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Chinese Imports: What's Behind the Slowdown?

by Joong Shik Kang and Wei Liao

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Abstract

Real imports in China have decelerated significantly over the last two years to below 4 percent (yoy) from double-digit growth in previous years. Weaker investment, partly due to progress in rebalancing from investment to consumption, has been the main factor accounting for about 40–50 percent of slowdown during this period. Weaker exports also account for about 40 percent of slowdown, of which about a quarter is due to stronger RMB. Onshoring—substitution of imported intermediate inputs with domestic production—has not been an additional drag over this period but it continues to slow import growth at a similar pace as previous periods. There is large uncertainty about the impact of rebalancing on the import slowdown due to difficulties in identifying the counterfactual nonrebalancing path.

JEL Classification Numbers: F31; F14; F4

Keywords: Imports; Rebalancing; Exchange Rate; Onshoring

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I. INTRODUCTION

In recent years, China has been the leading contributor to global growth and a stabilizing force during crises. During 2000–14, China accounted for one-third of global growth. Over the same period, exports to China increased dramatically from 3 percent to 9 percent of world exports and from 9 percent to 22 percent of regional exports. China accounts for over a quarter of exports and imports of emerging and developing economies and is one of the main trading partners (top ten) for over 100 economies that constitute about 80 percent of world GDP.

The more prominent role of China in the global economy brings with it greater scrutiny. China's slowdown since 2013 has raised concerns about its underlying strength and the potential implications to global growth and trade. Recent financial market turmoil in China, amid the slowing economy and weaker trade volumes, has further aggravated concerns. The main concern is that problems in China—the world's second largest economy at market exchange rates—may weigh on global growth at a time when low oil prices, geopolitical tensions, and tightening global financial conditions are also clouding the outlook.

Global trade growth has been sluggish for several years, both in absolute and relative terms to global GDP growth. For example, in the first half of 2015, compounded by low commodity prices, the sluggish growth in trade volume led to an outright decline in world trade value. Moreover, China's contribution to the global trade slowdown (measured by import volume of goods) was unusually large in 2015, in sharp contrast to its positive impact on trade volumes in the aftermath of the global financial crisis of 2008–09, raising concerns about a weaker-than-expected momentum in China.

Several hypotheses are suggested to explain the weak import demand from China:

- After strong investment-driven growth over the past decades, in particular after the massive stimulus since 2008 to counter the global financial crisis, overall domestic demand has moderated, which slowed import demand.

- The Chinese economy is currently undergoing significant structural changes and is transitioning to a model driven increasingly by consumption and services rather than public investment and exports, with growth gradually slowing to a more sustainable pace. While this slower growth is a desirable outcome that is good for both China and the world in the long run, it may result in lower import demand as the import intensity of consumption is relatively lower than investment and exports.

- China has been substituting imports of products with its own production ("onshoring").

- China's exchange rate has appreciated sharply, by about 15 percent in real effective terms, between mid-2014 and mid-2015, eroding the price competitiveness of Chinese exports, which is one of main sources of demand for Chinese imports, despite its direct impact of making imports cheaper.

To better understand the underlying factors behind China's recent import slowdown, we estimate Chinese imports by explicitly controlling for the different import intensity of different demand components and onshoring—substitution of imported intermediate inputs with domestic production. The main findings are as follows:

- Both domestic and external demand are important factors driving import dynamics, reflecting China's unique role of an assembling hub in global value chain.

- Weaker investment, partly due to progress in rebalancing, has been the main factor accounting for about 40–50 percent of the import slowdown since 2014. Weaker exports also account for about 40 percent of slowdown, of which about a quarter is due to stronger exchange rate.

- Onshoring is a drag on import growth. But it has not been an additional drag over the last two years as it continues to slow import growth at a constant pace.

- There is large uncertainty about the impact of rebalancing on imports due to difficulties in identifying the counterfactual nonrebalancing path.

Reflecting the importance of China in global trade, many studies have analyzed the Chinese import dynamics. Kwack and others (2007) use a gravity model augmented with a CPI-based real exchange rate for a panel covering 29 developed and developing countries over the 1984–2003 period and find that Chinese multilateral import price elasticity is 0.50 and an income elasticity of 1.57. However, Wang and Ji (2006) adopt a similar approach and find little effect of nominal exchange rates on Chinese trade. Marquez and Schindler (2007) use shares of ordinary trade as well as trade in parts and components from January 1997 to July 2006. They find that ordinary trade share's income elasticities have the wrong signs ranging from -0.021 to -0.001 while price elasticities range from 0.013 to 0.021. Garcia-Herrero and Koivu (2007) examine ordinary and processing/parts trade over the 1995–2005 period by taking into account additional factors, including the stock of FDI. They find that the real exchange rate coefficient on import equation has an opposite sign not only in the full sample but also in the post-World Trade Organization (WTO) period, while Chinese income and price elasticities for exports rise considerably during the post-WTO period. Aziz and Li (2008) find that aggregate trade elasticities are varying over time due to both compositional shifts in types of goods and variation in individual category elasticities. Ahmed (2009) examines a more recent period (between 1996 and 2009) using Chinese data, but is unable to obtain sensible price elasticities for Chinese imports.

Thorbecke (2006) examines aggregate bilateral U.S.-China data over the 1988–2005 period using both the Johansen maximum likelihood method and dynamic OLS methodology of Stock and Watson (1993). He finds that there is statistically significant cointegration relationship between incomes, real exchange rates, and CPI-deflated trade flows, and exchange rate elasticity for Chinese imports from the United States ranges from 0.42 to 2.04, while income elasticity varies between 1.05 and 1.21. Mann and Plück (2007) investigate China-U.S. bilateral trade pattern by an error correction model with disaggregate trade data over the 1980–2004 period. They find that

Chinese imports from the United States. have a relatively low income elasticity of 0.74 capital goods, and 2.25 for consumer goods, while the price elasticity estimates are not statistically significant.

Recent studies consider the important role of China as an assembly hub in the global value chain process, which implies that its trade flows may not respond to exchange rate changes as expected in the conventional approach (Parsley and Popper, 2010). For example, the net effect of an RMB appreciation on China's price competitiveness could be ambiguous as it will have opposite effect on the value added component of Chinese exports and corresponding intermediate input costs. Devereux and Genberg (2007) show analytically that the RMB depreciation could have an immediate perverse effect and little short-run effect on the current account balance. Thorbecke and Smith (2012) note that estimating the price elasticity of China's imports is difficult because a large share of imports is used to produce exports. To circumvent this problem, they control for re-exports and employ a panel data set including imports from 25 countries. They find that a 10 percent RMB appreciation would increase imports for processing and ordinary imports by three to four percent and infer that the potential for import substitution and hence the import price elasticity should increase as China climbs the value chain. More recently, Cheung, Chinn, and Qian (2012) find that, even after accounting for the fact a substantial share of imports are subsequently incorporated into Chinese exports, Chinese aggregate imports actually rise in response to an RMB depreciation and decline with Chinese GDP. Some of these counterintuitive results are mitigated when they disaggregate the trade flows by customs type, commodity type, and the type of firm undertaking the transactions.

We contribute to this literature in several dimensions:

- In addition to merchandise goods imports from customs data, which is extensively used in the literature, we also use goods and services imports series from the national accounts to capture the comprehensive picture. We use merchandise import data as well to study the potentially different dynamics between processing and nonprocessing imports.

- We consider a new measure of demand, import-intensity adjusted demand (IAD). IAD is a weighted average of traditional aggregate demand components—private consumption, government consumption, investment, and exports— with time-varying weight of component-specific import intensity derived from input-output table.

- We explicitly consider the development of onshoring in the empirical estimation of China' imports to capture the effect of onshoring on import dynamics.

- We also use the PPI-based real effective exchange rate (REER). The literature has largely used the CPI-based REER due to data availability, but PPI-based or ULC-based REERs are may be preferable as they are more relevant to firm competitiveness in the macroeconomic context (Chinn, 2006).

