the way China's final demand affected export patterns of trade partners. With China growing rapidly and trade barriers being removed, partner countries could supply China with investment and consumption goods in ways that were not feasible before accession. As such, the analysis of the relationship between China's demand and trade patterns must respect this structural break. Unfortunately, only a relatively small amount of data are available in the post-WTO accession period, meaning that we have limited degrees of freedom to identify key relationships in the data. We overcome this problem by using a panel approach. Jointly estimating the relationship between China's final demand and partner countries' exports in the context of a PVAR yields more robust results than what could be obtained for individual countries, given the short sample period and noise inherent in quarterly export-growth data.

The PVAR includes quarterly information from 2003:Q1 to 2015:Q3 for the 46 advanced and emerging market economies listed in Table 1. The selection of countries was based on data availability. In partic-

Table 1. Country Coverage

| Emerging Asia | | Advanced Economies | |
|---------------------------------|--------------|--------------------|----------------|
| Korea | Philippines | Austria | Italy |
| Hong Kong SAR | Singapore | Australia | Japan |
| Indonesia | Thailand | Belgium | Luxembourg |
| | | Canada | Netherlands |
| Other Emerging Market Economies | | Czech Republic | New Zealand |
| Argentina | Latvia | Denmark | Norway |
| Brazil | Mexico | Estonia | Portugal |
| Chile | Poland | Finland | Slovakia |
| Colombia | Russia | France | Slovenia |
| Hungary | Turkey | Germany | Spain |
| Lithuania | South Africa | Greece | Sweden |
| | | Iceland | Switzerland |
| | | Ireland | United States |
| | | Israel | United Kingdom |

ular, we found 46 countries that have both (1) TiVA data on trade exposure to China's final demand and (2) reliable quarterly data on export volumes in the national accounts.

The PVAR is configured as

$$Y_{i,t} = c_i + \sum_{p=0}^p A_p Y_{i,t-p} + \sum_{p=0}^p B_p T_{t-p} + \mu_{i,t} \quad (4)$$

in which c_i is a vector of country-specific fixed effects, A_p and B_p are reduced-form coefficient matrices, $\mu_{i,t}$ is a vector of shock terms, T_{t-p} is a time trend, and $Y_{i,t}$ is a vector of four endogenous variables (each of which enters the PVAR in quarter-over-quarter, seasonally adjusted annualized growth rates):

$$Y_{i,t} = \{ \text{ExportintensityadjustedChinaDemandShock}_{i,t}, \\ \text{Externaleffectivedemand(excludingChina)}_{i,t}, \\ \text{REER}_{i,t}, \text{Exportvolumes}_{i,t} \}$$

For each country, the external effective demand variable ($ED_{i,t}$) is calculated as shown in equation (5), in which the weights ($\omega_{i,j,t}$) are (time-varying) TiVA exposures of country i to each trade-partner country j in our sample (excluding China, whose influence on partner country exports is captured by the export-intensity-adjusted China demand shock in the PVAR), and $GDP_{j,t}$ is country j 's real GDP growth rate:

$$ED_{i,t} = \sum_{j=1}^j \omega_{i,j,t} GDP_{j,t} \quad (5)$$

We identify structural shocks in the PVAR using a Cholesky recursive scheme, ordering variables as

listed in $Y_{i,t}$. Given that our export-intensity-adjusted China demand shock is orthogonal to external effective demand by construction, it makes sense to order it first. From there, external effective demand should have a contemporaneous impact on both exchange rates and export volumes, but it is less likely that those two variables would contemporaneously determine external demand.⁶

The PVAR shows that, for a country with the sample's average trade exposure, a 1 percentage point increase in China's final demand growth increases export growth rates by 0.1–0.2 percentage point per quarter over the course of the first year. The impulse response functions show a large impact on (1) external effective demand growth (a proxy for global demand, excluding China), and (2) partner-country export volume growth (Figure 12).

