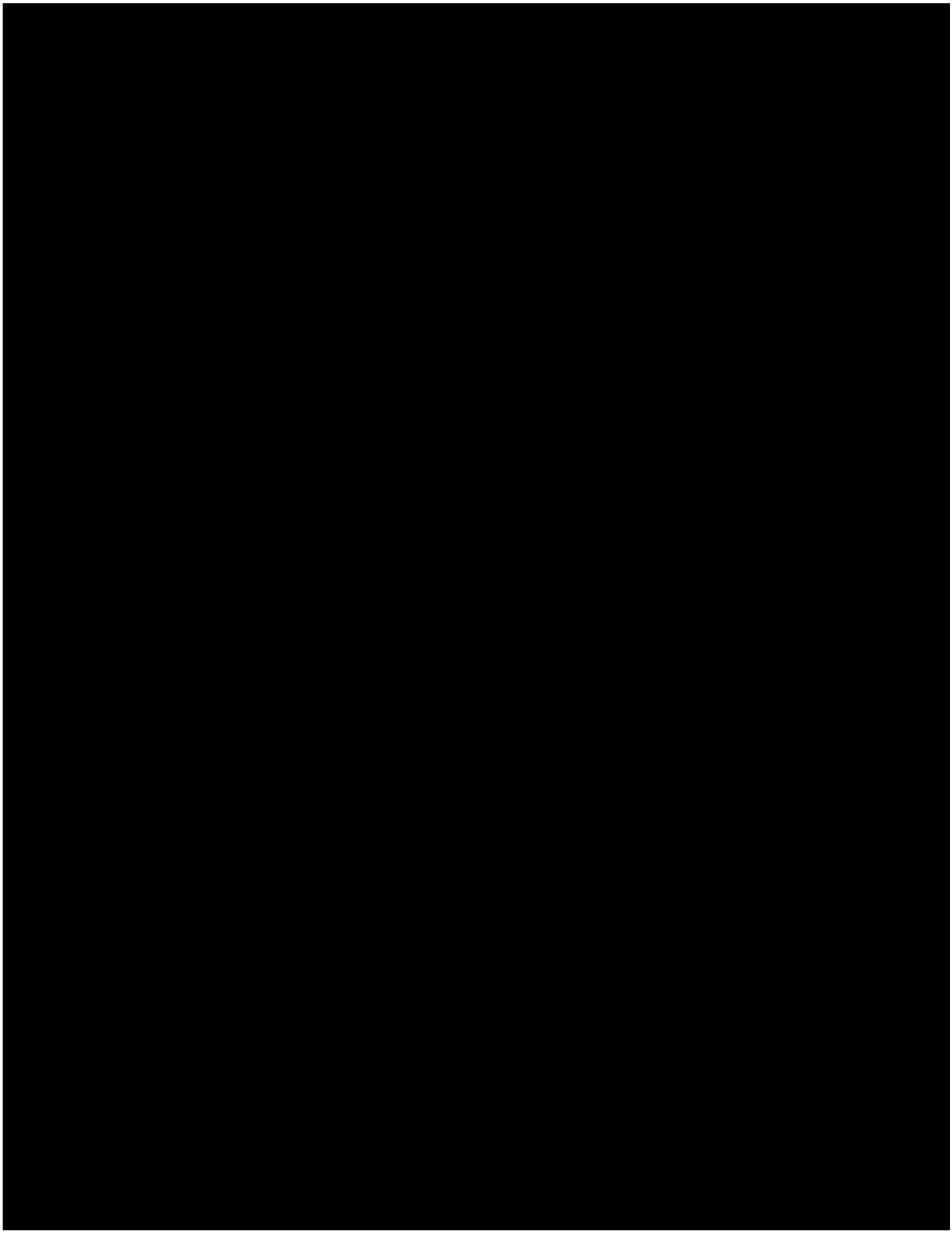

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China and Asia in Global Trade Slowdown[1]

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Abstract

Asia and China made disproportionate contributions to the slowdown of global trade growth in 2015. China's import growth slowed starkly, driven by both external and domestic factors, including a rebalancing of demand. Econometric results point to weak investment and rebalancing as the main causes of the import slowdown. Spillover effects from China's rebalancing are estimated for some 60 countries using value-added trade data, and are found to be more negative on Asia and commodity exporters than others.

JEL Classification Numbers: F14, F41, F42, F47

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[1] We appreciate comments and suggestions by many colleagues, including Elif Arbatli, Aqib Aslam, Emine Boz, Paul Cashin, Diego Cerdeiro, Menzie Chinn, Rodrigo Cubero, Charles Engel, Joong Shik Kang, Martin Kaufman, Rui Mano, Marcos Poplawski Ribeiro, Changyong Rhee, and Ranil Salgado. All remaining errors are due to the authors. The views expressed in this paper are those of the authors and do not represent those of the IMF or its policies.

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I. INTRODUCTION

Global trade growth has slowed in recent years, both relative to income growth and its past growth (Constantinescu and others 2015). The slowing accelerated in early 2015, particularly in China and neighboring Asian countries. The prominence of China and Asia in the trade slowdown of 2015 was a clear contrast to the previous episode of global trade slowdown in 2009 during the global financial crisis (GFC). Partly as a result, the slowing of China's imports generated keen interest as a possible harbinger of a much feared hard landing in China.

We look into three related questions motivated by the role of China and Asia in the global trade slowdown. First, we clarify the role that China played in the global trade slowdown in recent years including 2015. We document the surprising weakness of China's import growth relative to its GDP growth, and the now large weight that China commands in the global trade network. Next, we explore what explained the weakness of China's import growth. Slowing growth of investment and exports was the key driver, whereas the slowdown in the aggregate GDP growth alone did not explain it well. We also see that, viewed over the past decade, about a half of China's import growth slowdown could be attributed to the rebalancing of demand composition away from investment and exports and toward consumption. Finally, we estimate spillover effects from the rebalancing of demand in China, which is expected to progress further toward consumption in the coming years. In our estimates, Asia will sustain a larger loss than other regions, and so will commodity-exporting emerging markets.

Our results have several implications for the current policy discussion on trade and China. While China made a large numerical contribution to the global trade slowdown in 2015, it was not necessarily due to a slowing (or a collapse as often feared) of China's overall growth. China imported less partly because, as a hub in the global production network, it transmitted a negative global demand shock which reduced its own exports to the rest of the world. The transmission effect appears to have been particularly acute for Asian trading partners which have been most closely intertwined with China in the global value chain (GVC).

Spillover effects from the rebalancing of China's demand are mostly negative in the short term, while turning positive—or at least less negative—over the medium term, as the rebalancing will lead to a higher and more sustainable growth in the medium term. The economy rebalances away from an excessively high level of investment to a more consumption-led economy, and eventually experiences a positive growth dividend. While some countries are estimated to reap immediate gains owing to their high exposure to China's consumption demand, most countries will suffer for a while as their exports to China are geared more to China's investment demand. These results imply that China's trading

partners will have several more challenging years in their trade with China, while China goes through reform and restructuring (IMF 2015).

Our paper also makes several contributions to the applied research literature. We discuss statistical evidence on China's rising role in the global trade network, which strengthens its potential as a source and transmitter of global shocks. Its role as a source grows in proportion to its sheer size and share in the global trade, and its role as a transmitter strengthens with its function as a hub in the global value chain. Next, building up on Bussière and others (2013), we extend the import adjusted demand (IAD) for China up to 2011, the most recent year for which input-output tables are available, and provide another affirmation of the usefulness of the IAD for a question of global economic significance. To gauge spillover effects from the rebalancing, we estimate the separate effects that China's consumption and investment each have on exports and growth of trading partners. This is a meaningful contrast to the existing literature on China's spillover that has estimated the effect of an aggregate GDP growth slowdown in China, without accounting for the composition of aggregate demand (for instance, Moazzami and Wong (1988), Tang (2003), IMF (2014), Cashin and others (2016), and Dizioli and others (forthcoming)). By using value-added trade data, we also provide information on each country's exposure to China via both direct and indirect trade linkages.

The rest of the paper is organized as follows. Section II lays out factual information on the global trade slowdown, and the changing (rising) importance of China in the global trade network. Section III discusses the slowdown in China's imports, including the econometric estimates of import equations. Section IV discusses the spillover effects from China's rebalancing from investment toward consumption. Section V concludes.

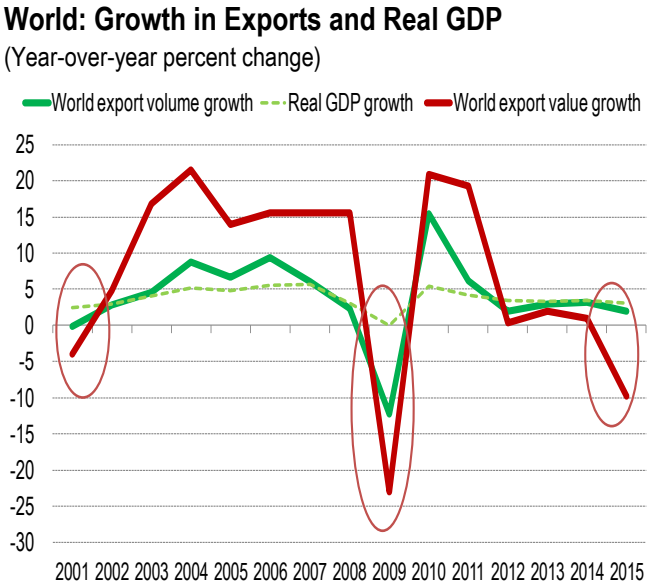
II. GLOBAL TRADE SLOWDOWN

A. Trade Slowdown in 2015 and Asia

Global trade growth has been sluggish for several years, both in absolute terms and relative to the global growth. In the first half of 2015, combined with weak commodity prices, the sluggish growth in trade volume led to an outright decline in the value of world trade (Figure 1).

Moreover, China's contribution to the global trade slowdown was unusually large in 2015, in a clear contrast to the 2008-09 period when all regions contributed to the trade slowdown (Figure 2). To look at goods trade slowdown from the import side, China made a big negative contribution to global goods import volume growth in 2015, while both the United States and euro area made sizable positive contributions to global import volume growth. Non-Asian emerging markets as a bloc also made a big contribution to the slowdown in global import growth. On the export side, China and Asia made by far the largest negative contribution to the slowdown in global export growth in 2015.

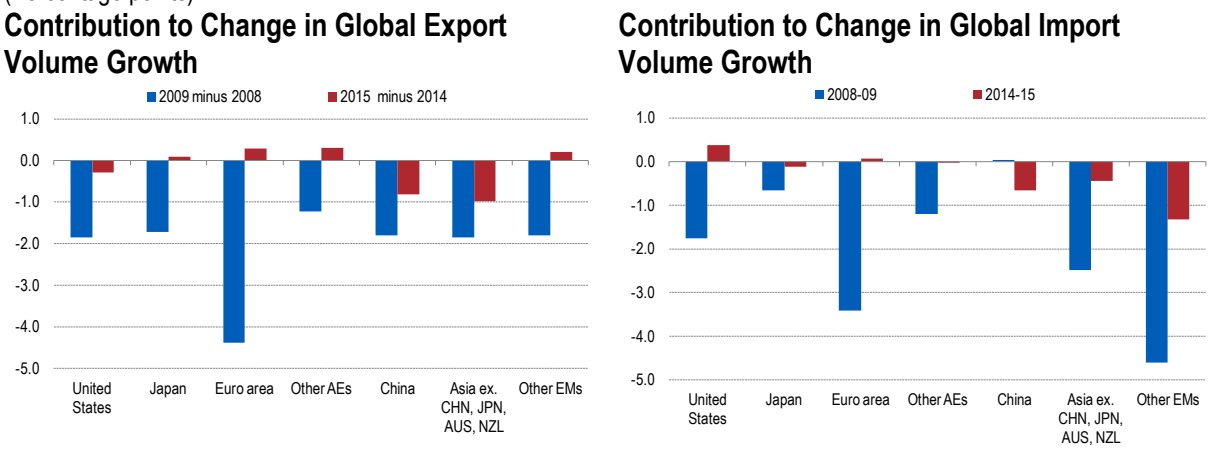
Figure 1. Global (Goods) Trade Slowdown



Source: IMF staff estimates.

Figure 2. Contribution to Global Trade Slowdown in 2009 and 2015

(Percentage points)



Source: IMF staff calculations.

B. China as a Potential Source and Transmitter of Shocks

Regional comparison of trade volume growth raises questions on the role that China played in the global trade slowdown, either as a source or a key transmitter of shocks. China can be a strong transmitter of global demand slowdown, given the central role played by China in global value chains. As the GVC expanded rapidly starting in the early 2000s, China seized the opportunity—facilitated by its WTO membership since 2001—and integrated itself tightly into global trade to become the "world factory." China imports capital and intermediate goods from its trading partners, and exports finished products to final destinations all over the world. When the demand from final destinations declines, China's exports will decline, in turn lowering China's imports and regional trading partners' exports to China as well as to other destinations (Box 1).[2]

The role of China as a source of shocks has gained importance for two reasons. The first is due to the increase in China's weight in world trade. In value-added terms, world's exports to China as the final destination increased dramatically in recent years, from 1 percent of total exports to 7 percent in 2011 (Figure 3). For Asian countries excluding China, this share was 16 percent in 2011, the same as the United States. Changes in China's demand will have that much more influence on Asian trading partners. Indeed, Box 2 shows that countries with tighter GVC links with China have experienced a larger decline in the correlation between their exports and partner-country GDP.