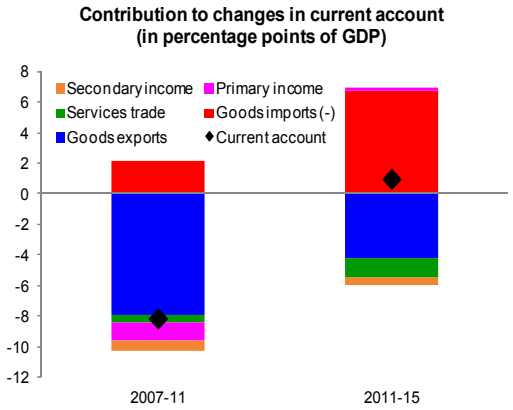
- We shed some light on quantifying the impact of rebalancing on import demand by

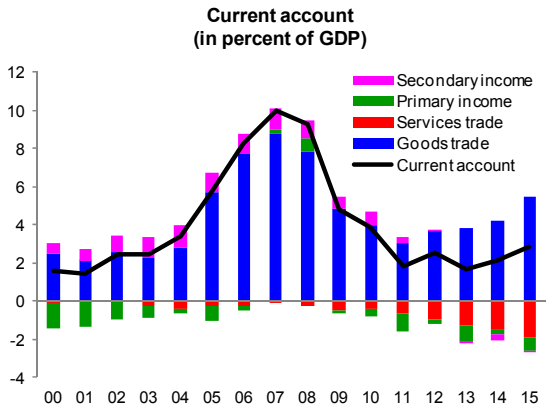
comparing the slowdown to several counterfactual nonrebalancing scenarios.

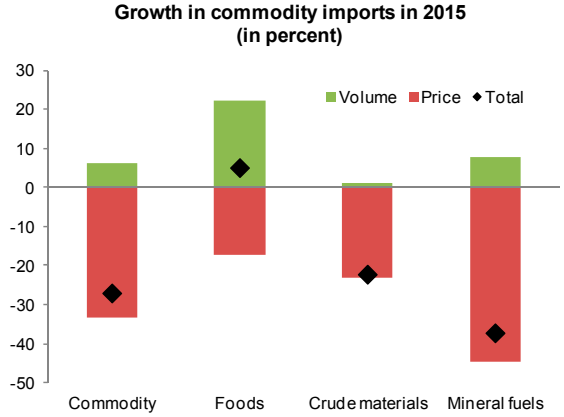
The remainder of the paper is structured as follows. Section II describes stylized facts about recent developments including discussion on progress in rebalancing, followed by discussion on Chinese processing trade and development in onshoring in Section III. Empirical estimations of Chinese import dynamics and their results are in Section IV and Section V discusses relative contribution of various factors to recent import slowdown based empirical results. Section VI concludes.

II. Recent Developments

Chinese imports have declined significantly over the last 4 years, reversing a trend decline in the current account surplus despite weak exports. After peaking at 10.0 percent of GDP in 2007, China's current account surplus declined significantly during the global financial crisis to below 2 percent in 2011. Since then it has increased somewhat, reaching 2.8 percent of GDP in 2015. These current account developments largely reflected trade developments, as the trade surplus narrowed from 8.7 percent of GDP in 2007 to 2.4 percent in 2011, then increased to 3.5 percent in 2015. While the services deficit has continued to widen by 1.3 percentage points of GDP over the last 4 years, the goods trade surplus has increased by 2.4 percentage points of GDP as a significant decline in imports (by 6.6 percentage points of GDP) more than offset the continued decline in exports (by 4.2 percentage points of GDP).

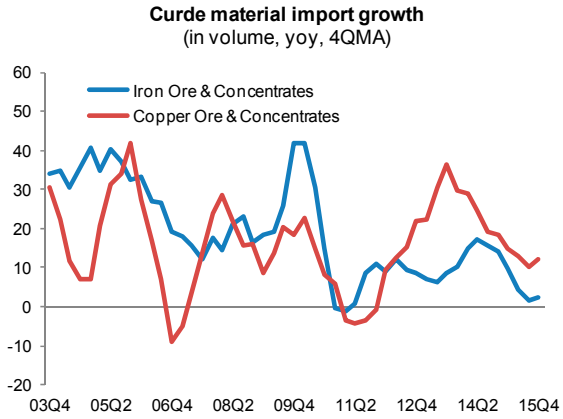


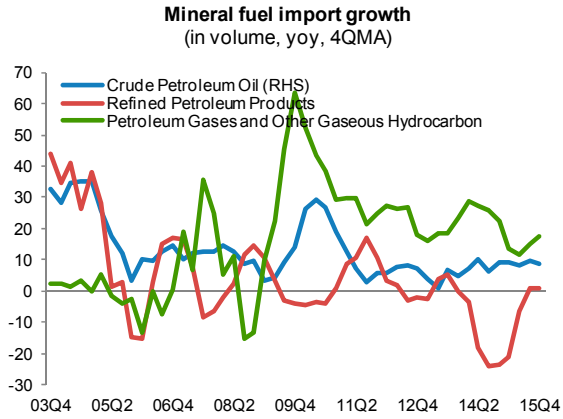


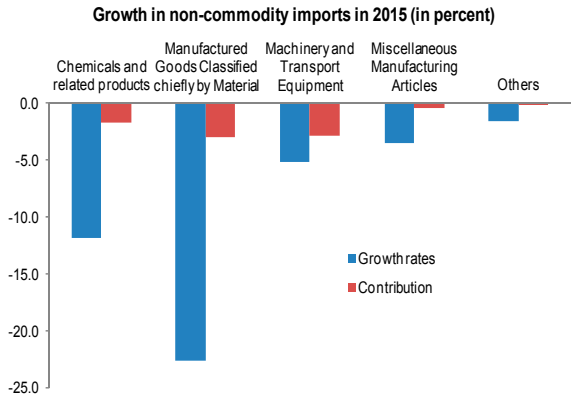


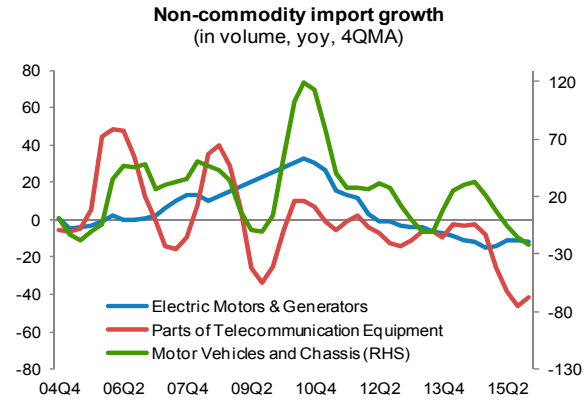
Nominal goods imports have slowed significantly over the last 4 years largely due to decline in prices. In sharp contrast to more than 20 percent growth every year on average between 2000 and 2011, import growth has slowed significantly on the back of global commodity price decline in recent years and contracted by 12.2 percent in 2015, the first contraction since 2009 amid the global financial crisis. While continued positive volume growth more than offset declining import prices effect until 2014, import volume also contracted in 2015 by 0.7 percent, together with another large decline import prices, leading to sizable contraction of nominal goods imports.