The response of individual countries to the shock varies considerably, depending on their exposure to China. To compute individual-country responses to a China demand shock, we scale the results from our average-country PVAR impulse responses by each country's exposure to China's final demand. The estimated cumulative impact on the level of exports, one year following a China demand shock, is presented in Figure 13.⁷

Emerging Asia is the most affected region in the sample (Figure 14). Following a shock to China's final demand, export volumes are depressed by almost 1 percent after a year in Emerging Asia, given the region's strong trade linkages with China. The impact on commodity-exporting countries is also large, given China significant share of global demand for many commodities. In addition, price inelastic commodity markets imply that exporters will also experience a significant loss in revenue due to price effects of China's slowdown.⁸ Other countries, such as those in Eastern Europe with limited trade linkages to China, experience milder estimated spillovers from a shock to final demand.

What would these findings imply for GDP? We use a simple rule of thumb (export-to-GDP ratio

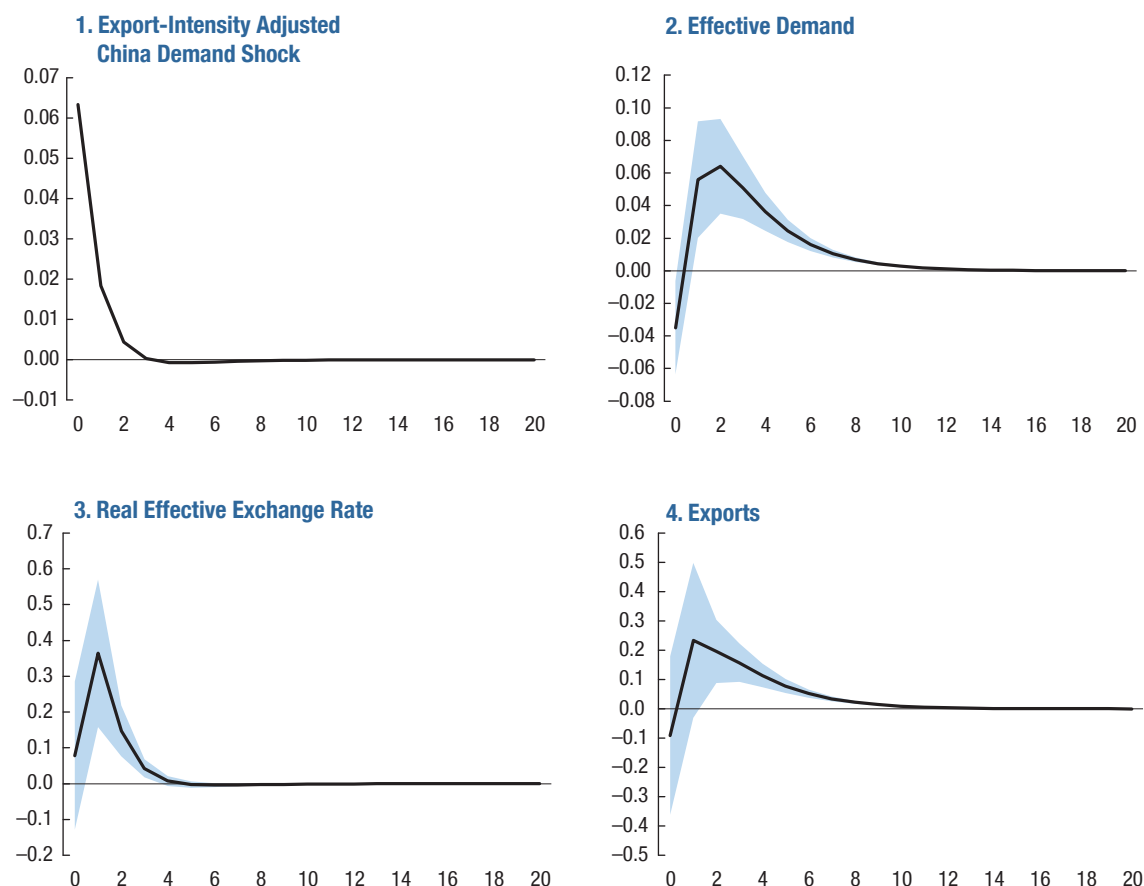
⁶The baseline specification includes only one lag ($p = 1$), but results are robust to the inclusion of additional lags, and alternate orderings in the identification scheme.

⁷To consider level effects of a 1 percent shock to the level of demand in China, we scale up the one quarter shock to China's growth rate presented in Figure 12.

⁸These effects are not modeled here, but the impact of China's slowdown on commodity prices is investigated in Kolerus, N'Diaye, and Saborowski (2016).