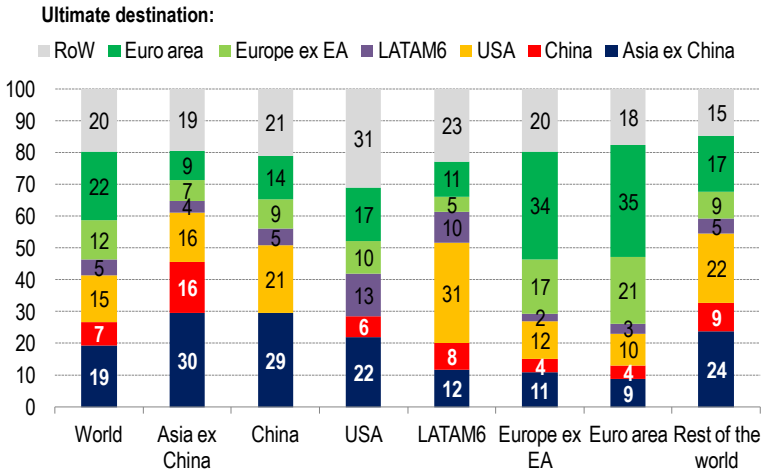
Next, given China's rising share in world's exports and its central role in GVCs, the structural change in China's import demand composition can impart meaningful shocks to the global trade. Since exports and investment are in general more import intensive than consumption, any compositional shift in import demand could change the level of import demand. Structural changes include external rebalancing (from export-driven to domestic demand driven-growth), internal rebalancing (from investment-based to consumption-oriented growth), and on-shoring (substituting imported goods by domestically-produced goods). This is discussed further in the rest of the paper.

[2] This transmission effect on regional "gross" trade can be amplified, since international trade is usually measured in gross terms, and intermediate products could cross international borders multiple times during the processing stage given the vertical trade structure.

Figure 3. Ultimate Sources of Demand for Exports

DVA in Foreign Final Demand by Ultimate Destination: 2011

(Percent of total)



Source: OECD-WTO TiVA database; and IMF staff calculations.

Box 1. Propagation of Global Demand Slowdown through GVCs: The Role of China

This box discusses the weight of China in global value chains (GVC), which suggests that China's role as a transmitter of global demand through GVCs has increased over time. With production segmentation along the GVCs, parts of goods could be shipped across borders multiple times. Such goods would have a large propagation—magnifying effect of GVCs—through the import content in exports (i.e. backward linkages) as well as through the domestic value added exported for re-exporting purposes (i.e. forward linkages).

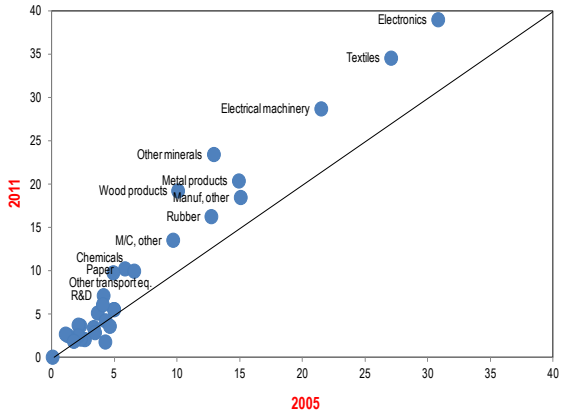
Since 2005, China's forward linkages and backward linkages in GVCs have increased. Figure 4 illustrates China's domestic value added exported through 35 different sectoral GVCs, in percent of world's total value added in each GVC. In several key GVCs, Chinese value added now amount to 5–12 percent of the world total (whereas the median country contributes less than 1 percent of the world total). A shock or slowdown in the final demand elsewhere would hinder China's GVC-related value added (i.e. a reduction in trade along forward linkages). In particular, in GVCs such as textiles and electronics, China's domestic value added share amounts to about 10 percent of the total—a significantly higher amount compared to that of the median economy's contribution which amounts to less than 1 percent in value added terms.

A decline in China's forward linkages driven by a slowdown in the global final demand would further propagate to China's upstream trade partners. China's backward linkages now ranges between 15–40 percent of the global share in about 10 large GVCs, suggesting that spillovers to upstream economies transmitted through China are now even larger than before. For instance, the import content China receives related to electronics for re-exporting now amounts to almost 40 percent of the total in world's electronics GVC trade; this is considerably higher compared to 0.3 percent backward linkages of the median economy in the electronics GVC trade based on a sample of 62 countries.

Figure 4. China's Place in Global Value Chains

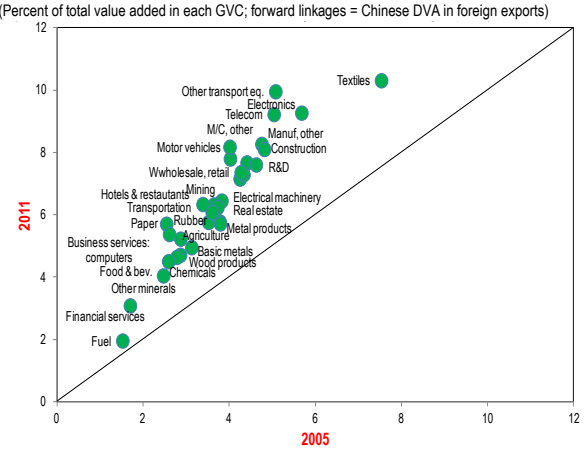
China's Backward Linkages in GVCs: 2005 vs. 2011

(Percent of total value added in each GVC; backward linkages = import content in Chinese exports)



China's Forward Linkages in GVCs: 2005 vs. 2011

(Percent of total value added in each GVC; forward linkages = Chinese DVA in foreign exports)



Source: OECD-WTO TiVA database.

Box 2. Can China Explain Asia's Export Slowdown?

This box explores a possible structural change in the relationship between trade and income in Asia over time. Exports of Asian countries over the past several years indeed seem to have been affected by their trade (especially GVC) linkages with China. Correlation between export growth and trade-partner GDP growth declined over the 2012–15 period for many Asian countries, and by a larger margin for countries with tighter GVC links with China..

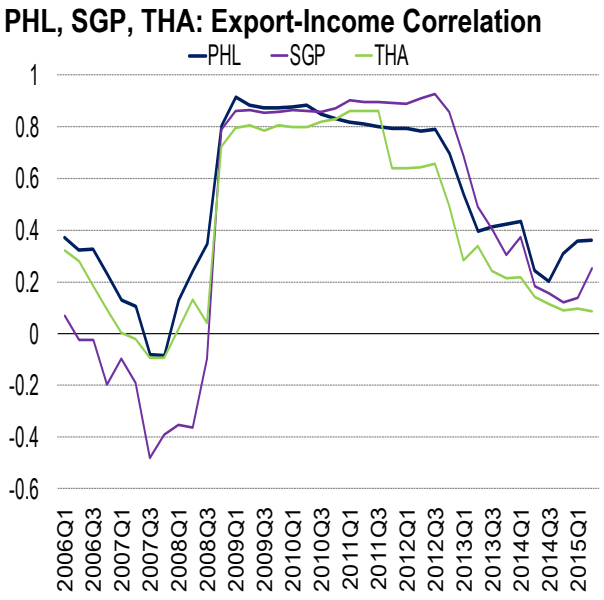
Export growth in Asia has slowed markedly in 2015. As presented in Figure 2, Asia (excluding China) stands out as the largest contributor to the slowdown in the global export growth over 2014–15. In fact, export growth slowdown in Asia has been an ongoing concern for policymakers since the global financial crisis – the export growth in the region dropped to an average growth rate of 4 percent from 2012 to 2014, after averaging 11 percent during the decade before the global financial crisis. While some part of the slowdown is due to cyclical factors such as the weakness in global demand, Hoekman (2015) also attributes to some structural factors that has resulted in lower trade income elasticity.

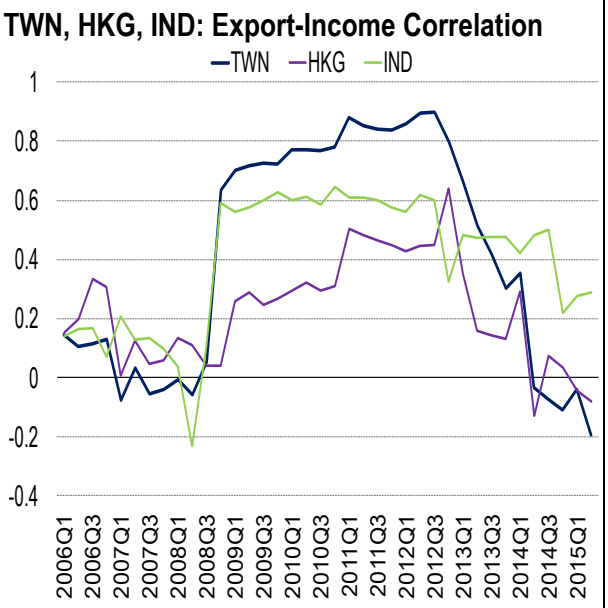
The sensitivity of export growth to the demand for these exports, often measured as real GDP growth of trading partner countries, has indeed been weakening for several years. We calculate the time-varying correlation between export growth and demand (trade-partner GDP), controlling for the exchange rate. We net out the role of the real effective exchange rates in these two variables first by regressing each of them on real effective exchange rates. To track over-time variation in correlations between export and trade-partner GDP (income) for each country, we calculate the rolling-window (16-quarter) correlations. For most of the countries, we observe a steep decline in the correlations since 2012 (Figure 5).

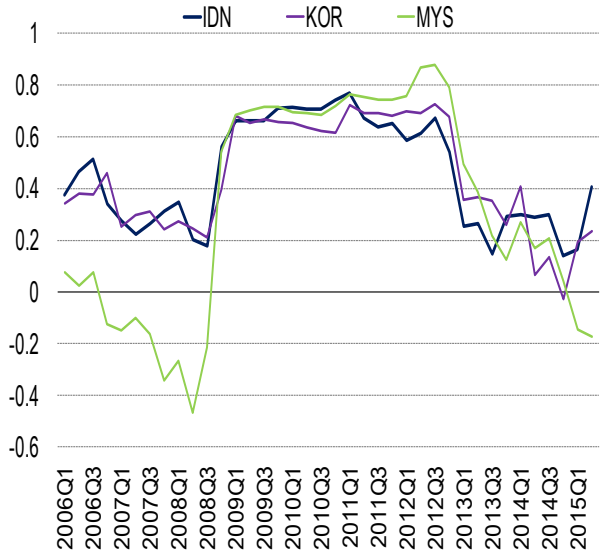
Furthermore, the bottom-right scatter plot of Figure 5 shows a negative correlation between the degree of GVC integration with China and the decline in the trade-income correlation in the last four years in selected Asian countries. These patterns are little affected when introducing the dummy variable for GFC periods. This channel could have been a part of the explanation for the very large negative contribution made by non-China Asia to the 2015 slowdown in global export volume growth, while making a small contribution to the slowdown in global import volume growth.

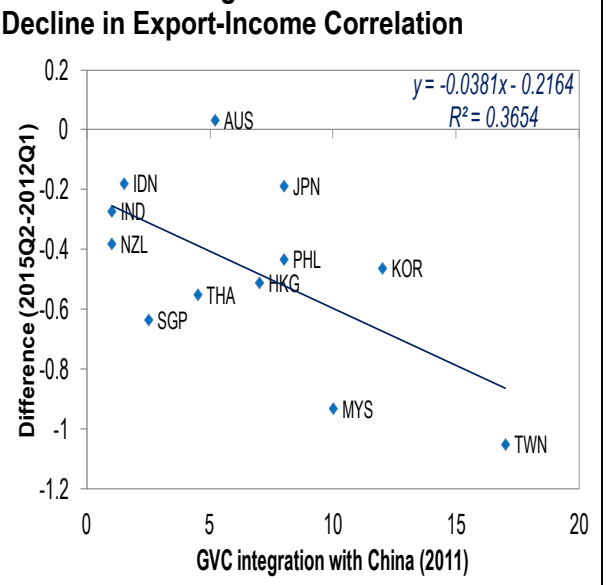
Given China's rising role in world's exports and GVCs, the structural change in its import demand composition could have affected the region's trade sensitivity to demand. Since exports and investment are more import intensive than consumption, a compositional shift in import demand toward consumption (rebalancing) could have lowered the sensitivity with greater intensity for countries with tighter GVC links with China. Moreover, the import substitution taking place in China (on-shoring) could have contributed to the decline of the sensitivity of exports to income in these countries with a high trade exposure to China, consistent with the findings in other work (IMF 2016b).

Figure 5. Trade-Income Correlations









Source: IMF staff estimates.

III. What Drove the Fall in China's Goods Imports?

What were the main causes of China's import growth slowdown? Rather, what were the relative roles of different causes? How big a role was played by the change in the composition of demand? We first discuss the likely causes and their recent movements, and then present the econometric results.

A. Main Causes

Our empirical findings attribute the decline in China's import growth to four causes: two primarily associated with the level of demand and the other two associated with the composition of demand (text table). However, we do not find evidence that the appreciation of China's real effective exchange rate over the past several years played a statistically significant role in its import growth slowdown.

China's role \ Effect on Demand	Level of Demand	Composition of Demand
China as a Source of Shocks	Demand in China	On-shoring Rebalancing
China as a Transmitter of Shocks	Global Demand	

Global Demand. Weak demand in China's export destinations reduces China's exports and imports of inputs, reflecting the role China has played as the key downstream leg in GVCs. The source of shocks can be both advanced and emerging-market economies, as China's exports have widely diversified destinations. Although the world economy has slowly recovered from the deep recession after GFC, the recovery has had many turns and twists. The growth momentum has remained soft in Europe, while the weak performance in emerging markets has added further uncertainty to growth prospects.

Demand in China. Meanwhile, weak domestic activity in China may also suppress its imports. Indeed growth in China has been moderating, as a by-product of the authorities' attempt to contain risks—accumulated since the global financial crisis—and the effort to move the economy away from the unsustainable growth path to a slower and more balanced growth model. The GDP growth slowdown is also a natural outcome of successful economic development which narrows room for high-speed catch-up growth. As the growth slowed from double digits before the GFC to 6.9 percent in 2015, China's demand for imports would have declined as well.