Both commodity and noncommodity items contributed to the significant import decline in 2015:









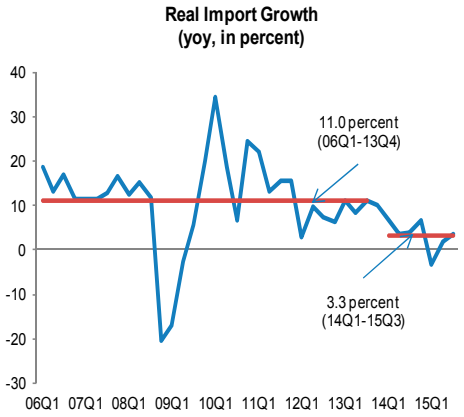
- While commodity imports account for about one-third of total imports, about a half of the import decline in 2015 was due to fall in commodity imports.
- Imports of mineral fuels and crude materials declined by 37 and 22 percent (yoy), respectively, while food imports increased by 5 percent, leading to decline of overall commodity imports by 27 percent.
- The continued large price decline was the main reason and the price effect itself would have reduced total commodity imports even more, by about 33 percent (yoy), if not offset

by still positive growth in import volume.[2] Food imports remained strong at 22 percent growth in volume terms in 2015, but mineral fuel and crude materials import growth slowed to 8 and 1 percent, respectively.[3]

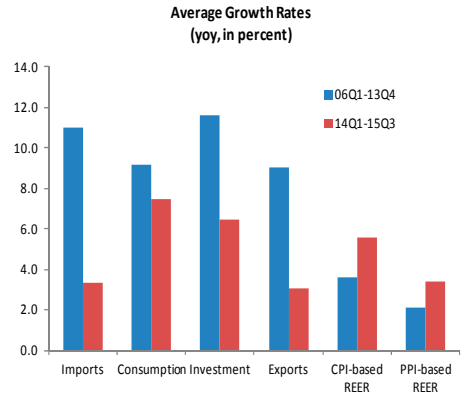
- Noncommodity imports also declined by 8 percent in 2015, of which about 35 percent is due to fall in non-commodity materials and another 35 percent is due to fall in machinery and transportation equipment.

While the import slowdown in nominal terms has important implications, including for external rebalancing, we focus in this paper, on volumes because it is more directly related to underlying economic activity. The literature has exclusively used goods trade data from the Chinese customs to estimate Chinese trade dynamics even in real terms, partly due to data limitations. To complement the literature and better understand the implication on trade as China's rebalancing away from exports and investment-driven growth model, we use more comprehensive trade data from the national accounts.[4]

Real imports in China have decelerated significantly over the last two years, raising concerns about a hard landing for the second-largest economy in the world. After double-digit growth until 2013 (11 percent, yoy, for 2006–13), import growth slowed significantly to around 3 percent over the last two years (up to 2015:Q3). In particular, real imports contracted in 2015:Q1 for the first time since the global financial crisis, by 3½ percent (yoy). Real import growth has subsequently recovered to about 2 and 3⅔ percent (yoy) in Q2 and Q3.



Over the same period, both investment and exports decelerated significantly by about 5¼ and 6 percentage points, respectively, while consumption growth slowed only modestly by about 1¾ percentage points and still faster than GDP growth. China's real effective exchange rate continued to appreciate but at a faster pace in recent years. These developments imply that the recent import slowdown need to be understood in the context of China's ongoing rebalancing from investment and exports-driven economy to consumption-driven economy.



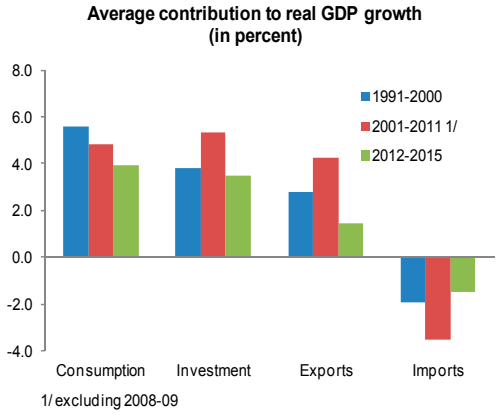
[2] Authors' estimates assuming that commodity import prices moved in line with the IMF commodity price indices for foods, metals, and fuels.
[3] Among mineral fuels, imported volume of crude petroleum oil and petroleum gases increased by 8.8 and 17.6 percent, respectively, while refined petroleum products remained flat in 2015. Crude material imports has been mixed with iron ore and copper up by 2.2 and 12.3 percent, respectively, while aluminum down by 18.5 percent.
[4] See Appendix I for more discussion on national account data that we use in this paper.

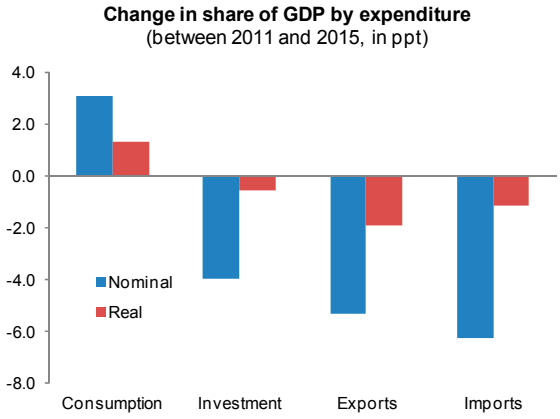
Rebalancing

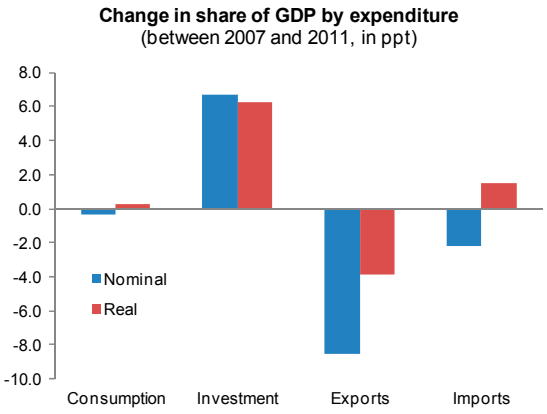
China's rebalancing has important implications for trade dynamics. A full-fledged assessment of rebalancing progress is beyond the scope of this paper, but we note a few observations on the impact of rebalancing on Chinese import dynamics over the past years.

We can observe that continued progress has been made in external rebalancing over the past decade.

- After peaking at 36 percent in 2006, the export-to-GDP ratio in nominal terms declined to 27 percent in 2011 and further to 21½ percent in 2015. Even in real terms, the export-to-GDP ratio has declined by about 5¾ percentage points between 2007 and 2015.
- In line with this, real exports, which grew by more than 15 percent every year on average between 1990 and 2011, has moderated significantly to about 5½ percent per year on average over the last 4 years (including only about 1 percent in 2015). Hence its contribution to real GDP growth has also declined to about 1½ percent over the last four years, compared to about 4¼ percent in the previous decade.







But progress in internal rebalancing away from investment toward consumption appears to be somewhat slower than external rebalancing:

- The nominal share of investment in GDP has declined by about 4 percentage points of GDP while that of consumption has increased by about 3 percentage points. However, in real terms, the degree of internal rebalancing has been much more limited. The share of consumption in real GDP has increased only by about 1¼ percentage points of GDP and that of investment has declined remained by ½ percentage point of GDP over this period.
- This implies that much of the internal rebalancing in nominal terms has come from the price developments as can be seen in sharp difference between CPI and PPI during the period: the

CPI has increased by about 9 percent but the PPI fell by about 10 percent. This development is in sharp contrast to the previous four year period between 2007 and 2011 during which investment-to-GDP ratio increased significantly by about 6½ percentage points in both real and nominal terms on the back of large stimulus after the global financial crisis.