Figure 12. Impulse Response Function for China Demand Shock

(Percentage points of quarter over quarter, seasonally adjusted annual rate growth; results for a country with 'average' China trade exposure)



Source: IMF staff calculations.

Note: The figure shows results for a country with average China trade exposure. The export-intensity-adjusted China demand shock comprises two terms: one that corresponds to China's growth shock (equation (1)) and the other to a given country's TiVA exposure to China's final demand (equation (3)). These results reflect a normalization on the first component of the China shock (dividing the impulse response functions, which are initially presented in terms of standard deviations, by the standard deviation of China's growth shock). This ensures that the impulse response functions depict the "average" country response to a 1 percentage point shock to China's final demand growth.

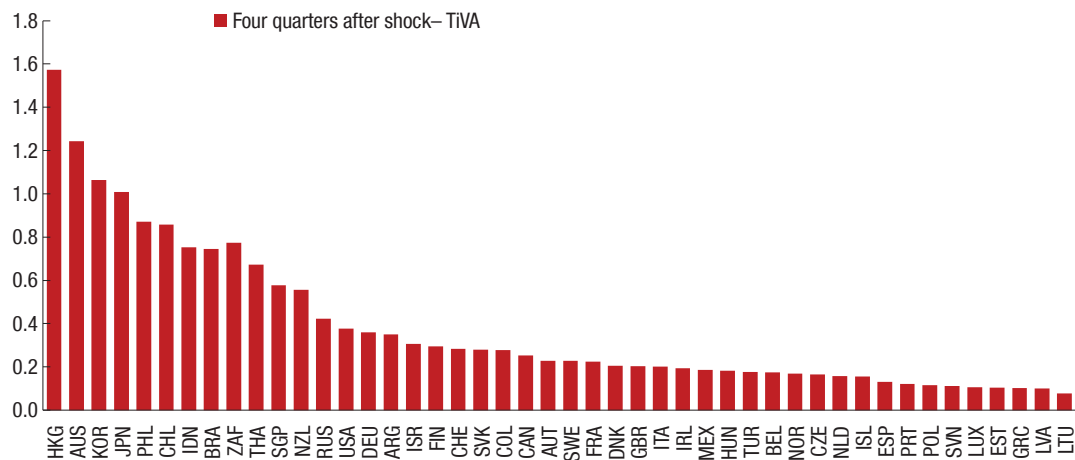
The response of export growth rates to a China shock is statistically significant and economically meaningful. The same is true for the response of external effective demand. Given that we are estimating a panel vector autoregression, these results show an "average" country response (about 6.5 percent of total value-added exports destined for China), and individual-country responses will differ depending on their exposure to China's final demand.

and its imported goods content in exports) to obtain an estimate of the *direct* impact—that is, operating only through net exports—of a shock to China's final demand on trade-partner GDP. For our sample of countries, this calculation suggests that a 1 percent shock to the level of China's final demand would yield an aggregate (market-GDP weighted) impact of about 0.15 percent on the level of global GDP (excluding China) after one year, broadly similar to estimates in

other studies which look at GDP-to-GDP spillovers.⁹ Of course, this direct impact could be reduced by other factors, such as the response of monetary and fiscal policy, which could attenuate the impact of the China shock in some cases.

⁹See Ahuja, Ashvin, and Nabar (2012), Bems, Rudolfs, Johnson, and Yi (2010), IMF (2014), Furceri, Jalles, and Zdzienicka (forthcoming), and Cashin, Mohaddes, and Raissi (2016).

Figure 13. Individual-Country Level Impact of China Demand Shock
(Impact on Export Level of a 1 Percent China Demand Shock after One Year; percent)



Source: IMF staff calculations.