Rebalancing. An important part of China's transition is a shift away from exports towards domestic demand, and within the latter from investment to consumption, a less import-intensive sector. On the production side, transition away from the import- and investment-intensive manufacturing sector toward a more domestic demand-oriented service sector will

be the primary channel. This will lower import growth even without a change in the level of economic activity.[3] Since the late 1990s, the share of consumption in GDP (in nominal terms) has risen slightly, by 1½ percentage points, on account of strong private consumption in the urban area. In real terms, investment growth has halved since 2011.

On-shoring. Lastly, progress in China's technological sophistication increases the share of domestically-produced capital and intermediate goods, lowering import demand. It involves import substitution, under which Chinese corporations domestically produce capital or intermediate goods that used to be imported from advanced economies. Evidence of on-shoring—or rebalancing away from exports—can be seen in the movement of the ratio of processing imports to exports, as shown in Figure 6. Except for the jump around trade collapse in 2009, and another blip in the mid-2014, possibly due to the introduction of a new mobile phone model, the ratio shows a declining trend over the past decade. Incidentally, the decline in the ratio of intermediate imports to exports seems to have accelerated in 2015.

Figure 6. A Ratio of Processing Imports to Total Exports

(Percent)

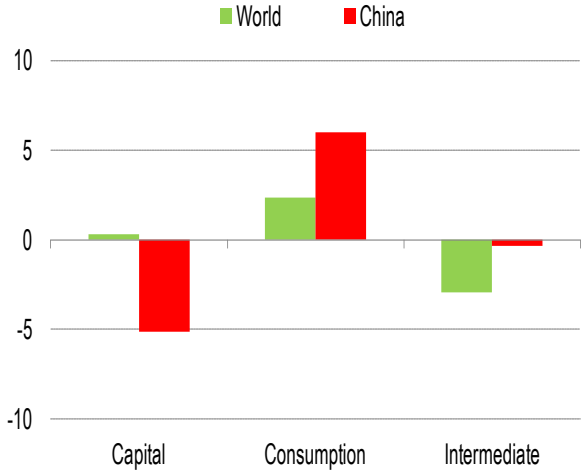
Sources: CEIC; and IMF staff estimates.

Exchange Rates. The RMB exchange rate has been on appreciating trend in real effective terms since the reform in 2005. Theoretically, it should have boosted China's import demand as foreign goods become cheaper, but many empirical studies have found limited impact of the REER on China's imports (Ahmed 2009, and Cheung and others 2012). The traditional relative price channel could get complicated by the GVC structure in the region (Liao and others 2011 and Cheng and others 2015): an appreciation lowers exports, and can thereby lower import demand.

[3] Greater efficiencies, especially in the energy sector, could also lead to lower energy-related imports.

Box 3. Footprints of China's Rebalancing in Global Trade

Figure 7. Average Growth in Exports to the World and to China
(Average year-on-year growth between 2012–14)



Source: IMF staff estimates.

Trade data show signs of rebalancing from investment toward consumption, although consumption imports are still a small share of China's total imports. The average growth rate of China's consumption imports has been increasing much faster than the world average, while China's capital goods imports growth contracted sharply against the slightly positive growth rate of the world average (Figure 7).

Changing shares of China's goods and service trade in total trade are another sign of rebalancing. The slowdown in China's imports since the last quarter in 2014 has been driven by a sharp contraction in goods imports, while service imports have been going strong. If any, China's service import growth has been gaining speed over previous years. Strong service imports are unlikely to have been inputs for exports, which have been declining. Instead, the recent strength of service imports is suggestive of strong domestic demand, consistent with rebalancing.

B. Estimating the Import Equation

To quantify the contribution of the four drivers to China's import slowdown, we estimate a conventional trade elasticity equation. Let M denote imports, Y denote demand, and $REER$ denote the real effective exchange rate.

$$lnM_t = \beta_0 + \beta_1 lnY_t + \beta_2 lnREER_t + u_t$$

In growth rate, the relation is given by the following equation.

$$\Delta lnM_t = \beta_0 + \beta_1 \Delta lnY_t + \beta_2 \Delta lnREER_t + \gamma Z_t + u_t$$

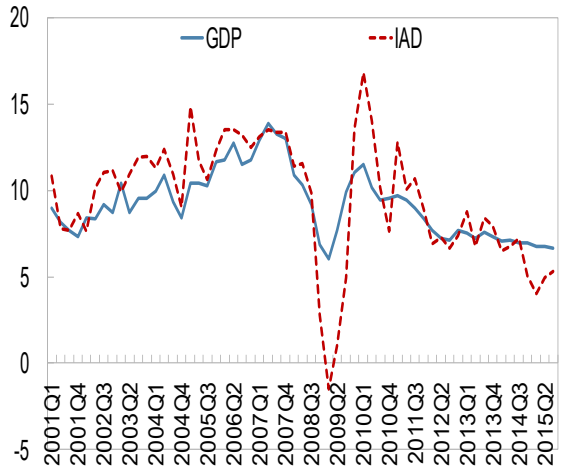
Here Z_t is a vector of control variables, including lags of dependent variable and regressors. We use robust standard errors, which are consistent regardless of serial correlation and heteroskedasticity in u_t.

We take a two-step empirical strategy. Following Bussière and others (2013), we first construct the import-adjusted demand (IAD), which can be a better measure of an effective demand for imports. Import intensity-adjusted measure of demand (IAD) is:

$$IAD_t = C_t^{\omega_{C_t}} G_t^{\omega_{G_t}} I_t^{\omega_{I_t}} X_t^{\omega_{X_t}}$$

where ω_{C_t} , $\omega_{G_t}, \omega_{I_t}, \omega_{X_t}$ are import intensities of C(private consumption), G(public consumption), I(investment), and X(exports) respectively[4], and the import intensities have been normalized to sum up to one in each period.

Figure 8. GDP and IAD
(Real growth, percentage points)



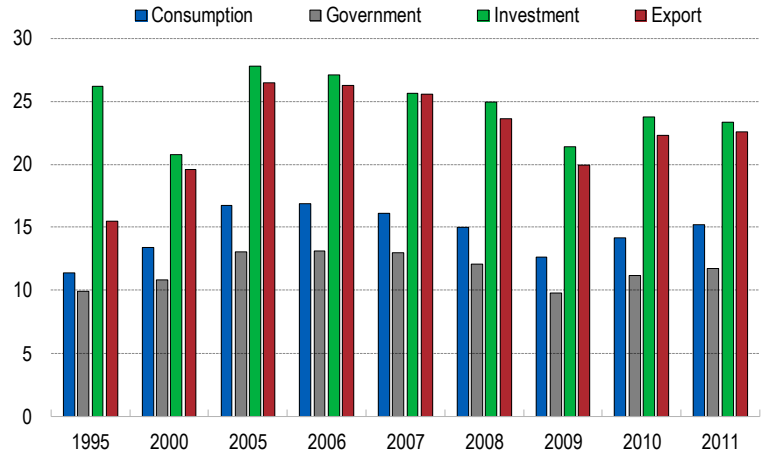
Source: IMF staff estimates.

When the GFC triggered the trade contraction in 2009, trade declined much faster than the GDP slowdown. First used by Bussière and others (2013), IAD did a better job of explaining the trade collapse than GDP when used as a measure of demand (Figure 8). The reason lies in

[4] The method of estimating import intensity for different GDP components using input-output table is discussed in the appendix.

the fact that different GDP components have different import intensities: investment and exports are in general more import-intensive than consumption. By adjusting the import-intensity of different GDP components, IAD better captures the effective demand for imports. As investment and exports are much more pro-cyclical than consumption, the sharp reduction of these two components during crisis could cause trade to contract more severely than GDP growth.

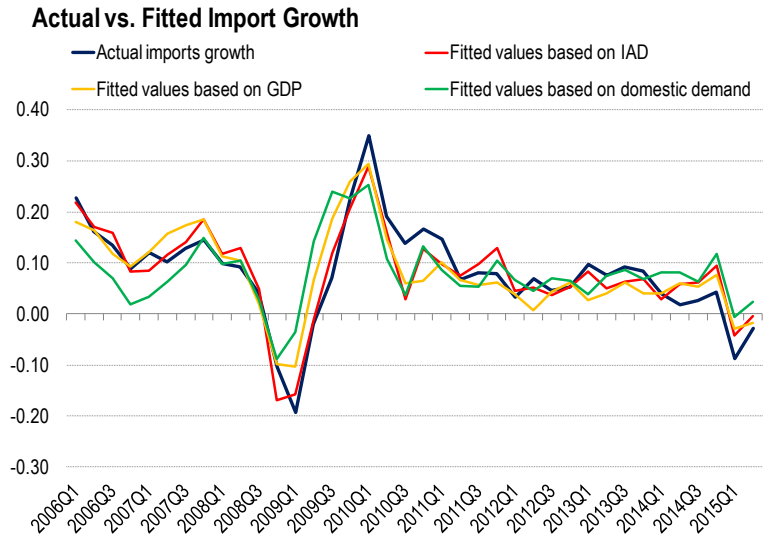
Figure 9. Import Intensity in GDP Components



Source: WIOD; and IMF staff estimates.

Figure 9 presents the import intensity for each GDP component of China updated to 2011 using the currently available input-output tables. The results are intuitive, showing that investment and exports indeed are more import-intensive than consumption (private and public). The intensities peaked in 2005, but there seems to have been a downward trend in these intensities since then, with a short-lived recovery in 2010. This partly reflects the on-shoring in China—substituting domestic inputs for imported inputs (intermediate goods), especially if the trend continues after 2011 as the decreasing share of intermediate imports in exports suggests. Our finding is consistent with previous studies, including Koopman, Wang, and Wei (2012), and Kee and Tang (2015).

Figure 10. Actual vs. Fitted Import Growth



Source: IMF staff estimates.

Among different measures of demand (IAD, GDP and domestic demand), the IAD in general explains trade flows best, consistent with the literature (Figure 10). The income elasticity is around 1.5 to 2, depending on the model specification and sample periods. However, while the fitted value of imports from IAD regression tracks the 2009 trade collapse very well, the model could explain only part of the 2015 trade contraction. One reason is that the input-output table is only available up to 2011, and we have kept the import intensity constant after that. This could lead to a less accurate measurement of IAD if the import intensity of different GDP components has since changed significantly. In addition, there could be factors other than income or relative prices driving trade flows, and the movement of these factors could have become more significant recently.

For trade flows, we use goods and service trade data from national accounts, as well as goods trade only. It is goods trade that contracted sharply, being often referred to as "trade collapse" in 2015, and thus we will decompose the impact of different drivers on import slowdown based on regressions using goods trade. Service imports, on the contrary, have been on a rising trend as tourism has been increasing sharply in recent years, and the economy is shifting away from traditional manufacturing industries to the service sector. For robustness, we estimate different models using simple OLS and dynamic OLS. The results we report are broadly consistent across different model specifications and estimation methods. As we use growth rates of all variables in the regressions, co-integration is less of a concern. In addition, we examined whether different methods of de-trending matter, and we found using HP-filtered series in the estimation produces broadly similar results.

Table 1 reports the results of estimation for the volume of imports in goods over 2005Q1–2015Q3 and for a longer sample 2000Q1–2015Q3. For a robustness check, we report results from estimation using trade in goods and services from national accounts data (IMF WEO database) in Table 2. In both tables, the dependent variables are real growth of imports, while the right hand side (RHS) variables are year-on-year growth rate of total demand, proxy for on-shoring, and the REER. We also added a time dummy for the GFC to control for the extreme trade movement during 2008Q3 to 2009Q2. In general, regressions using IAD as a measure of total demand produce a better fit, especially in recent years (2005Q1 to 2015Q3). Our on-shoring proxy is significantly positive across different model specifications, as expected (notice that higher the proxy, lesser on-shoring). The income elasticity is in general sensible and consistent with the literature.

The model using domestic demand and controlling for exports explicitly sometimes performs better compared to the model using IAD, based on R-squares. This may reflect the importance of exports in driving China's imports, while the IAD could become less accurate as the import-intensity is assumed constant after 2011 due to data availability. It also worth noticing that the income elasticities estimated using a longer sample are in general smaller, suggesting structural changes may have occurred. This is very likely as China joined WTO in 2001 and the longer sample covers this period of a rapidly transforming trade structure. Kang and Liao (2016) also report the results of using the GDP components separately, which are often statistically weaker than the IAD-based results.

For the period after the 2005 exchange rate reform, the REER[5] is statistically insignificant across different model specifications. However, we find the price elasticity generally bears a negative sign for most model specifications, implying that China's demand for imported goods decreases when the purchasing power of the RMB rises. Though counter-intuitive, the ambiguous impact of exchange rate on China's trade is well established in the literature (Ahmed 2009, and Cheung and others 2012). The findings of insignificant price elasticity could be due to the classical simultaneity and omitted-variable biases, as pointed out by Orcutt (1950). However, in the case of China, a common hypothesis is that China has been intensively integrated into the global value chains, using a lion's share of imported goods to produce exports, and thus that the "net" effect of relative price movement on imports could be muted or even opposite to what the classic demand theory predicts, once impact on exports is considered. In our regressions, exports is controlled, either as a separate regressor, or as part of aggregate demand. Exchange rate could affect exports, then affect imports indirectly. Kang and Liao (2016) use a second stage regression to further explore the impact of REER on imports, transmitted by exports. The exchange rate depreciation still increases trade balance, as it increases exports, while having little effect on imports (right or wrong sign).

[5] We use CPI-based REER in this analysis. Using PPI-based REER also results in insignificant price elasticity.