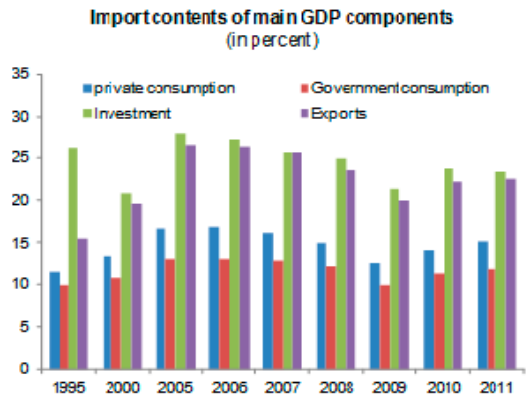
China's rebalancing has important implications for its import dynamics because each demand component of GDP has a different degree of import intensity. Rebalancing away from economic activities with relatively higher import contents to other activities with relatively lower import contents would lead to an overall slowdown in import demand, even without headline GDP declining. A new measure for domestic demand, "import intensity-adjusted demand" (IAD), shows this point clearly. IAD is a relatively new measure of demand in the trade literature, and is a weighted average of traditional aggregate demand components–private consumption, government consumption, investment, and exports–using the share of import content in each component as weights. Bussiere and others (2011), who first introduce this series, find that IAD fares well compared to conventional GDP or various alternative measures of aggregate demand used in the literature in terms of both goodness of fit and stability of parameter estimates in import equation estimation. In particular, they find that the IAD-based model performs remarkably well in explaining the trade collapse during the global financial crisis compared to the alternatives.

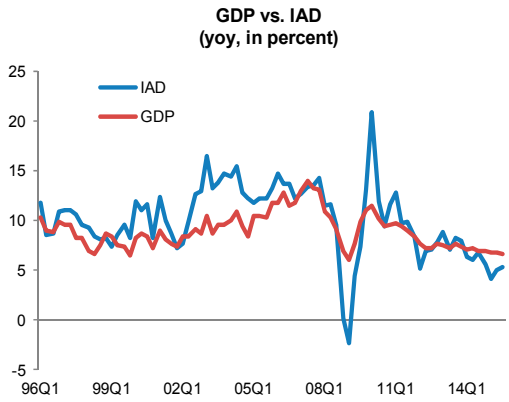
We construct Chinese IAD based on the Input-Output database.[5] The Input-Output database provides information on total inter-industry flows of transactions of goods and services with a breakdown into domestically provided and imported inputs. The domestic matrix allows computing, the value of domestic products from different sectors which is used to produce each expenditure component. Also for each of these domestic sectors, it traces the value of inputs from other sectors used in production. Imports imbedded in these domestically provided goods and services are called indirect imports, which could be tracked down using the import matrix. Together with the value of direct imports for each expenditure component from the import matrix, we can construct total import contents for each expenditure component.[6] Given that data are available only in annual frequency up to 2011, we linearly interpolate the available points to construct quarterly weights. For the period after 2011, we assume the same weights as in 2011 following Bussiere and others (2011).[7]

[5] The literature has used the information in the input-output system to better understand the implication of the growing importance of globalization and developed several measures including the import penetration of intermediate and final goods, the import content of exports, and the unit value added induced by exports. Please see Hummels, Ishii, and Yi (2001), De Backer and Yamano (2007), and Antràs and others (2012) for more detailed discussion on various measures based on the input-output system.

[6] See Appendix II for alternative measure of import intensity.

[7] As robustness checks, we construct different IADs by using different interpolation methods, including constant weights between available points and time-varying weights implied by corresponding gross trade series from U.N. Comtrade database. Import regressions with these alternative interpolations generate qualitatively similar results.





Estimated import contents across different demand components show interesting patterns. As in the case of other countries as well, investment has the highest import content, followed by exports and private consumption. The import content of government consumption is lower than those of other demand components as government spending mostly includes nontradables such as services. We can also observe that import contents have been on a somewhat declining trend since mid-2000s, reflecting a seemingly onshoring trend. Although overall GDP growth has moderated to about 7–7¼ percent in 2014–15, we find that IAD growth was slower than GDP growth as the economy has been gradually rebalancing from investment and exports to consumption, implying that the effect on imports would have been somewhat larger than implied by headline GDP growth slowdown.

III. China's Processing Trade and Onshoring

Given the China's important role as an assembly hub in global value chain, studies on China's trade have emphasized the breakdown between trade for processing goods and ordinary goods (Cheung, Chinn, and Fujii, 2010; Garcia-Herrero and Koivu, 2007; Marquez and Schindler, 2007). China' customs data provide breakdown of goods imports by different regimes, which allows us to construct imports for processing goods and ordinary imports separately. Classification by China's customs data shows 19 types of trade regimes (see Table 1), of which processing trade is under "processing and assembling" and "processing with imported materials." There are three main differences between these two regimes: allocation of control rights and tax:

- In the "processing and assembling" regime, a foreign firm supplies components to a Chinese assembly plant and retains ownership and control over the imported inputs throughout the production process. Accordingly, this regime does not require firms to pay for the raw materials. Chinese firms import raw materials for free and then send the value-added products to the same firm in the country of origin.

- In contrast, a Chinese assembly plant imports components of its own accord and retains control over their use in the "processing with imported materials" regime, so firms are required to pay for the imported intermediate inputs. Under this regime, the source and destination countries can be different.

- Imports under "processing and assembling" regime is 100 percent duty free but firms engaged in "processing with imported materials" must pay import duties for these inputs first and may obtain a full duty rebate after exporting their processed or final goods.[8] In our discussion and analysis below, we define processing trade as a sum of these two regimes.

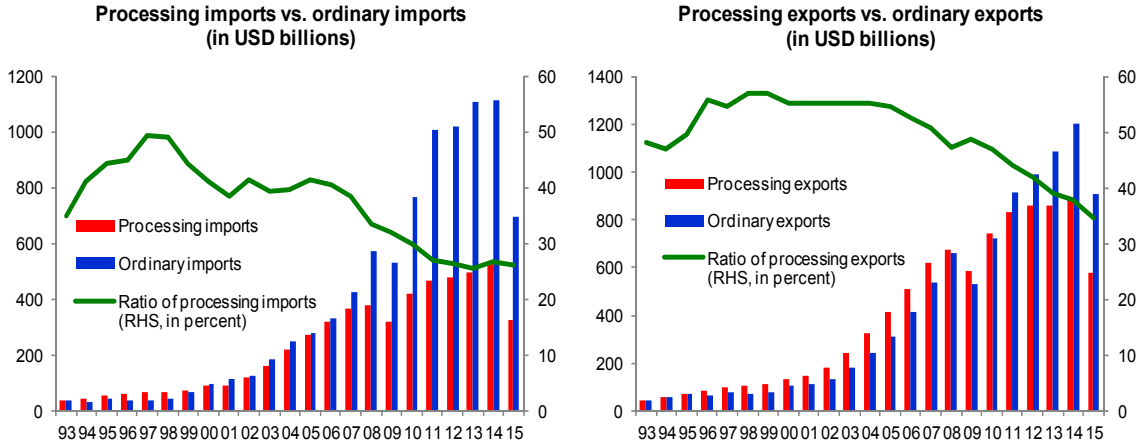
Processing trade still constitutes a significant portion of China's total trade. It accounted for less than 10 percent of total trade in early 1980s but increased significantly through 1980s and 1990s with the establishment of various free-trade zones such as special economic zones, economic and technological development zones, high-technology industrial development zones and export-processing zones (Yu and Tian, 2012). As a result, both processing imports and processing exports accounted for about a half of total trade until late 1990s.

With the acceleration of domestic substitution (onshoring) either by local suppliers or foreign subsidiaries, the share of processing trade in both imports and exports has begun to decline since early 2000s and now accounts for about a quarter or a third of total imports and exports, respectively (See table and figures below). To understand the implication of global value chain evolution on Chinese import demand, we construct a proxy variable for onshoring as the ratio of processing imports to total exports. While China used to count on about 35–40 percent of its exports on imported intermediate inputs until early 2000s, in line with the economy's moving up along the value chain, processing imports account for only about 20 percent of exports currently.