Note: TiVA = Trade in Value Added. Data labels in the figure use International Organization for Standardization

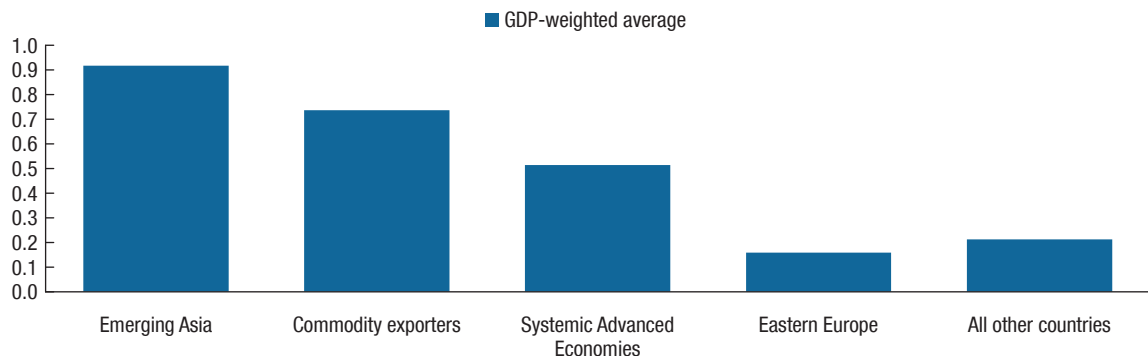
Export-Growth Slowdown Accounting Exercise

To quantify the impact of China's recent growth slowdown on partner country export growth rates, we conduct an in-sample forecast exercise best thought of as an "export-growth accounting" exercise. This exercise is completed in two stages:

- First, we estimate a naive baseline forecast for export growth in each country that reflects the actual

information up until the start of the forecast, as well as the *World Economic Outlook* (WEO) baseline forecast for China as of January 2012 (IMF 2012). Then, the model's estimated parameters are used to compute forecasts. This "benchmark" forecast is counterfactual, depicting what would have happened had China's growth proceeded as expected in the January 2012 WEO projection. The January 2012 projection is chosen since it captures expectations

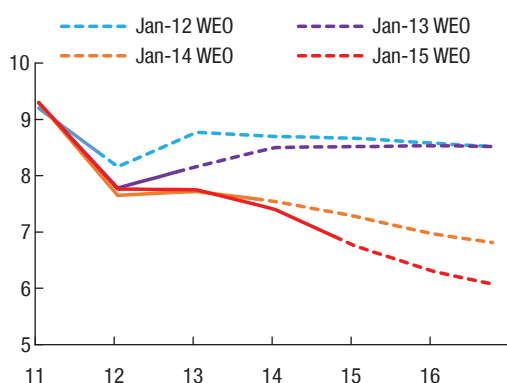
Figure 14. Region-by-Region Level Impact of China Demand Shock
(Impact on Export Level of a One Percent China Demand Shock after One Year; percent)



Source: IMF staff calculations.

Note: Emerging Asia = HKG, KOR, PHL, IDN, THA, SGP. Commodity exporters = AUS, CHL, BRA, ZAF, RUS, COL. Eastern Europe = LTU, LVA, EST, SVN, POL, CZE, TUR, HUN, SVK. Systemic advanced economies = JPN, USA, DEU. All other countries = NZL, ARG, ISR, FIN, CHE, CAN, AUT, SWE, FRA, DNK, GBR, ITA, IRL, MEX, BEL, NOR, NLD, ISL, ESP, PRT, LUX, GRC. (Abbreviations in the note use International Organization for Standardization [ISO] country codes.)

Figure 15. China: *World Economic Outlook* Growth Vintages
(Percent)



Source: IMF, *World Economic Outlook* (WEO).

for continued strong growth in China. Indeed, this forecast would later prove to be too optimistic, as China's economy slowed rapidly in subsequent years (see Figure 15).¹⁰

- Then we construct a “conditional” forecast using the same starting point as the naive baseline forecast for all non-China variables—effective demand and the real effective exchange rate—but incorporating the actual evolution of our export-intensity-adjusted China demand shock over the forecast horizon. The difference between these two forecasts provides an estimate of the impact of negative China demand shocks relative to the January 2012 WEO baseline—or equivalently, the marginal effect of (weaker) China demand on export growth in a given country, relative to the WEO (no slowdown) benchmark.

Following this procedure, we consider the impact of China demand shocks on trade partner exports growth over the in-sample forecast horizon—2014:Q1 to 2015:Q3.¹¹ The unconditional and

¹⁰Data from the WEO baseline are used to construct an export-intensity-adjusted China demand shock in the baseline. An alternative exercise, in which the naive baseline forecast is zero export-intensity-adjusted China demand shock (that is, China growth at the sample's historical average) yields slightly larger effects of China's slowdown—which is larger—on trade.