Table 1: Imports of Goods (yoy growth, national accounts)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IAD	1.924***	1.413***				
	(9.508)	(4.548)				
GDP			2.147***	1.636***		
			(5.102)	(3.962)		
Domestic Demand					0.748***	0.614***
					(3.349)	(3.804)
Exports					0.503***	0.395***
					(8.630)	(4.572)
REER	0.026	-0.586**	-0.206	-0.795***	-0.245	-0.565**
	(0.163)	(-2.036)	(-0.794)	(-3.005)	(-0.914)	(-2.271)
Onshoring	0.559***	0.526***	0.647***	0.563***	0.674***	0.526***
	(7.761)	(5.518)	(5.187)	(5.059)	(6.140)	(4.313)
GFC dummy	-0.054**	-0.045	-0.146***	-0.110***	-0.054**	-0.055**
	(-2.526)	(-1.635)	(-5.045)	(-3.683)	(-2.230)	(-2.406)
Constant	-0.049**	0.013	-0.053	0.004	0.014	0.034
	(-2.047)	(0.357)	(-1.256)	(0.100)	(0.449)	(1.292)
Observations	38	53	38	53	38	53
R-squared	0.927	0.851	0.855	0.824	0.907	0.889

Source: IMF staff estimates.
Note: Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Imports of Goods and Services (yoy growth, national accounts)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IAD	1.715***	1.230***				
	(10.133)	(4.339)				
GDP			1.837***	1.382***		
			(4.885)	(3.836)		
Domestic Demand					1.362***	1.180***
					(7.997)	(5.165)
Exports					0.520***	0.301***
					(9.503)	(3.402)
REER	0.090	-0.490*	-0.142	-0.679***	0.091	-0.665***
	(0.570)	(-1.894)	(-0.589)	(-2.985)	(0.622)	(-2.798)
Onshoring	0.411***	0.396***	0.484***	0.427***	0.382***	0.259***
	(7.404)	(4.974)	(5.047)	(4.981)	(6.445)	(3.205)
GFC dummy	-0.079***	-0.071***	-0.160***	-0.127***	-0.088***	-0.088***
	(-5.381)	(-3.076)	(-7.052)	(-5.033)	(-5.265)	(-3.280)
Constant	-0.028	0.032	-0.024	0.028	-0.045**	0.001
	(-1.471)	(0.981)	(-0.633)	(0.758)	(-2.093)	(0.041)
Observations	38	53	38	53	38	53
R-squared	0.938	0.849	0.854	0.820	0.940	0.878

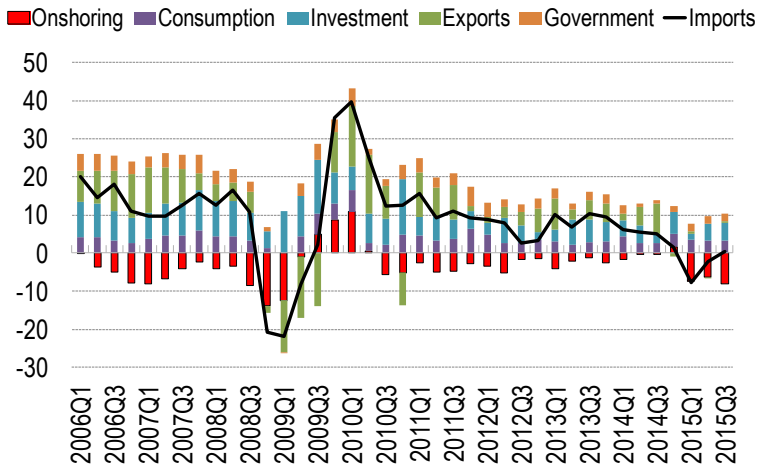
Source: IMF staff estimates.
Note: Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

C. Decomposition of Imports Slowdown

We decompose the effects of different GDP components on real imports of goods. Our calculation is based on the regression using IAD as China demand, which provides the best fit among different income measures (Table 1, Column 1). As the IAD variable is a weighted average of GDP components, we can divide the total effect of IAD into consumption, investment and exports, making use of the information from the import-intensity weights (Figure 11)[6]. In addition, as the regression includes the proxy for on-shoring, we can assess the contribution of on-shoring to imports slowdown.

Figure 11. Contribution to Import Growth

(Percentage points)



Source: IMF staff estimates.

Table 3 decomposes import growth slowdown over the past decade, divided into two five-year intervals of 2006–10 and 2011–15. The first column shows that the average growth rate of goods imports during 2011–2015 declined by 6.8 percentage points compared to the average over 2006–2010. The IAD more than fully explains it, by predicting a decline of 7.2 percentage points. Among the components of IAD, investment and exports (external demand) played a big part. External demand dragged imports down by 1.5 percentage points, while domestic demand, consisting of private and public consumption as well as investment, contributed 5.8 percentage points. Within domestic demand, weaker investment caused import growth to decline by 3.9 percentage points, while private consumption only contributed to trade slowdown marginally. This is consistent with the view that China's private consumption held up well, but investment weakened significantly, party driven by the housing market correction, and partly due to policy-induced rebalancing.

[6] One can also separate the effects by directly using GDP components in the model as regressors (for instance, Kang and Liao 2016). Results are broadly consistent.

Our on-shoring measure, processing imports as a share of exports (which can also reflect GVC-related structural changes in trade)[7], contributed 0.5 percent, as the pace of on-shoring slowed over the last few years except in 2015. It seems that on-shoring (measured by our proxy) accelerates in 2015 Q1–Q3, which was a big drag on import contraction in early 2015[8]. However, without an accurate measure, it is hard to say whether this was temporary or a more long-term trend.

How big is the role of rebalancing in this? Rebalancing is the key element of China's comprehensive structural reform. A full-fledged rebalancing includes both external rebalancing (from export-led growth to a more domestic demand-driven economy), as well as domestic adjustment such as shifting away from excessive investment to greater consumption, and promoting the service sector while cutting overcapacity in manufacturing. Here we perform a counterfactual calculation based on a particular version of non-rebalancing scenario. Assume that consumption, investment, and exports growth rates decline at the same pace as the GDP growth rate over the 2012–15 periods. It is worth noting that the growth moderation in China after GFC is partly driven by the weak global economy and thus sluggish external demand has been already reflected in the non-rebalancing scenario, helping us to separate the impact of rebalancing from the aggregate growth slowdown.

Table 3 presents the roles of different factors behind the import growth slowdown. The second column shows the decomposition for a non-rebalancing scenario, in which consumption would make a bigger negative contribution, while investment and exports make less negative contributions. The third column, the difference between the first and second columns, is a measure of the effect of rebalancing. Consumption makes a positive contribution, while investment and exports make negative contributions. In sum, the rebalancing accounts for about a half of the actual import slowdown.

7 Conceptually, on-shoring refers to Chinese companies' production substituting for previous. It can be measured by the decreasing share of foreign value added in gross exports and final domestic demand from the OECD-WTO's Trade in Value Added (TiVA) database, which is available only up to 2011. Our proxy broadly follows the similar pattern observed in foreign value added share in gross exports and final domestic demand in TiVA database during overlapping periods, and shows a continued downward trend at a similar pace in recent years.

8 We acknowledge that there could be a potential endogeneity problem as the numerator of this variable is a component of the import demand. However, this series shows the similar trend as an alternative measure (a share of foreign value added in gross exports and domestic demand) which is less subject to endogeneity problem but has relatively short sample period.

Table 3. China: Import Growth Decomposition
(Percentage points)

	2012-2015 over 2006-2011	If no Rebalancing	Effect of Rebalancing
Imports	-6.8		
IAD	-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.

IV. SPILLOVER FROM CHINA'S REBALANCING

In addition to the role it played in imports slowdown over the past decade, rebalancing has been pursued by the Chinese authorities to achieve slower, more sustainable, consumption-led growth (IMF 2015). Progress has been slow so far but could speed up if the authorities make further progress on key structural reforms outlined during the Third Plenum.

Considering the rising importance of rebalancing, we explore its implications along the following questions. What is the implication of rebalancing on the exporters to China? What is the implication on the growth of a country that is exposed to China through trade linkages? Who are likely to benefit (or lose) from these changes? China's final consumption and final investment, to bring out the difference between exports for ultimate uses in consumption and investment of China, we work with trade data in value-added terms.

In our spillover analysis, we focus on China's internal rebalancing: moving away from investment-driven growth model to a more consumption-based economy, which is intertwined with but not identical to external rebalancing from exports to domestic demand. We start with a unitary rebalancing, defined as a shift of growth from investment to consumption when the consumption growth rate increases by 1 percentage point and the investment growth rate declines by 1 percentage point. As China's consumption and investment have similar shares in GDP, the unitary rebalancing is largely growth neutral and captures the effect of pure rebalancing. However, the medium-term story will inevitably be more complicated. For instance, a lack of rebalancing can result in rising vulnerability and thus much lower growth several years later, which will hurt partner countries and the world economy as well. In contrast, a successful rebalancing will lead to a more balanced and

sustainable growth model for China, thereby benefiting the whole world in the long run. As a significant endogenous consequence is likely to materialize in the medium term, we base our medium-term analysis on full-fledged projections of scenarios with and without rebalancing.

We proceed as follows.

- We look at the export profiles of each country in relation to China's final demand in value-added terms.
- We measure the 'sensitivity' of the domestic value-added used for China's final consumption (or investment) with respect to the change in China's consumption (or investment). These measures of 'sensitivity' are used to estimate the effects on each country's value-added exports that result from China's rebalancing.
- We assess the growth implications coming from China's rebalancing, by estimating how shocks to China's consumption (or investment) have varying impacts on a country's growth depending on the country's trade linkages to China.

A. Medium-Term Rebalancing Scenario

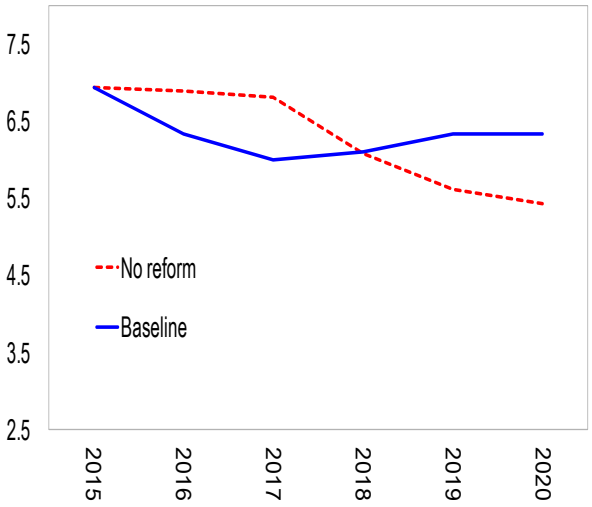
Figure 12 presents illustrative simulations of the future reform and rebalancing, to form the basis of several calculations afterwards. They are virtually identical to those discussed in the 2015 China Staff Report (IMF Country Report No. 15/234). Some rebalancing toward private consumption occurs over the medium term, accompanied by a sharper decline in investment. In this exercise, the reform-and-rebalancing scenario is the baseline scenario, while the counter-factual scenario is the growth path which can be a result of unsuccessfully implemented reforms.

Under the rebalancing scenario, the overall growth is lower compared to the counterfactual in the near term. However, the rebalancing resulting from successful reforms will lead to a higher and sustainable growth in the medium-term.

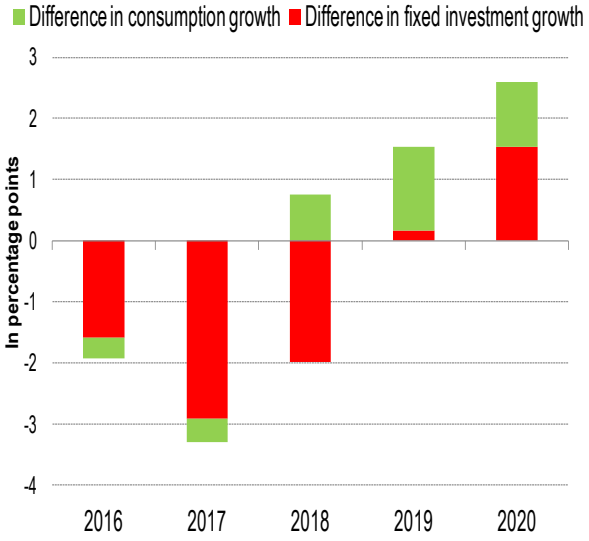
In the baseline scenario, both consumption and investment growth will be lower than under the counterfactual until 2017. Positive gains from the overall rebalancing will start to materialize in 2019, supported by stronger growth of both consumption and investment compared with the counterfactual scenario. The shift of composition from investment to consumption, however, begins to take place in the near term, as the (negative) difference in growth between the counterfactual and the baseline is larger for investment than consumption.

Figure 12. China's Rebalancing Scenario over the Medium-Term

China: GDP Growth Under Various Scenarios
(Percent)



Difference in Growth Rate Between Baseline and Counterfactual Scenario



Source: IMF staff estimates

B. Trade Exposure to China

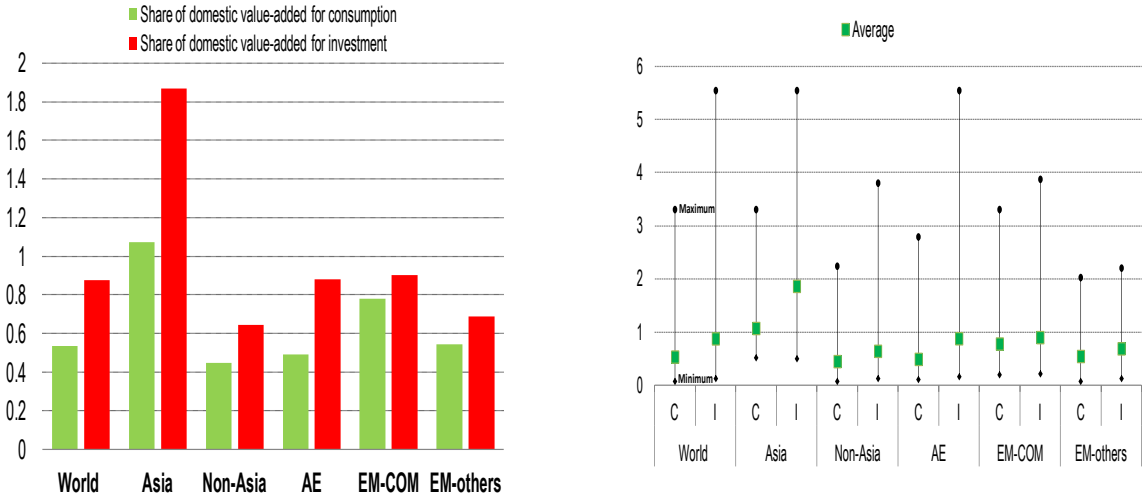
In this section, we look at the export profiles of each country in relation to China's final demand. Using value-added data from the OECD-WTO Trade in Value Added (TiVA) database that covers 62 countries between 1995 and 2011, we measure how much each country is exposed to China, in terms of the domestic value-added content of its exports for China's final demand.[9] This variable—domestic value-added content embodied in China's final demand—captures both the value-added content a country exports both directly via exports of final goods or services to China and indirectly via exports of intermediate goods and services that ultimately reach Chinese final demand (i.e. consumption and investment). We obtain the value-added data particularly from OECD-WTO TiVA database as it provides broader country coverage compared to World Input Output Database (WIOD), thereby enabling us to include more Asian economies and other emerging market economies in our analysis. Moreover, TiVA treats processing trade more accurately compared to WIOD as identified in Jones and others (2014), particularly for emerging economies such as China.