Table 1. Proportion of Customs Regime by Trade Value in 2014

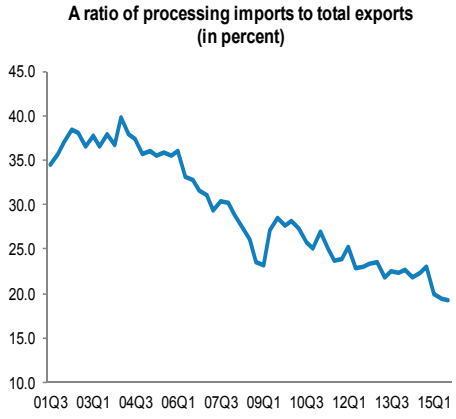
Trade type by customs regime	Exports (%)	Imports (%)
Ordinary Trade	51.4	56.6
International aid	0.0	0.0
Donation by overseas Chinese	0.0	0.0
Compensation trade	0.0	0.0
Processing & assembling	3.9	5.0
Processing with imported materials	33.9	21.8
Goods on consignment	0.0	0.0
Border trade	1.6	0.5
Equipment for processing trade	0.0	0.0
Contracting projects	0.7	0.0
Goods on lease	0.0	0.5
Equipment/materials investment by foreign-ivested enterprises	0.0	0.5
Outward processing	0.0	0.0
Barter trade	0.0	0.0
Duty-free commodities on payment of foreign currency	0.0	0.0
Customs warehousing trade	2.3	5.1
Entrepot trade by bonded area	4.7	9.5
Equipment imported into export processing zone	0.0	0.3
Other trade	1.6	0.1

[8] See Yu and Tian (2012) and Feenstra and Hanson (2005) for more details about differences between these two regimes.



This increasing role of "onshoring" has been found elsewhere in the literature. Koopman, Wang, and Wei (2012) adopt an Input-Ouput table-based approach and find that China's domestic value added rose between 2002 and 2007. Kee and Tang (2015) study China's rising domestic content in exports using firm- and customs transaction-level data and find that the substitution of domestically produced inputs for imported materials by individual processing exporters caused China's domestic content in exports to increase from 65 to 70 percent in 2000–2007, confirming the upward trend found in Koopman, Wang, and Wei (2012). Ma, Wang, and Zhu (2013) estimate the domestic value added in China by different types of firms and find that about 45 percent of Chinese value added in exports are created by foreign-invested enterprises. Upward, Wang, and Zheng (2012) study a merged sample of Chinese firms, with trade and production information from 2003 to 2006 and find that the foreign content of Chinese export is high but is falling over the sample period.

To understand the impact of ongoing import substitution by domestic production on import dynamics, we use the ratio of processing imports to total exports as a proxy to onshoring in our empirical work in next sections. Conceptually, onshoring should be measured by Chinese companies' production substituting previous imports and foreign companies' production in China. However, due to data availability, literature uses a share of domestic value added in gross exports and final domestic demand from the OECD-WTO's Trade in Value Added (TiVA) database alternatively. However, this data series is also available only at annual frequency up to only 2011. So as an alternative measure, we use the ratio of processing imports to total exports from the customs data, which shows a continued downward trend at a similar pace in recent years. For the overlapping periods, this proxy measure broadly follows the similar pattern observed in foreign value added share in gross exports and final domestic demand in TiVA database.



IV. EMPIRICAL ESTIMATION AND RESULTS

Our model specification is as below:

$$\Delta lnM_t = c + \beta \Delta lnY_t + \gamma \Delta lnREER_t + \delta \Delta Onshoring_t + \varepsilon_t$$

where *M* is real imports, *Y* is various combination of demand components in real terms, and *REER* is real effective exchange rates. To capture the effect of substituting imported intermediate goods with domestically produced inputs, we also add a proxy variable for onshoring. We use a log difference over four quarters (i.e., yoy growth) using Newey-West estimator (1987) to address potential serial correlations in error terms.[9]

We first estimate goods and services imports from the national accounts to capture the comprehensive picture, followed by estimation for goods only also from the national accounts data. We then estimate disaggregate imports from customs data—processing and nonprocessing imports—to capture potentially different dynamics. We consider several different measures of demand components: IAD; GDP; domestic demand and exports; and consumption, investment, and exports. A ratio of processing imports to total exports is used as a proxy for onshoring. While literature has largely counted on CPI-based REER due to data availability, we also use PPI-based REER as it is more relevant to capture price competitiveness in the macroeconomic context.

Table 2 presents the estimation results for aggregate imports of goods and services from the national accounts. As Chinese trade undertook a structural shift around the time of the WTO accession (Cheung, Chinn, and Qian, 2012; Garcia-Herrero and Koivu, 2007), we consider a sample period from 2002:Q1 to 2015:Q3 as our baseline period. Estimation results for 10 different models are shown in the table with different combination of contemporaneous demand and REER variables as robustness checks indicate that lagged explanatory variables are not statistically significant.

[9] Alternatively, we also estimate the same specification using quarter-over-quarter growth of seasonally adjusted series. We obtain the similar estimation results as we discuss in this section using year-over-year growth series. See Appendix III for estimation results.

Table 2. Aggregate Imports of Goods and Services from National Accounts
(2002:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.738***	1.636***	1.637***							
	(8.961)	(7.268)	(7.761)							
GDP				1.594***	1.482***	1.585***				
				(3.280)	(3.408)	(3.065)				
Domestic demand							1.343***	1.344***		
							(5.594)	(5.418)		
Consumption									0.441*	0.435*
									(1.777)	(1.713)
Investment									0.784***	0.790***
									(6.133)	(6.051)
Exports							0.527***	0.547***	0.512***	0.523***
							(6.253)	(7.453)	(5.920)	(6.913)
CPI-based REER		-0.090			-0.602***		-0.175		-0.072	
		(-0.493)			(-2.868)		(-0.974)		(-0.473)	
PPI-based REER	-0.254		-0.122	-0.991***		-0.651**		-0.175		-0.057
	(-1.412)		(-0.605)	(-3.590)		(-2.273)		(-0.879)		(-0.328)
Onshoring	0.800***	0.903***	0.891***	1.171***	1.241***	1.323***	0.742***	0.762***	0.799***	0.816***
	(2.995)	(4.113)	(4.091)	(3.279)	(3.945)	(4.531)	(2.999)	(2.937)	(3.679)	(3.406)
GFC dummy		-0.065***	-0.060***		-0.127***	-0.105***	-0.061***	-0.052***	-0.083***	-0.080***
		(-4.561)	(-3.608)		(-8.097)	(-4.936)	(-3.924)	(-2.984)	(-4.436)	(-3.792)
Constant	-0.046**	-0.030	-0.031	-0.007	0.017	0.001	-0.050	-0.054*	-0.043	-0.045
	(-2.221)	(-1.153)	(-1.382)	(-0.139)	(0.368)	(0.016)	(-1.672)	(-1.912)	(-1.426)	(-1.609)
Observations	55	55	55	55	55	55	55	55	55	55
Adjusted R-squared	0.859	0.873	0.873	0.689	0.754	0.740	0.886	0.885	0.895	0.894

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All different combinations of demand variables are positively associated with import demand with statistically significant coefficient estimates, implying that both domestic and external demands are important factors driving import dynamics. Aggregate demand—either measured as conventional GDP (columns 4–6) or IAD (columns 1–3)—registers significant positive coefficients ranging from 1.5 to 1.8. Models with disaggregate demand variables (columns 7–10) show that not only domestic demand but also external demand are important drivers for Chinese imports reflecting the China's unique role of an assembling hub in global value chain.

Coefficient estimates on real effective exchange rates are counterintuitive. As the real value of the Chinese RMB is expressed so that an increase represents an appreciation, tradition trade theory predicts that exchange rate should enter in with positive coefficient. However, coefficient estimates on both CPI-based and PPI-based REERs are negative in models with GDP (models 46) or not statistically significant in models with IAD (columns 1–3) and with disaggregate demand variables (columns 7–10). These counterintuitive results are already reported in literature as noted above, which is likely to reflect the ambiguous net effect of an RMB appreciation on China's price competitiveness due to the opposite effect on the value added component of Chinese exports and imported intermediate input costs (Devereux and Genberg, 2007; Thorbecke and Smith, 2012; Cheung, Chinn, and Qian, 2012).