¹¹The selection of this time period takes into account the analysis of China's shocks presented in “Estimation of the Panel Autoregression,” which shows that the sharpest slowdown in China's final demand has taken place since mid-2013. Similar analysis of longer

conditional forecasts can be formulated in many different ways. For example, we could simply use actual data through 2013:Q4 and run the unconditional and conditional forecasts from 2014:Q1 forward.¹² Alternatively, we can construct rolling forecasts, which allow for periodic updating of the information set contained in both the unconditional and conditional forecasts. These rolling forecasts tend to be more stable. In what follows, we only present results from the latter approach, as both forecast methodologies yield broadly similar results.

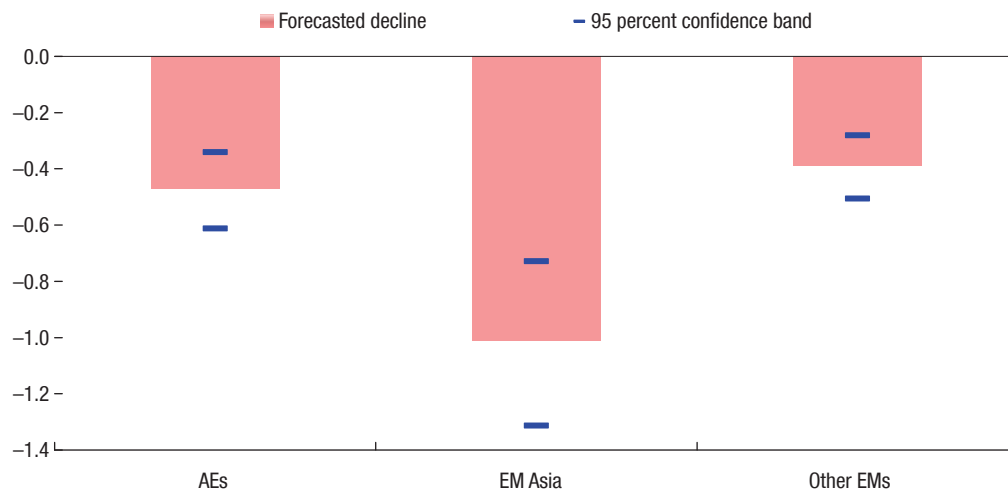
Emerging Asia's exports were most affected by the recent slowdown (Figure 16).¹³ The forecast exercise suggests that weaker demand in China—relative to a pre-slowdown benchmark—depressed export growth rates (quarter-over-quarter, seasonally adjusted annualized rate) by about 1 percentage point each quarter over the last two years in this region. Given that the observed slowdown in 2014–15 in Emerging Asia was approximately 6 percentage points (see “Stylized Facts”), the forecast exercise suggests weaker demand in China could account for approximately one-sixth of this recent export-growth slowdown. The negative impact on Emerging Asia is larger than what is predicted for advanced economies and other emerging market economies, whose estimated export-growth impacts are slightly below ½ percentage point. Of course, the slowdown predicted by our exercise still leaves an important portion of actual export growth declines unexplained by China demand weakness, particularly in Emerging Asia. In addition, actual export-growth declines have been modest in advanced and other emerging market economies since 2014:Q1, suggesting that other factors have counteracted the negative impetus from China's growth slowdown.

time periods (beginning in 2013:Q1 or 2012:Q1) would not change the qualitative results, but could result in slightly smaller average export growth-rate impacts (albeit over a longer time period) given that China demand shocks are estimated to have been smaller in 2012 and early 2013.

¹²Concretely, starting at time $t = 0$, the unconditional forecasts for periods $t = 1, 2, \dots, T$ would use information only available up to time 0. The conditional forecast would also use this information set, but would be augmented with actual data only on the China shocks in periods $t = 1, 2, \dots, T$.

¹³Although only the impact on regional aggregates is shown, individual country results for each of the 46 members of our sample are available from the authors upon request.

Figure 16. Decline in Average Export Growth Rate over 2014:Q1–2015:Q3 Attributed to China Demand
(Percent)



Source: IMF staff calculations. Note: Red bars depict the marginal impact of weaker GDP growth in China (relative to the January 2012 *World Economic Outlook* [WEO] forecast) on average export growth rates from 2014:Q1 to 2015:Q3. They represent the difference between an unconditional forecast (with China's growth rates based on the January 2012 WEO baseline) and a conditional forecast with the same information set, but adding actual GDP growth rates in China.