The exposure of Asian countries to China's final demand is higher than that of other countries or regions (Figure 13). Asian countries as a group also have a high relative

[9] TiVa data is only available for the following years: 1995, 2000, 2005, 2008, 2009, 2010, 2011.

exposure to China's investment (vis-a-vis consumption), when compared with the rest of the world (Figure 13). Asia's exposure to China's investment is about 1.8 times its exposure to China's consumption, while non-Asia's exposure to China's investment is about 1.5 times its exposure to China's consumption.

Figure 13. Share of Domestic Value-Added for China's Final Demand by Region
(Percent of GDP, 2011)[10]



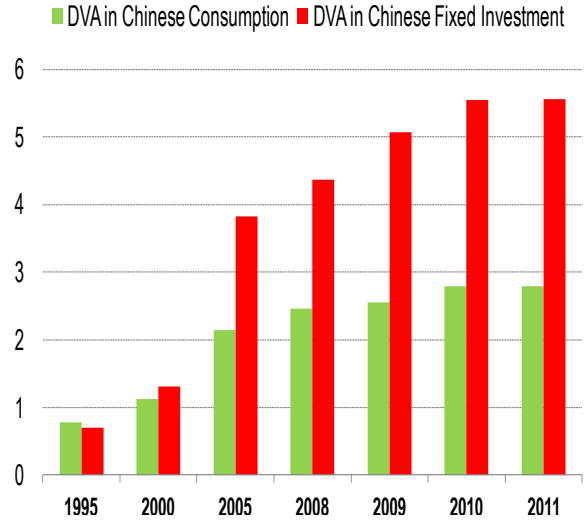
Sources: OECD-WTO TiVA database; and IMF staff estimates.
Note: C = share of domestic value-added for consumption; I = share of domestic value-added for investment.

Within Asia, we also observe some interesting variations across different countries in terms of a country's exposure to China. Countries show a great variation not only in terms of the magnitude of its exposure, but also the pace of increase in its exposure to China's final demand. Such diverse export profiles will lead to different degrees of spillover onto its exports to China or to its GDP growth, as the composition of China's domestic demand shifts away from investment toward consumption. Some countries in Asia, such as New Zealand, have expanded the roles of consumption goods and services exports to China, while Taiwan Province of China has become closely integrated with China through a substantial exposure to China's investment (Figure 14). As such, New Zealand is likely to be in a better position than Taiwan Province of China to absorb spillovers from China's rebalancing.

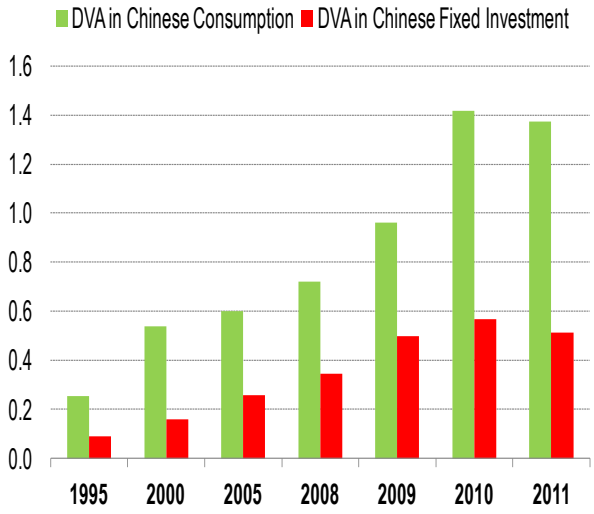
[10] We follow the classification of commodity exporters used for the World Economic Outlook (IMF, October 2015). According to this classification, a country is classified as a commodity exporter if the country meets the following two conditions: (1) commodities constitute at least 35 percent of the country's total exports, on average, from 1962 to 2014 and (2) net commodity exports accounted for at least 5 percent of its gross trade (exports plus imports), on average, between 1962 and 2014. Following these classifications, the emerging market commodity exporters used for our analysis are Argentina, Brazil, Brunei Darussalam, Chile, Colombia, Costa Rica, Indonesia, Malaysia, Mexico, Peru, and Russia.

Figure 14. Share of Domestic Value-Added for China's Final Demand: Taiwan Province of China and New Zealand
(Percent of the country's GDP, 1995–2011)

Taiwan Province of China: DVA Exported for Chinese Ultimate Demand—Consumption vs. Investment
(Percent of Taiwan Province of China's GDP)



New Zealand: DVA Exported for Chinese Ultimate Demand—Consumption vs. Investment
(Percent of New Zealand's GDP)



Sources: OECD-WTO TiVA database; and IMF staff estimates.
Note: DVA = domestic value-added

C. Spillover to a Country's Exports to China in Value-Added Terms

The first step in calculating the potential spillover effects from China's rebalancing is to look at the sensitivity of a country's value-added exports to China's final demand. We use a sample of 62 countries at annual frequency from 1995–2011 to gauge how a country's domestic value-added has historically responded to China's final demand.[11] The baseline regression is the following country-specific OLS regression:

$$DVA^{D}_{i,t}/GDP_{i,t} = \alpha_i + \beta^{D}_{i} D_{CHN,t} + \varepsilon_{i,t}$$

where *i* refers to a country, *t* is time, *D* is the real China's consumption or investment from the national accounts data. Left-hand side variable, $DVA^{D}_{i,t}/GDP_{i,t}$ is the ratio of domestic value-added to reach China's *D* as a share of a country's GDP. Both variables are in log terms, and estimations results are reported in the annex tables. The interpretation of β^{D}_{i} is the elasticity of a country's domestic value-added exports as a share of its own GDP in response

[11] For years 1995, 2000, 2005, 2008, 2009, 2010, and 2011 we use value added in exports data from OECD-WTO Trade in Value Added (TiVA) database. The interim years are interpolated in line with the methodology specified in Duval and others (2015).

to 1 percent change in China's consumption (or investment). Appendix Tables 1 and 2 report the country-specific results. We have also tried seemingly unrelated regressions (Zellner 1962), obtaining similar results for the ranking and size of the export spillover effects from China's rebalancing.

Using these sensitivity measures for consumption and investment and given reform vs. non-reform scenarios, one can assess the winners and losers from rebalancing as follows. Let us assume that under a hypothetical rebalancing scenario, China's consumption grows by $x^{c,R}\%$ and investment grows by $y^{c,R}\%$ (where superscript c stands for a country and R a rebalancing scenario). Also, let the China's consumption and investment growth under no-rebalancing scenario (denoted by superscript N) be $x^{c,N}\%$ and $y^{c,N}\%$. We assume that $x^{c,R} > x^{c,N}$ and $y^{c,R} < y^{c,N}$. So, the net change in the exports to China from each country will be

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

Assuming that β_i^C and β_i^I are positive, the size of the net change depends on the size of betas, as the first term will be positive and the second term will be negative. If Δ_i>0, the country gains from rebalancing. If negative, the country loses from rebalancing.

1. Spillover Results: Unitary Rebalancing

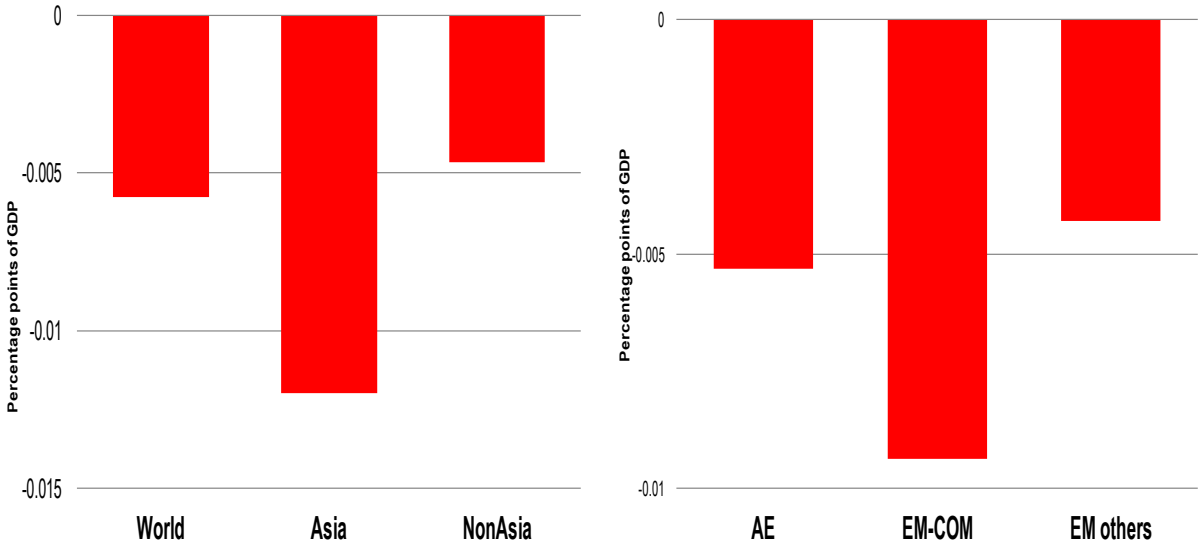
We first look at the spillover effect of a unitary rebalancing, defined as a shift of growth from investment to consumption when the consumption growth difference is normalized to be 1 percentage point, i.e. $x^{c,R} - x^{c,N} = 1$, and the investment growth difference to be -1 percentage point, i.e. $y^{c,R} - y^{c,N} = -1$.

Figure 15 shows the average impact on value-added exports to China from unitary rebalancing: 1 percentage point increase in China's consumption growth and 1 percentage point decrease in China's investment growth. Compared with other regions and other groups, Asia and commodity exporters will be most negatively impacted from the rebalancing between investment and consumption.

Similarly, Figure 16 shows the results for individual countries in Asia. Countries closely integrated to China through the global value chain, therefore exposed heavily to China's investment demand will be most adversely affected. Examples are Taiwan Province of China and Korea. Also, as China's consumption demand increases, New Zealand will benefit, as it exports mainly consumption-related products to China. Finally, Figure 17 reports the results for all countries in the sample, highlighting that the spillover effects will hinge on the country's export profile to China.

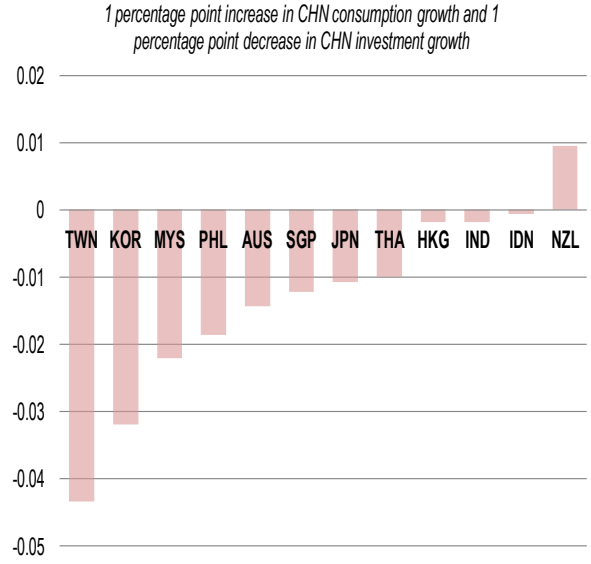
Our results indicate that a broadly growth-neutral rebalancing in China—from unitary shifting of composition of demand—is likely to have negative spillovers to trading partners, especially those which are more exposed to China's investment than to its consumption. The unitary rebalancing will have little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

Figure 15. Impact of Unitary Rebalancing on Value-Added Exports to China
(Average by Region)



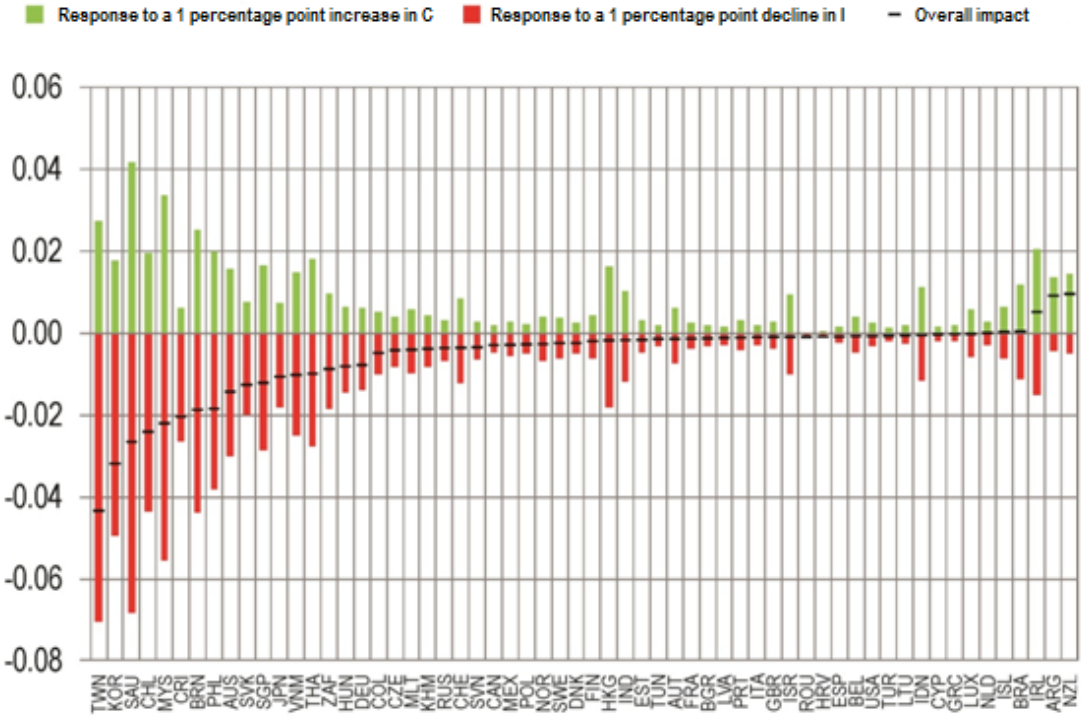
Source: IMF staff estimates.