Import intensity-adjusted demand improves the goodness-of-fit of the model. Compared to the model with conventional GDP without GFC dummy (column 4), the model with IAD variable (column 1) improves the empirical fit significantly with adjusted R-squared being higher by more than 0.2. The goodness-of-fit of the model with IAD variable without GFC dummy (column 1) is still better than that of the model with GDP with GFC dummy (column 6). This finding is in line with literature as IAD series reflects the different developments of expenditure components of

aggregate demand over cycles (Bussiere and others, 2011). Although the IAD-based model performs well in explaining the large collapse of trade during the GFC period, additional GFC period dummy are statistically significant (models 2–3).

Estimated import elasticities are consistent with corresponding import intensities. Models with IAD variables (columns 1–3) impose different import intensities of individual demand components as estimated in Appendix III. In contrast, columns 9–10 show the estimation results for the aggregate import model with disaggregate demand variables without such a constraint. Estimated import elasticity for investment is higher than those for exports and consumption. When we consider relative share of each component together, these results imply that import intensity is the highest for investment, followed by exports and consumption, consistent with the estimates from Input-Output table in Appendix III.

Onshoring has been a drag on import growth. As discussed in Section III, there has been a trend onshoring (domestic substitution) by local suppliers and foreign subsidiaries since early 2000s. As a result, a share of processing trade in imports, which accounted for about a half of total imports until late 1990s, has declined to about a quarter of total imports recently. The estimation results imply that onshoring has reduced import growth by about ¾–1 percentage points per year considering that a share of imported inputs for exports has been declining by about 1 percentage point every year.[10]

Table 3. Aggregate Imports of Goods from National Accounts
(2000:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.842***	1.768***	1.797***							
	(9.581)	(7.906)	(8.660)							
GDP				1.850***	1.715***	1.843***				
				(3.397)	(3.605)	(3.241)				
Domestic demand							1.441***	1.439***		
							(6.935)	(6.687)		
Consumption									0.483***	0.477***
									(2.764)	(2.693)
Investment									0.826***	0.831***
									(8.727)	(8.643)
Exports							0.597***	0.623***	0.567***	0.586***
							(7.602)	(8.946)	(7.236)	(8.420)
CPI-based REER		-0.212			-0.746***		-0.231		-0.145	
		(-1.093)			(-3.047)		(-1.393)		(-0.997)	
PPI-based REER	-0.302*		-0.244	-1.051***		-0.805**		-0.232		-0.129
	(-1.693)		(-1.181)	(-3.813)		(-2.449)		(-1.305)		(-0.819)
Onshoring	1.043***	1.085***	1.083***	1.465***	1.472***	1.575***	1.048***	1.079***	1.100***	1.128***
	(4.974)	(4.848)	(5.134)	(4.433)	(4.276)	(4.881)	(4.702)	(4.754)	(5.636)	(5.437)
GFC dummy		-0.037**	-0.026		-0.103***	-0.076***	-0.026	-0.013	-0.050**	-0.043*
		(-2.162)	(-1.332)		(-5.914)	(-3.120)	(-1.394)	(-0.654)	(-2.297)	(-1.792)
Constant	-0.061***	-0.049*	-0.055**	-0.035	-0.009	-0.029	-0.075***	-0.081***	-0.065**	-0.069**
	(-2.871)	(-1.796)	(-2.326)	(-0.644)	(-0.180)	(-0.515)	(-2.830)	(-3.182)	(-2.414)	(-2.665)
Observations	55	55	55	55	55	55	55	55	55	55
Adjusted R-squared	0.888	0.889	0.889	0.744	0.782	0.764	0.917	0.916	0.923	0.922

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[10] We acknowledge that these could be a potential endogeneity problem as the numerator of this variable is a component of the import demand. However, as we noted in Section III, this series shows the similar trend of 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 shows the qualitatively very similar results for aggregate imports of goods from the national accounts: both domestic and external demands are important factors behind import dynamics; coefficient estimates on real effective exchange rates are counterintuitive; IAD improves the goodness-of-fit of the empirical models; estimated import elasticities are consistent with corresponding import intensities; and onshoring has been a drag on import growth.

As shown in Tables 2 and 3 and subsequent empirical findings below, our regression results are quite stable for different model specifications, and coefficients for main explanatory variables are statistically significant, suggesting that multicollearity may not be a concern. To test this formally, we calculate variance inflation factor (VIF) for the each of the benchmark regressions. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. For all regressions reported in the tables, VIFs are lower than three for each explanatory variable, confirming that the possibility of multicollearity is rather limited in our specifications.

Next, we consider a shorter sample period starting from 2005:Q3 for two reasons. First, China introduced an exchange rate reform in July 2005. After more than a decade of strictly pegging the RMB to the U.S. dollar at an exchange rate of 8.28, the People's Bank of China announced a revaluation of the currency at 8.11 against the dollar and a reform of the exchange rate regime to incorporate a reference basket of currencies to guide the target for the RMB exchange rate. Second, customs data for both aggregate and disaggregate merchandise goods imports are available from this period, which enables us to examine the potentially different dynamics for processing and nonprocessing imports.

Tables 4 and 5 present estimation results for aggregate imports of goods and services and goods only, respectively, from the national accounts for this shorter sample period. Estimation results are qualitatively similar with those for the post-WTO period in Tables 2 and 3, with all demand variables (except consumption in columns 9–10) being important factors and ambiguous exchange rate effect. The onshoring effect seems a bit stronger during this period, with the estimation results implying that onshoring has reduced import growth by about 1 to 1¾ percentage points per year.

Estimation results with customs data for post-2005 period are reported in Tables 6 to 8. Table 6 for aggregate goods imports show broadly the similar results with those in Table 5 from the national accounts reflecting the fact that these two series co-move closely during this sample period as seen in Appendix I. All demand variables are important determinants for import demand while the effect of exchange rate movement remains ambiguous. Onshoring effect seems to have been a bigger drag for merchandise goods imports while the elasticity for investment being a bit lower.

Table 4. Aggregate Imports of Goods and Services from National Accounts
(2005:Q3–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.751***	1.621***	1.611***							
	(8.431)	(6.588)	(7.407)							
GDP				1.801***	1.789***	1.938***				
				(3.463)	(3.275)	(3.708)				
Domestic demand							1.325***	1.329***		
							(5.220)	(5.640)		
Consumption									0.508	0.509
									(1.684)	(1.684)
Investment									0.721***	0.723***
									(3.845)	(3.930)
Exports							0.540***	0.537***	0.520***	0.516***
							(6.742)	(7.781)	(6.193)	(7.175)
CPI-based REER		0.057			-0.232		0.104		0.113	
		(0.363)			(-1.033)		(0.742)		(0.790)	
PPI-based REER	-0.201		0.061	-0.763*		-0.085		0.140		0.151
	(-1.017)		(0.332)	(-1.933)		(-0.309)		(0.896)		(0.958)
Onshoring	0.739**	0.947***	0.947***	1.303***	1.529***	1.693***	0.923***	0.937***	0.950***	0.964***
	(2.228)	(4.605)	(4.048)	(3.040)	(6.034)	(5.267)	(4.759)	(4.031)	(4.914)	(4.135)
GFC dummy		-0.074***	-0.077***		-0.140***	-0.142***	-0.071***	-0.078***	-0.085***	-0.093***
		(-4.766)	(-4.682)		(-9.571)	(-7.038)	(-4.215)	(-4.293)	(-3.773)	(-3.770)
Constant	-0.048**	-0.032	-0.030	-0.030	-0.021	-0.039	-0.058*	-0.057**	-0.048	-0.046
	(-2.225)	(-1.143)	(-1.320)	(-0.551)	(-0.344)	(-0.721)	(-1.852)	(-2.180)	(-1.439)	(-1.666)
Observations	41	41	41	41	41	41	41	41	41	41
Adjusted R-squared	0.841	0.874	0.874	0.631	0.759	0.753	0.891	0.892	0.889	0.890