The conditional and unconditional forecasts are "rolling." We start by constructing multi-year-ahead forecasts for starting periods $t = 1, 2, \dots, T$. However, from any given starting period we take only the forecast for period $t = 4$ (rolling, one-year-ahead forecast). So to obtain the forecasted impact of China's weaker demand for exports in 2014:Q1, we take the one-year-ahead forecast from 2013:Q1. To obtain the forecast for 2014:Q2, we take the one-year-ahead forecast from 2013:Q2, which includes one extra quarter of information relative to the previous forecast. We proceed in that way through 2015:Q3. We then report the average difference in export growth rates between the conditional and unconditional forecasts over 2014:Q1–2015:Q3.

Blue dashes depict confidence intervals around these point estimates, which are taken from a distribution of forecasts. This distribution is obtained by estimating panel vector autoregressions and performing this same forecast exercise using data obtained via standard resampling (bootstrapping) techniques (1,000 draws). AEs = advanced economy; EMs = emerging markets; EM Asia = Emerging Asia.

Conclusion and Policy

China's economic transition is a positive development for the global economy. While economic activity will inevitably slow in coming years, the move to a growth model driven by consumption and services will lessen the reliance on public investment and exports. The authorities' efforts to converge to slower yet more sustainable growth will benefit both China and the global economy in the long-term, reducing tail risks.

However, there will be spillovers during the transition—China's trading partners will face lower demand for exports. This note shows that China's transition has played a significant role in the recent slowdown in global exports, with PVAR estimates suggesting that a 1 percentage point negative shock to China's final demand growth reduces average export growth rates by about 0.1–0.2 for the average country in a sample of 46 advanced and emerging economies. The impact

of China's slowdown and rebalancing is relatively large in countries with high trade exposure to China—particularly in Emerging Asia, where in-sample forecasts suggest that China's slowdown has lowered average quarterly export growth rates by about 1 percentage point since the first quarter of 2014. The analysis also points to a large impact on countries exposed to China's manufacturing sector and commodity exporters.

- The impact of China's transition calls for adjustment in countries experiencing spillovers from China. Even a smooth transition will reduce demand for exports and create an environment of lower prices (see IMF 2016). In the face of permanently weaker demand from China, policymakers should facilitate structural adjustment. In countries where demand for exported goods has fallen and no alternate export destination can be found, a reallocation of

resources away from the most affected sectors will be needed. In other cases, there may be scope to find alternate destinations for existing exports, which could be achieved through greater trade integration and participation in value chains. In addition, commodity exporters should use fiscal buffers, but also plan for adjustment, including through reduced and more efficient public expenditures and stronger fiscal frameworks, enhanced revenues sources, and new growth models.

- From a global perspective, an environment of less dynamic global trade may raise the temptation of resorting to protectionist practices for some. Countries should refrain from such practices, as they would be detrimental to trade in the long term. Global and regional trade agreements would support China's efforts to reform and rebalance its economy.

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Annex 1. Data Sources

Annex Table 1.1. Country Coverage

| Country | Indicator | Source |
|--------------------|---|--|
| China | Gross domestic product (constant prices, quarter over quarter, seasonally adjusted annualized rate) | IMF, World Economic Outlook database |
| China | China secondary sector growth (quarter over quarter, seasonally adjusted annualized rate) | Haver Analytics |
| China | China tertiary sector growth (quarter over quarter, seasonally adjusted annualized rate) | Haver Analytics |
| World | Gross domestic product (constant prices, quarter over quarter, seasonally adjusted annualized rate) | IMF, World Economic Outlook database |
| Selected Economies | Gross domestic product (constant prices, quarter over quarter, seasonally adjusted annualized rate) | IMF, World Economic Outlook database |
| Selected Economies | TiVA exposures (percent) | Organisation for Economic Co-operation and Development |
| Selected Economies | Real effective exchange rate (index) | IMF, Information Notice System database |
| Selected Economies | Export volumes (quarter over quarter, seasonally adjusted annualized rate) | IMF, World Economic Outlook database |