Figure 16. Impact on Value-Added Exports to China in Asia: Unitary Rebalancing
Change in Value-Added Exports to China after China's Rebalancing



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

Figure 17. Average Impact on Value-Added Exports to China: Unitary Rebalancing
Impact on Partner Country Value Added Exports to China
of 1 percentage point change in the growth rate of consumption/investment in China
(Percentage points of GDP)

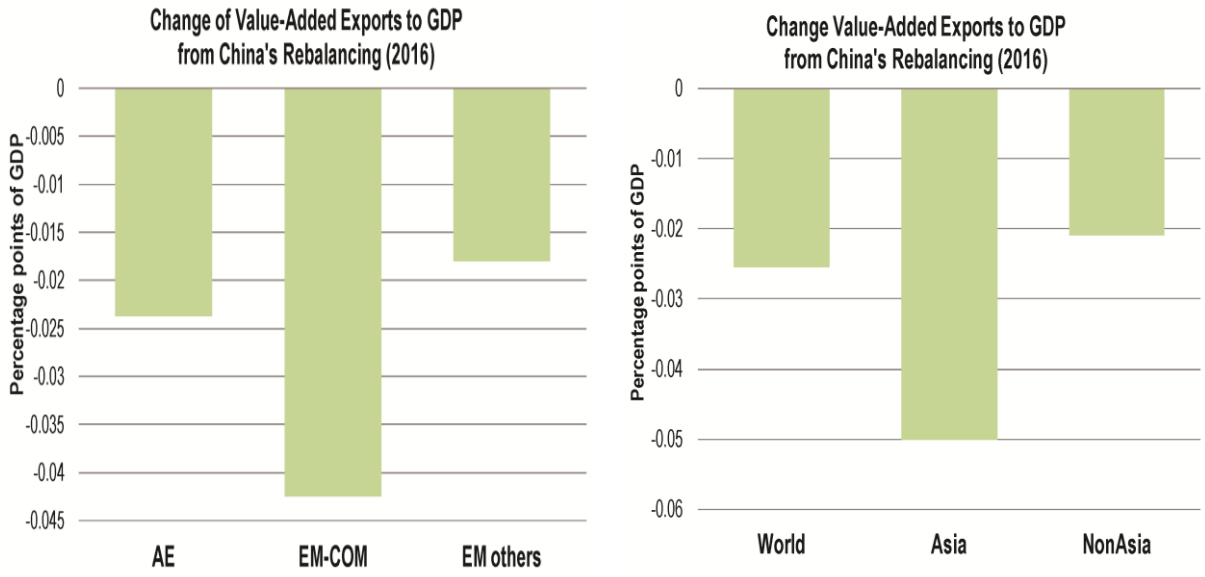


Source: IMF staff estimates.

2. Spillover Results: Medium-Term Growth Projections

We now turn to analyzing the impact on domestic exports to China using the growth projections of consumption and investment presented in Figure 12. First, we estimate the effects of the 2016 growth projections of China. Figure 18 shows that exports from each country that ultimately reach China's final demand in value-added terms will decline in 2016. This is mainly due to the growth projection that assumes a lower growth of both consumption and investment compared with the counterfactual scenario in 2016.

Figure 18. Impact on Value-Added Exports to China from the Projected Rebalancing: By Region in 2016



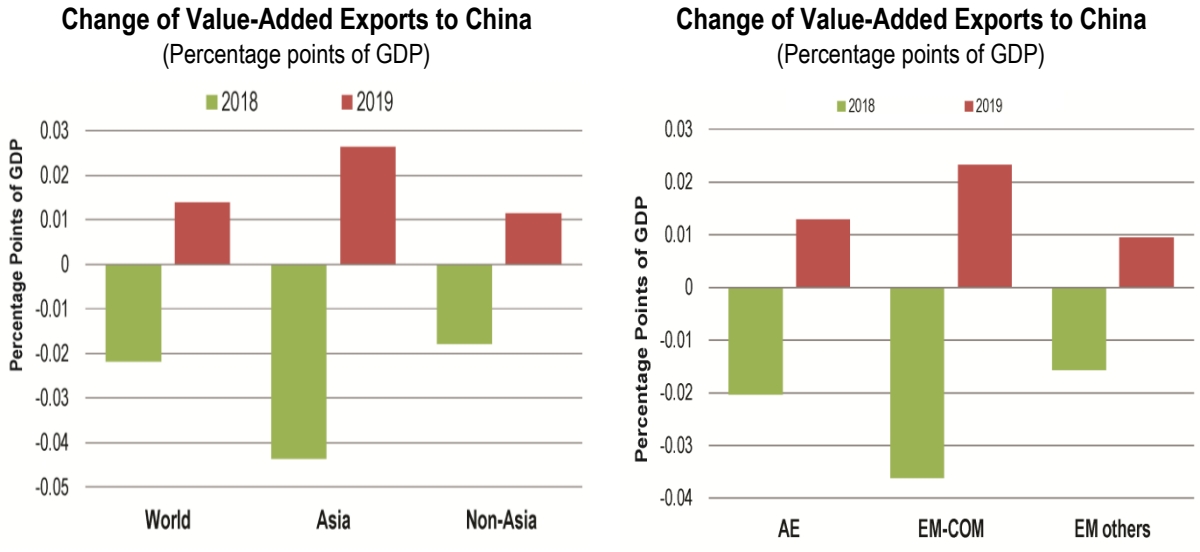
Source: IMF staff estimates.

Now, we incorporate the medium-term projection to estimate the medium-term spillover effects from China's rebalancing. From the projection in Figure 12, positive effects on the overall growth from rebalancing are expected to materialize from 2019. This boost to overall growth from rebalancing is supported by the higher growth of both consumption and investment, compared to the no-reform scenario, while the consumption growth picks up more than investment growth.

Figure 19 shows the results by using the growth projections for 2018 and 2019. In 2018, most countries still lose in their exports to China as a share of its GDP, as the overall growth rate is lower under rebalancing compared to the counter-factual. There are some exceptions to the case. For instance, New Zealand gains in 2018, as its exports for China's consumption are substantial enough for its total exports to benefit from the higher growth of consumption that starts in 2018. On average, though, most economies continue to lose in 2018. Asia and emerging-market commodity exporters are the largest losers under this particular growth path.

As the overall growth begins to benefit from rebalancing compared with the counterfactual in 2019, supported by both higher growth of consumption and investment, countries begin to gain from rebalancing. Interestingly, Asia benefits most compared to non-Asian countries under this projection. This is in line with the fact that the sheer magnitude of exposure to China's final demand is much higher in Asia compared to other regions (Figure 13).Medium-term calculations, however, are subject to large uncertainty, not least because the estimated elasticities can change substantially and growth can take different paths.

Figure 19. Impact on Value-Added Exports to China from Rebalancing: By Region over Medium-Term



Source: IMF staff estimates.

D. Impact of China's Consumption-Investment Rebalancing on Partner Country GDP Growth

This section estimates the growth impact coming from shocks to China's consumption and investment growth, transmitted through the trade channel via consumption and investment-related trade separately. The difference between this and the previous section is worthy of a short discussion. The previous section's analysis can be called as the "first-round" effect of rebalancing, as it has not incorporated the full propagation effects through the global economy. As China's rebalancing affects all countries via trade, overall economic activity of each country will be affected, in turn generating the second-round effects on trade among themselves. For a small open economy, this second round effect can be no smaller than the first round effect, as illustrated in Kireyev and Leonidov (2016). In addition, key global prices will be adjusted as economies go through second and higher round effects, producing further repercussions on global economic activity and trade of the world economy. Although we do not have an empirically-based general equilibrium model which can fully account for multi-round and multi-dimensional repercussions, we make an attempt to go beyond the first-round effects and estimate the effects of rebalancing on GDP growth of each country in this section.

The estimation proceeds in two steps. The first step estimates the shocks to China's consumption growth and investment growth. The second step estimates the response of each country's growth to them separately, allowing the responses to vary with the strength of bilateral trade linkages with China. These estimates enable us to calculate how the GDP growth of each country responds when China's consumption and investment growth rates change as a result of rebalancing from investment toward consumption.

Shocks to China's consumption and investment growth are estimated on the basis of a four variable VAR: global GDP, growth rates of Chinese GDP, consumption, and investment; $Q_t = [\, Y_{WLD,t}, Y_{CHN,t}, C_{CHN,t}, I_{CHN,t}]$ and $Q_t = \Phi Q_{t-1} + u_t$ where t is year. Shocks thus estimated are used as follows, to calculate the growth effect of shocks to consumption and investment.

Growth effects of shocks to consumption or investment are estimated as follows:

$$\Delta g_{i,t} = \alpha_i + \beta_t + \varphi_1(l)\text{shock}^D_{CHN,t} + \varphi_2(l)\text{shock}^D_{CHN,t}\text{TradeLink}^D{}_{CHN,t-1} + \varphi_3(l)\text{TradeLink}^D{}_{CHN,t-1} + \gamma X'_{it} + u_{i,t}$$

where, $g_{i,t}$ stands for GDP growth of country i at time t; superscript D stands for China's consumption or investment demand; $\text{shock}^D_{CHN,t}$ denotes shocks to growth in China's D (consumption or investment); and $X'_{i,t}$ denotes other controls including VIX to control for global financial uncertainty and global commodity prices. $\text{TradeLink}_{CHN,t-1}$ captures direct

and indirect bilateral trade linkages with China measured as domestic valued added of country i exported for Chinese final consumption, in percent of country i's GDP.
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 linkage: $\varphi_1(l) + \varphi_2(l)\text{TradeLink}^{D}_{CHN,t-1}$.

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 consumption and investment.

Results from a panel estimation over 1995–2014 are presented in Table 4. The interaction term between investment growth shock and the trade linkages is statistically significant at 1 percent, confirming the propagation of shocks strengthen with trade linkages.[12]

Table 4. Spillovers from China's Consumption/Investment Growth Shock to GDP Growth

Dependent variable: GDP growth of country i	Investment	Consumption
Year 1		
China investment growth shock X Trade exposure	0.019***	
China investment growth shock	0.048***	
	0.067	
China consumption growth shock X Trade exposure		0.002
China consumption growth shock		0.041**
		0.043
Year 2		
China investment growth shock X Trade exposure	0.021***	
China investment growth shock	0.025**	
	0.046	
China consumption growth shock X Trade exposure		0.019*
China consumption growth shock		0.021
		0.040
Additional controls	Trade exposure (investment related), VIX, oil prices	Trade exposure (consumption related), VIX, oil prices
Constant	Y	Y
Country FE	Y	Y
Time FE	Y	Y
Observations	1,140	1,140
R-squared	0.267	0.224

Source: IMF staff calculations.
Note: Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

[12] While the interaction term between consumption growth shock and the consumption trade linkage is not statistically significant by itself, the interaction term and the consumption growth shock variables are jointly significant at 1 percent (F statistic=8.77).

1. Unitary Rebalancing

Using the estimated coefficients from above and the historical value-added trade data, we then estimate the GDP growth exposure of the partner countries propagated through the ultimate final demand-related trade channels. Trade linkages are assumed to be at the latest available historical data (i.e. 2011). We find that a 1 percentage point positive shock to consumption growth and 1 percentage point negative shock to investment growth would yield an overall negative impact to the GDP growth of the average economy in the sample. Moreover, countries that are more exposed to China's investment are affected more adversely by a 1 percentage point shock to China's investment growth, despite a positive shock to Chinese consumption growth. The average Asian economy will experience a larger decline in its growth given the heavy reliance of its value-added exports on China's fixed investment (Figure 20, left panel), compared to the average non-Asian economy. Furthermore, the adverse growth impact due to +/- 1 percent change in China's consumption/investment growth on the average commodity exporting emerging economy is higher than on other emerging economies or the average advanced economy (Figure 20, right panel).[13]

Within the sample of 62 countries and particularly in Asia, there exists significant heterogeneity in growth exposures (Figures 21 and 22); for instance, New Zealand in fact faces less negative growth spillovers given that value-added exports vis-à-vis China includes more Chinese consumption-oriented exports. On the other hand, Asian economies exporting investment-related goods and services such as machinery (e.g. Taiwan Province of China and Korea) as well as less-diversified commodity exporters could face significantly larger negative growth spillovers.

2. Deducing the Role of Rebalancing in the Past Decade

In order to put the magnitudes presented in section D.1 into context, we consider a historical scenario based on actual changes that occurred between 2001–07 and 2011–15. Over these two periods, China's GDP growth rate declined by 3 percentage points. To deduce the role of rebalancing over these periods, we assume a counterfactual non-rebalancing scenario in which both consumption and investment growth rates declined by the same 3 percentage points. Between the two periods, in actuality, China's consumption growth rate rose by 0.1 percentage point, while the investment growth rate fell by 5.5 percentage points. We thus assume a rebalancing effect in China between 2001–07 and 2011–15 of 3.1 percentage points for consumption (0.1-(-3)) and -2.5 percentage points for investment (-5.5-(-3)).