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Aggregate Imports of Goods from National Accounts
(2005:Q3–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.857***	1.756***	1.774***							
	(9.535)	(7.105)	(8.346)							
GDP				2.133***	2.064***	2.247***				
				(3.934)	(3.617)	(4.159)				
Domestic demand							1.350***	1.360***		
							(5.619)	(5.798)		
Consumption									0.367*	0.368*
									(1.708)	(1.747)
Investment									0.832***	0.839***
									(6.193)	(6.383)
Exports							0.594***	0.604***	0.556***	0.564***
							(6.881)	(7.883)	(6.778)	(7.867)
CPI-based REER		-0.050			-0.324		-0.039		-0.019	
		(-0.329)			(-1.436)		(-0.273)		(-0.138)	
PPI-based REER	-0.187		-0.032	-0.720**		-0.158		0.001		0.024
	(-1.243)		(-0.195)	(-2.166)		(-0.596)		(0.008)		(0.167)
Onshoring	1.080***	1.188***	1.203***	1.728***	1.856***	2.052***	1.282***	1.315***	1.302***	1.334***
	(5.063)	(6.359)	(5.755)	(5.137)	(8.097)	(6.649)	(6.352)	(5.974)	(6.859)	(6.338)
GFC dummy		-0.047**	-0.046**		-0.118***	-0.118***	-0.035*	-0.035	-0.063***	-0.064***
		(-2.558)	(-2.211)		(-7.175)	(-5.048)	(-1.750)	(-1.649)	(-2.900)	(-2.743)
Constant	-0.064***	-0.051*	-0.054**	-0.066	-0.051	-0.074	-0.070**	-0.072**	-0.054	-0.056*
	(-3.060)	(-1.701)	(-2.210)	(-1.182)	(-0.817)	(-1.339)	(-2.289)	(-2.653)	(-1.665)	(-1.924)
Observations	41	41	41	41	41	41	41	41	41	41
Adjusted R-squared	0.890	0.899	0.899	0.717	0.798	0.790	0.923	0.923	0.928	0.928

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Aggregate Imports of Goods from Customs
(2006:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.635***	1.416***	1.575***							
	(8.416)	(4.770)	(7.967)							
GDP				1.944***	1.748***	2.143***				
				(3.461)	(2.819)	(4.118)				
Domestic demand							0.871**	0.891***		
							(2.710)	(2.949)		
Consumption									0.189	0.202
									(0.903)	(1.013)
Investment									0.556**	0.561**
									(2.601)	(2.691)
Exports							0.566***	0.565***	0.540***	0.538***
							(8.203)	(8.244)	(6.552)	(6.651)
CPI-based REER		-0.183			-0.366		0.075		0.083	
		(-0.673)			(-1.142)		(0.456)		(0.517)	
PPI-based REER	-0.030		0.115	-0.489		0.074		0.143		0.142
	(-0.182)		(0.804)	(-1.404)		(0.336)		(0.981)		(0.963)
Onshoring	1.840***	1.741***	1.961***	2.399***	2.324***	2.794***	2.151***	2.195***	2.144***	2.181***
	(6.372)	(7.240)	(7.148)	(5.499)	(7.250)	(8.670)	(5.643)	(5.934)	(5.653)	(5.874)
GFC dummy		-0.031**	-0.039***		-0.089***	-0.106***	0.005	-0.003	-0.015	-0.023
		(-2.659)	(-2.955)		(-5.238)	(-5.069)	(0.255)	(-0.118)	(-0.518)	(-0.793)
Constant	-0.068***	-0.040	-0.060***	-0.078	-0.049	-0.092*	-0.039	-0.039	-0.027	-0.027
	(-3.867)	(-1.175)	(-3.290)	(-1.498)	(-0.761)	(-1.959)	(-1.042)	(-1.157)	(-0.728)	(-0.811)
Observations	39	39	39	39	39	39	39	39	39	39
R-squared	0.863	0.873	0.871	0.748	0.818	0.807	0.900	0.901	0.904	0.905
Adjusted R-squared	0.852	0.858	0.856	0.727	0.796	0.784	0.885	0.886	0.886	0.887

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tables 7 and 8 show different dynamics between processing and non-processing imports. Export demand is the main factor behind processing goods import dynamics. Columns 7–10 in Table 6 show that 1 percent increase in external demand would lead to about 0.4 percent increase in processing import demand, while domestic demand is not statistically significant factor. Although coefficient estimates on exchange rate are negative as expected in eight out of 10 models, implying the processing import demand would decline with falling exports due to appreciation, they are still not statistically significant. This might be due to some noncommercial behavior of firms induced by the domestic policies which aim at supporting export sector. Onshoring is a much bigger drag on processing goods imports, implying that it has reduced processing goods import growth by about 3 percentage points per year. For nonprocessing imports in Table 8, we can see that not only domestic demand but also external demand is important factors. Coefficient estimates on exchange rate are positive as expected in seven out of 10 models, implying the nonprocessing import demand would increase with falling import prices arising from currency appreciation, but they are still not statistically significant.

Table 7. Imports of Processing Goods from Customs

(2006:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	0.965*	0.458	0.815							
	(1.902)	(0.796)	(1.550)							
GDP				1.148	0.818	1.404*				
				(1.346)	(0.995)	(1.806)				
Domestic demand							-0.445	-0.430		
							(-1.495)	(-1.436)		
Consumption									-0.146	-0.124
									(-0.494)	(-0.421)
Investment									-0.251	-0.251
									(-0.922)	(-0.926)
Exports							0.820***	0.794***	0.828***	0.804***
							(4.232)	(4.393)	(4.197)	(4.325)
CPI-based REER		-0.579			-0.551		0.288		0.287	
		(-1.276)			(-1.230)		(0.833)		(0.814)	
PPI-based REER	-0.352		0.013	-0.622		0.100		0.346		0.349
	(-0.816)		(0.031)	(-1.255)		(0.231)		(1.035)		(1.028)
Onshoring	2.796***	2.651***	3.100***	3.126***	2.936***	3.632***	3.654***	3.672***	3.653***	3.674***
	(3.328)	(3.608)	(3.607)	(3.626)	(4.208)	(5.057)	(4.726)	(4.941)	(4.606)	(4.800)
GFC dummy		-0.092***	-0.098**		-0.111***	-0.136***	0.048	0.027	0.054	0.035
		(-2.758)	(-2.585)		(-3.820)	(-4.034)	(1.158)	(0.678)	(1.128)	(0.701)
Constant	-0.027	0.041	-0.007	-0.033	0.013	-0.051	0.042	0.048	0.037	0.042
	(-0.474)	(0.617)	(-0.121)	(-0.411)	(0.163)	(-0.693)	(1.370)	(1.551)	(1.357)	(1.499)
Observations	39	39	39	39	39	39	39	39	39	39
R-squared	0.622	0.672	0.654	0.596	0.675	0.659	0.861	0.863	0.861	0.863
Adjusted R-squared	0.590	0.633	0.614	0.562	0.637	0.619	0.840	0.842	0.835	0.838

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8. Imports of Nonprocessing Goods from Customs