[13] Robustness checks, using a different ordering of VAR to identify shocks to China, produce similar results (Figure 25).

Combining these historical deviations with the estimated effects of consumption and investment slowdown (Table 4), we find that 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 Figure 23. 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 IMF (2014). 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.

Among Asian economies, effects are larger 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.

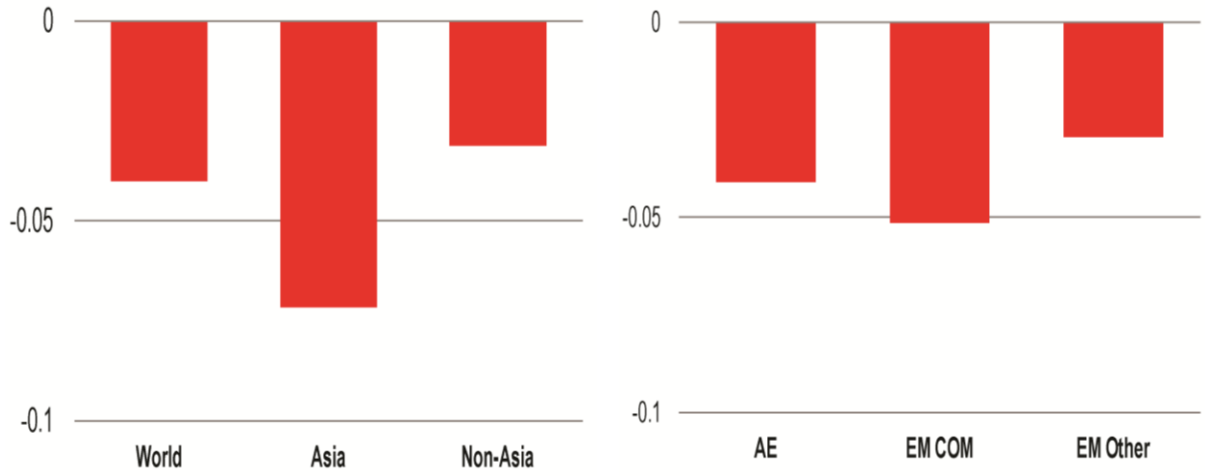
3. Medium-Term Growth Projections

Next, incorporating the consumption and investment growth profiles presented in Figure 12, we estimate the impact on partner country GDP growth once China's consumption growth starts to pick up in 2018 under the reform scenario vis-à-vis the no-reform scenario (Figure 24). In 2018 negative growth spillovers still dominate as investment growth differential between reform and no-reform scenarios remains negative. Specifically, the overall negative spillover is estimated to reach about 0.17 percentage point for the average country in the world, while this negative impact is much larger for the average Asian country, reaching nearly 0.21 percentage point given the large exposure to China's investment. In subsequent years, owing to further realization of the productivity gains while China's growth becomes more sustainable, both consumption growth as well as investment growth differentials between reform and no-reform scenarios turn positive. Hence subsequent to 2018, all partner economies could receive positive GDP growth spillovers as China's growth becomes more sustainable. For instance, in 2019, the average economy in the world will gain positive growth spillovers of 0.12 percentage point, while the positive spillovers into the average Asian trade partner will be slightly higher at around 0.14 percentage point due to Asia's high exposure to China's investment demand.

Figure 20. Impacts on GDP Growth of a Unitary Rebalancing

Average Impact on Partner-Country GDP Growth

(Percentage points of GDP)

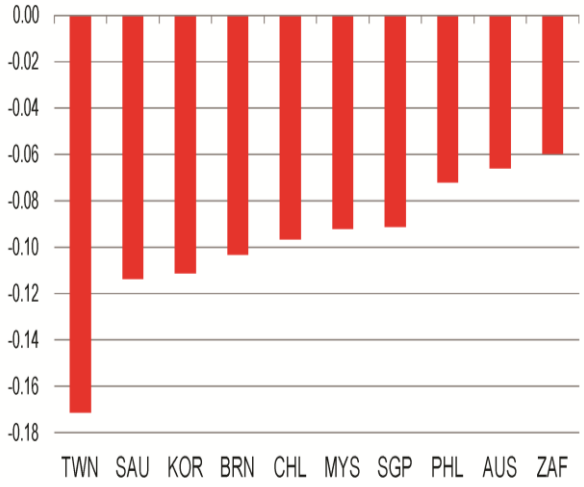


Source: IMF staff estimates.

Figure 21. Impacts on GDP Growth of Asian Countries: Unitary Rebalancing

Impact on Partner Country GDP Growth of a 1 Percentage Point Change in the Growth Rate of Consumption/Investment in China

(Percentage points of GDP)

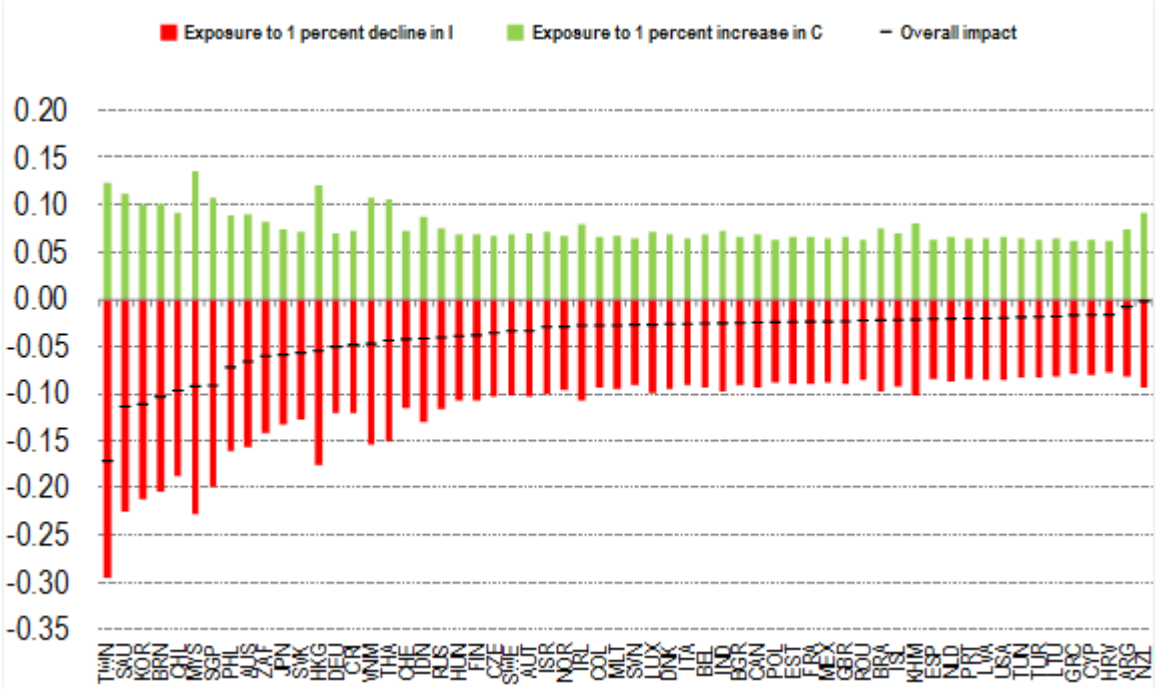


Source: IMF staff estimates.
Note: AUS = Australia; BRN = Bahrain; CHL = Chile; KOR = Korea; MYS = Malaysia; PHL = the Philippines; SAU = Saudi Arabia; SGP = Singapore; TWN = Taiwan Province of China; ZAF = South Africa.

Figure 22. Impacts on GDP Growth: Unitary Rebalancing

Estimated Impact of 1 Percent Investment/Consumption Growth Surprise in China on Partner Country Growth Transmitted Through the Trade Channel

(Percentage points of GDP)

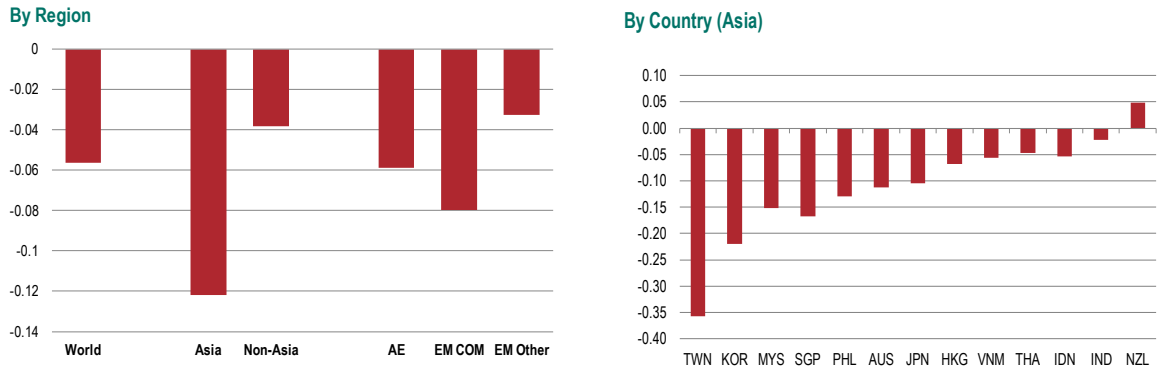


Source: IMF staff estimates.

Figure 23. Impact of Historical Rebalancing on GDP Growth

(*3.1 percentage point increase in Chinese consumption growth and 2.5 percentage point decrease in Chinese investment growth over non-rebalancing scenario)*

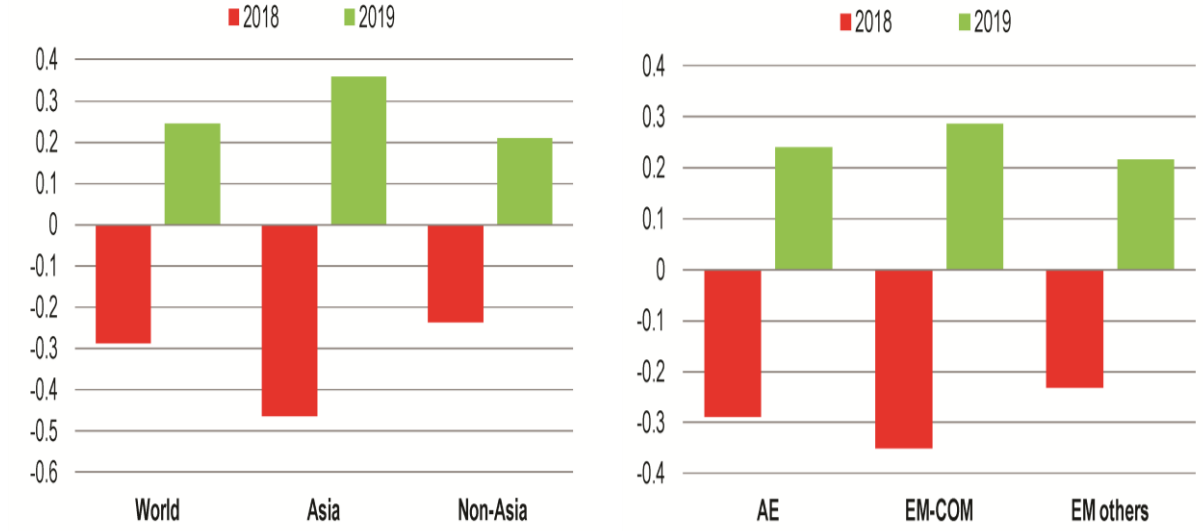
(Percentage points of GDP)



Source: IMF staff estimates.

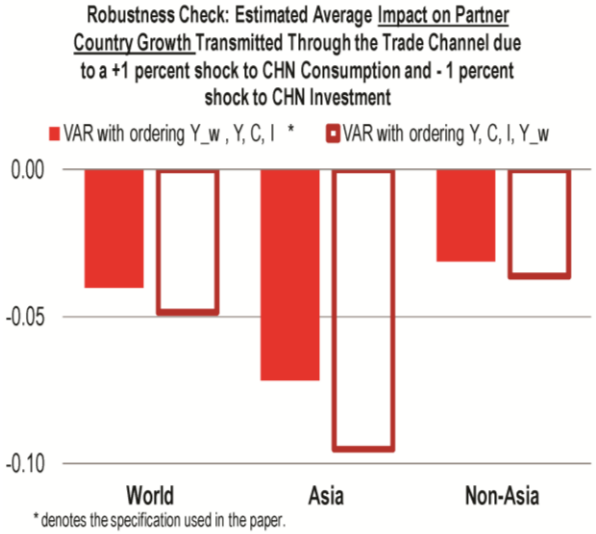
Note: AE – advanced economies; EM COM = commodity-exporting emerging markets; EM Other = other emerging markets; AUS = Australia; HKG = Hong Kong SAR; IDN = Indonesia; IND = India; JPN = Japan; KOR = Korea; MYS = Malaysia; NZL = New Zealand; PHL = the Philippines; SGP = Singapore; THA = Thailand; TWN = Taiwan Province of China; VNM = Vietnam.

Figure 24. Impacts on Regional Growth of the Projected Rebalancing



Source: IMF staff estimates.

Figure 25. Different Measures of Shocks to Consumption and Investment



Source: IMF staff estimates.
Note: Y_w = global GDP; Y = Chinese GDP; C = Chinese consumption; I = Chinese investment.

V. CONCLUSION

This paper explores causes of the recent weakness in China's imports, which was a large chunk in the global trade slowdown in 2015. A slowing in the growth of investment and exports was the key driver, whereas the slowdown in the aggregate GDP growth alone did not account for it well. Over the past decade, the rebalancing of demand composition away from investment and exports played a significant role in the slowing of China's imports.

The paper also estimates spillover effects from a rebalancing of demand in China from investment toward consumption. Asia will sustain a larger loss than other regions, and so will commodity-exporting emerging markets. For most countries, spillover effects from the rebalancing in China's demand are negative in the short term, and turn positive only over the medium term when the reform-cum-rebalancing boosts China's growth higher than under the alternative of no-reform or rebalancing.

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VII. APPENDIX

A. OECD Input-Output Database

Link: http://www.oecd.org/trade/input-outputtables.htm

The I-O tables describe the sale and purchase relations between producers and consumers within an economy.

Examples of I-O-based globalization indicators include: the import penetration ratio of intermediate and final goods, the import content of exports (an indicator of vertical specialization), the unit value added induced by exports.

The maximum number of sectors is 48: 2 mining, 22 manufacturing, 23 services, 1 agriculture. Imported intermediaries and domestically provided inputs are separated.

Input matrices:

- $Z^d = \left(z_{i,j}^d\right)$. (Raw data) Amount of domestically produced inputs from sector *i* needed by sector j for production throughout the year of reference.
- $Z^m = \left(z_{i,j}^m\right)$. (Raw data) Amount of imported inputs from sector *i* needed by sector *j* for production throughout the year of reference.
- $A^d = \left(a_{i,j}^d\right) = Z^d/output$. Amount of domestically produced inputs from sector *i* needed to produce one unit of output in sector j. The column j of "output" is sector j's total output.
- $A^m = \left(a_{i,j}^m\right) = Z^m/output$. Amount of imported inputs from sector *i* needed to produce one unit of output in sector j.
- $F^d = \left(f_{i,k}^d\right)$. Final demand of domestically produced goods and services (each column refers to a different expenditure component: household consumption, government consumption, exports, gross fixed capital formation/investment, change in inventories, etc.)
- F^m. Direct imports of goods and services by final expenditure components.

Use both domestic and import matrices to to construct the import content of four expenditure components (*C*, *G*, *I*, *X*). Aggregate information across sectors and look at the import contents only at country level.

The matrices also allow computing, for each expenditure component *k*, value of indirect imports: i.e., the amount of imports induced by expenditure on domestically provided goods and services. These include imports of intermediate inputs from foreign suppliers, as well as imports that are already incorporated in capital and intermediate inputs acquired from domestic suppliers.

The "import" matrix allows computing value of direct imports for each k.

Consider *S* sectors and *K* final demand components. Domestic output in each sector *i* is used both as intermediate inputs for other sectors and to satisfy final demand.

The domestic output from sector *i* needed to satisfy/produce final demand from *k* is

$$x_{i,k} = \sum_{j=1}^{S} a_{i,j}^d x_{j,k} + f_{i,k}^d.$$

In matrix form ($S \times K$)

$$X = A^d X + F^d.$$

Solve it to obtain

$$X = (I - A^d)^{-1} F^d.$$

The matrix $(I - A^d)^{-1}$ is refered to as Leontief Inverse.

The imports of intermediate inputs from sector *i* induced by the expenditure on domestically provided goods and services for each *k*: expenditure component *k* induced intermediate imports (i.e., indirect imports, so as to separate from direct imports!)

$$m_{i,k}^{ind} = \sum_{j=1}^{S} a_{i,j}^{m} x_{j,k}.$$

In matrix form

$$M^{ind} = A^m X = A^m (I - A^d)^{-1} F^d$$

Note that $M^{dir} = F^m$.

Total imports is

$$M = M^{ind} + M^{dir} = A^m (I - A^d)^{-1} F^d + F^m.$$

Let 1 be $S \times 1$ of ones. The total import content for each expenditure component *k* is

$$\omega_k = \frac{1' M_k^{dir} + 1' M_k^{ind}}{1' F_k^d + 1' F_k^m} = \frac{1' F_k^m + 1' A^m (I - A^d)^{-1} F_k^d}{1' F_k^d + 1' F_k^m}$$

Accordingly, ω_k can be decomposed as direct and indirect import content:$\omega_k = \omega_k^{dir} + \omega_k^{ind}$,

$$\omega_k^{dir} = \frac{1' F_k^m}{1' F_k^d + 1' F_k^m},$$

$$\omega_k^{ind} = \frac{1' A^m (I - A^d)^{-1} F_k^d}{1' F_k^d + 1' F_k^m}.$$

Define import intensity-adjusted measure of demand (IAD)

$$IAD_t = C_t^{\omega_{C_t}} G_t^{\omega_{G_t}} I_t^{\omega_{I_t}} X_t^{\omega_{X_t}}$$

The total import contents are normalized in each period so that they sum up to one.

B. Database

- http://www.wiod.org/
- http://www.oecd.org/trade/input-outputtables.htm

Appendix Table 1. Sensitivity of a Country's Value-Added Exports to China's Final Consumption Demand

	ARG	AUS	AUT	BEL	BGR	BRA	BRN	CAN	CHE	CHL	COL	CRI	CYP	CZE	DEU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ln_consumption	2.214***	1.172***	1.465***	1.115***	0.689***	1.799***	1.419***	0.490***	1.476***	1.426***	1.915***	1.087***	1.132***	1.353***	1.322***
	(0.28)	(0.08)	(0.07)	(0.09)	(0.14)	(0.10)	(0.16)	(0.09)	(0.06)	(0.09)	(0.15)	(0.36)	(0.16)	(0.10)	(0.06)
Constant	-30.314***	-13.772***	-19.561***	-14.301***	-8.079***	-24.336***	-17.131***	-4.384***	-19.397***	-17.625***	-27.476***	-13.236**	-15.223***	-18.315***	-17.237***
	(4.24)	(1.22)	(1.10)	(1.40)	(2.11)	(1.51)	(2.36)	(1.41)	(0.91)	(1.29)	(2.33)	(5.49)	(2.36)	(1.58)	(0.95)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.808	0.935	0.964	0.908	0.622	0.956	0.848	0.65	0.976	0.95	0.912	0.376	0.779	0.919	0.968

	DNK	ESP	EST	FIN	FRA	GBR	GRC	HKG	HRV	HUN	IDN	IND	IRL	ISL	ISR
	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
ln_consumption	0.652***	0.897***	1.156***	1.048***	1.015***	1.058***	1.671***	0.613***	0.468**	1.768***	0.929***	1.945***	2.401***	1.394***	1.809***
	(0.06)	(0.16)	(0.13)	(0.16)	(0.07)	(0.06)	(0.12)	(0.04)	(0.19)	(0.16)	(0.14)	(0.15)	(0.18)	(0.10)	(0.13)
Constant	-6.703***	-11.824***	-15.173***	-12.615***	-13.001***	-13.685***	-24.256***	-4.180***	-5.968*	-24.717***	-9.986***	-26.762***	-33.560***	-18.464***	-24.536***
	(0.88)	(2.36)	(1.90)	(2.40)	(1.00)	(0.85)	(1.82)	(0.63)	(2.82)	(2.35)	(2.19)	(2.25)	(2.79)	(1.54)	(1.96)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.894	0.69	0.851	0.746	0.941	0.96	0.928	0.936	0.298	0.897	0.735	0.92	0.919	0.927	0.929

	ITA	JPN	KHM	KOR	LTU	LUX	LVA	MEX	MLT	MYS	NLD	NOR	NZL	PHL	POL
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)
ln_consumption	0.939***	1.200***	0.482***	0.989***	1.062***	1.122***	0.694***	1.371***	1.713***	1.013***	1.010***	1.149***	1.047***	1.562***	1.377***
	(0.07)	(0.08)	(0.09)	(0.08)	(0.23)	(0.15)	(0.12)	(0.08)	(0.13)	(0.08)	(0.13)	(0.12)	(0.10)	(0.08)	(0.11)
Constant	-12.054***	-14.772***	-3.536**	-10.450***	-14.337***	-13.911***	-8.291***	-19.066***	-23.263***	-10.217***	-12.849***	-14.753***	-11.849***	-19.759***	-19.238***
	(1.05)	(1.26)	(1.38)	(1.18)	(3.42)	(2.28)	(1.79)	(1.28)	(1.98)	(1.15)	(2.01)	(1.76)	(1.50)	(1.22)	(1.68)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.925	0.933	0.652	0.916	0.597	0.789	0.699	0.946	0.92	0.922	0.795	0.867	0.883	0.962	0.911

	PRT	ROU	RUS	SAU	SGP	SVK	SVN	SWE	THA	TUN	TUR	TWN	USA	VNM	ZAF
	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
ln_consumption	1.689***	-0.033	0.461***	1.856***	0.794***	1.571***	1.438***	0.983***	0.882***	1.012***	0.720***	0.972***	0.957***	0.711**	0.997***
	(0.12)	(0.17)	(0.14)	(0.12)	(0.06)	(0.15)	(0.08)	(0.11)	(0.11)	(0.21)	(0.14)	(0.06)	(0.08)	(0.25)	(0.10)
Constant	-24.303***	2.684	-3.241	-23.847***	-7.234***	-21.640***	-19.991***	-11.880***	-8.854***	-13.655***	-8.806***	-9.657***	-12.142***	-5.952	-11.611***
	(1.88)	(2.57)	(2.07)	(1.88)	(0.88)	(2.25)	(1.19)	(1.65)	(1.59)	(3.13)	(2.14)	(0.92)	(1.16)	(3.81)	(1.57)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.925	0.002	0.432	0.937	0.926	0.882	0.958	0.845	0.826	0.616	0.636	0.945	0.913	0.349	0.861

Source: IMF staff estimates.

Appendix Table 2. Sensitivity of a Country's Value-Added Exports to China's Final Investment Demand

	ARG	AUS	AUT	BEL	BGR	BRA	BRN	CAN	CHE	CHL	COL	CRI	CYP	CZE	DEU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ln_investment	2.028***	1.436***	0.996***	0.907***	0.693***	1.878***	1.341***	0.949***	1.141***	1.515***	1.928***	2.215***	1.149***	1.126***	1.165***
	(0.23)	(0.09)	(0.05)	(0.06)	(0.15)	(0.07)	(0.08)	(0.03)	(0.04)	(0.06)	(0.16)	(0.19)	(0.10)	(0.09)	(0.05)
Constant	-27.979***	-17.309***	-11.427***	-10.418***	-7.693***	-25.338***	-15.149***	-11.134***	-13.315***	-18.048***	-26.725***	-29.349***	-15.039***	-13.732***	-13.601***
	(3.45)	(1.25)	(0.68)	(0.93)	(2.14)	(0.99)	(1.24)	(0.43)	(0.56)	(0.81)	(2.38)	(2.83)	(1.53)	(1.36)	(0.72)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.834	0.95	0.969	0.933	0.604	0.981	0.944	0.986	0.984	0.981	0.905	0.899	0.892	0.909	0.975

	DNK	ESP	EST	FIN	FRA	GBR	GRC	HKG	HRV	HUN	IDN	IND	IRL	ISL	ISR
	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
ln_investment	0.903***	0.829***	1.111***	0.723***	0.950***	0.915***	1.362***	0.702***	1.009***	1.705***	0.834***	1.974***	1.777***	1.263***	1.458***
	(0.04)	(0.12)	(0.10)	(0.12)	(0.04)	(0.04)	(0.07)	(0.04)	(0.05)	(0.10)	(0.10)	(0.15)	(0.12)	(0.14)	(0.11)
Constant	-10.102***	-10.055***	-13.717***	-6.754***	-11.232***	-10.801***	-18.752***	-5.393***	-13.532***	-22.476***	-8.265***	-26.627***	-23.295***	-16.098***	-18.406***
	(0.55)	(1.76)	(1.49)	(1.71)	(0.58)	(0.62)	(1.08)	(0.59)	(0.80)	(1.47)	(1.46)	(2.21)	(1.80)	(2.06)	(1.54)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.975	0.763	0.89	0.723	0.975	0.97	0.959	0.954	0.958	0.951	0.825	0.921	0.934	0.845	0.928

	ITA	JPN	KHM	KOR	LTU	LUX	LVA	MEX	MLT	MYS	NLD	NOR	NZL	PHL	POL
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)
ln_investment	0.677***	1.209***	1.130***	1.423***	1.103***	0.942***	0.899***	1.481***	1.762***	1.432***	0.804***	1.121***	0.956***	1.736***	1.341***
	(0.05)	(0.07)	(0.14)	(0.07)	(0.10)	(0.09)	(0.10)	(0.06)	(0.14)	(0.11)	(0.09)	(0.05)	(0.05)	(0.12)	(0.08)
Constant	-7.046***	-13.783***	-13.403***	-16.301***	-14.462***	-10.730***	-10.934***	-19.897***	-22.942***	-16.256***	-9.210***	-13.525***	-11.027***	-21.369***	-17.594***
	(0.78)	(1.01)	(2.07)	(1.08)	(1.49)	(1.31)	(1.43)	(0.84)	(2.04)	(1.64)	(1.26)	(0.75)	(0.78)	(1.78)	(1.22)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.916	0.955	0.813	0.962	0.888	0.883	0.851	0.979	0.915	0.918	0.855	0.97	0.956	0.932	0.946

	PRT	ROU	RUS	SAU	SGP	SVK	SVN	SWE	THA	TUN	TUR	TWN	USA	VNM	ZAF
	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
ln_investment	1.438***	0.276	0.637***	1.791***	0.908***	1.478***	1.373***	0.839***	1.442***	1.309***	0.817***	1.269***	1.012***	1.221***	1.064***
	(0.08)	(0.16)	(0.10)	(0.10)	(0.07)	(0.15)	(0.07)	(0.10)	(0.11)	(0.09)	(0.09)	(0.08)	(0.02)	(0.14)	(0.11)
Constant	-19.541***	-1.481	-5.547***	-21.976***	-8.375***	-18.920***	-17.856***	-8.767***	-17.115***	-17.565***	-9.931***	-13.334***	-12.478***	-13.641***	-12.002***
	(1.13)	(2.39)	(1.54)	(1.40)	(0.96)	(2.25)	(1.02)	(1.40)	(1.56)	(1.31)	(1.36)	(1.13)	(0.26)	(1.99)	(1.62)
Observations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
R-squared	0.96	0.163	0.715	0.96	0.928	0.863	0.963	0.839	0.925	0.936	0.84	0.949	0.996	0.846	0.863

Source: IMF staff estimates.