(2006:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.974***	1.895***	1.965***							
	(8.649)	(5.565)	(7.766)							
GDP				2.418***	2.279***	2.583***				
				(3.649)	(3.038)	(3.947)				
Domestic demand							1.509***	1.528***		
							(3.426)	(3.619)		
Consumption									0.321	0.327
									(0.979)	(1.009)
Investment									0.966***	0.973***
									(3.794)	(3.911)
Exports							0.461***	0.474***	0.416***	0.426***
							(6.215)	(7.501)	(5.099)	(6.140)
PPI-based REER	0.107		0.128	-0.424		0.044		0.019		0.015
	(0.694)		(0.798)	(-1.279)		(0.160)		(0.088)		(0.070)
Onshoring	1.271***	1.177***	1.288***	1.967***	1.934***	2.295***	1.320***	1.370***	1.308***	1.345***
	(5.873)	(4.501)	(4.979)	(5.460)	(5.704)	(6.440)	(2.969)	(3.046)	(3.066)	(3.104)
GFC dummy		0.001	-0.005		-0.075***	-0.088***	-0.009	-0.010	-0.045*	-0.045*
		(0.062)	(-0.241)		(-3.904)	(-3.181)	(-0.430)	(-0.357)	(-1.818)	(-1.747)
Constant	-0.090***	-0.080*	-0.088***	-0.108	-0.086	-0.119*	-0.079	-0.083	-0.059	-0.061
	(-3.306)	(-1.820)	(-2.851)	(-1.605)	(-1.048)	(-1.834)	(-1.517)	(-1.660)	(-1.114)	(-1.214)
Observations	39	39	39	39	39	39	39	39	39	39
R-squared	0.867	0.866	0.867	0.711	0.759	0.752	0.815	0.815	0.826	0.826
Adjusted R-squared	0.855	0.850	0.851	0.686	0.730	0.723	0.787	0.787	0.794	0.794

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Aggregate Imports of Goods and Services from National Accounts
(1996:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.919***	1.738***	1.773***							
	(10.315)	(9.104)	(9.489)							
GDP				1.598***	1.433***	1.493***				
				(3.532)	(3.317)	(3.192)				
Domestic demand							1.401***	1.434***		
							(5.306)	(5.289)		
Consumption									0.736***	0.743***
									(3.012)	(2.994)
Investment									0.619***	0.638***
									(4.625)	(4.533)
Exports							0.541***	0.557***	0.538***	0.554***
							(8.602)	(9.177)	(7.973)	(8.266)
CPI-based REER		-0.070			-0.416***		-0.128		-0.127	
		(-0.681)			(-2.924)		(-1.197)		(-1.188)	
PPI-based REER	-0.086		-0.039	-0.631***		-0.407**		-0.083		-0.081
	(-0.720)		(-0.327)	(-2.881)		(-2.195)		(-0.651)		(-0.633)
Onshoring	0.919***	0.907***	0.921***	1.299***	1.182***	1.243***	0.852***	0.880***	0.888***	0.920***
	(4.543)	(5.235)	(5.434)	(5.072)	(5.730)	(6.460)	(3.858)	(3.981)	(3.996)	(4.142)
GFC dummy		-0.062***	-0.060***		-0.150***	-0.140***	-0.065***	-0.062***	-0.064***	-0.061***
		(-4.755)	(-4.373)		(-8.224)	(-6.385)	(-4.950)	(-4.265)	(-3.333)	(-2.919)
Constant	-0.058***	-0.037*	-0.041**	0.003	0.025	0.015	-0.051*	-0.058**	-0.046	-0.052*
	(-3.172)	(-1.773)	(-2.185)	(0.056)	(0.565)	(0.321)	(-1.829)	(-2.088)	(-1.515)	(-1.722)
Observations	79	79	79	79	79	79	79	79	79	79
Adjusted R-squared	0.803	0.818	0.817	0.504	0.623	0.601	0.829	0.825	0.826	0.823

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Aggregate Imports of Goods from National Accounts
(1996:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	2.088***	1.944***	1.973***							
	(10.238)	(8.442)	(8.872)							
GDP				1.797***	1.631***	1.695***				
				(3.344)	(3.076)	(3.023)				
Domestic demand							1.356***	1.386***		
							(4.686)	(4.739)		
Consumption									0.717***	0.722***
									(2.694)	(2.691)
Investment									0.593***	0.610***
									(3.579)	(3.548)
Exports							0.585***	0.600***	0.581***	0.595***
							(10.497)	(10.161)	(8.633)	(8.400)
CPI-based REER		-0.002			-0.387**		-0.083		-0.084	
		(-0.020)			(-2.216)		(-0.755)		(-0.729)	
PPI-based REER	0.002		0.039	-0.585**		-0.367		-0.029		-0.030
	(0.015)		(0.272)	(-2.407)		(-1.660)		(-0.208)		(-0.200)
Onshoring	1.287***	1.276***	1.288***	1.702***	1.586***	1.648***	1.350***	1.379***	1.385***	1.417***
	(5.832)	(6.240)	(6.508)	(5.930)	(6.384)	(7.242)	(5.822)	(6.137)	(5.945)	(6.262)
GFC dummy		-0.047***	-0.048***		-0.145***	-0.136***	-0.049***	-0.048**	-0.048*	-0.047
		(-2.858)	(-2.721)		(-6.620)	(-5.107)	(-2.836)	(-2.368)	(-1.803)	(-1.590)
Constant	-0.075***	-0.058**	-0.061***	-0.014	0.008	-0.002	-0.051	-0.057*	-0.046	-0.052
	(-3.763)	(-2.318)	(-2.694)	(-0.259)	(0.155)	(-0.031)	(-1.586)	(-1.773)	(-1.317)	(-1.475)
Observations	79	79	79	79	79	79	79	79	79	79
Adjusted R-squared	0.812	0.818	0.819	0.524	0.617	0.600	0.822	0.820	0.818	0.816

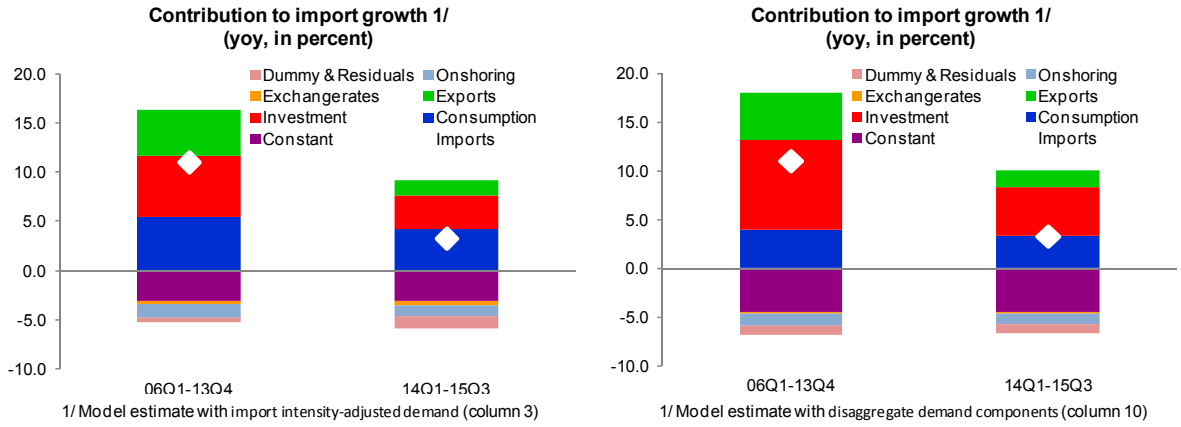
t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, in Tables 9 and 10, we consider a longer sample period since 1996:Q1 (only for import series from the national accounts due to data availability). We truncate pre-1995 period to circumvent a concern about the correct exchange rate. Chinese REER depreciated sharply by about 30 percent in January 1994, implying that RMB was highly appreciated before 1994 although it is also noted that the relevant exchange rate was probably much weaker than the official rate as many transactions were taking at swap rates (Fernald and others, 1999). The estimation results are broadly similar as well with those during the post-WTO period in Table 1 and 2. But the goodness-of-fits are smaller in this longer sample period, in particular models with conventional GDP series, possibility reflecting structural shift before and after the WTO accession. The coefficient estimates on GFC dummy variable become smaller or statistically insignificant and the estimated elasticity for investment is smaller than those for consumption and exports (columns 9–10).

V. Contribution to the Import Slowdown

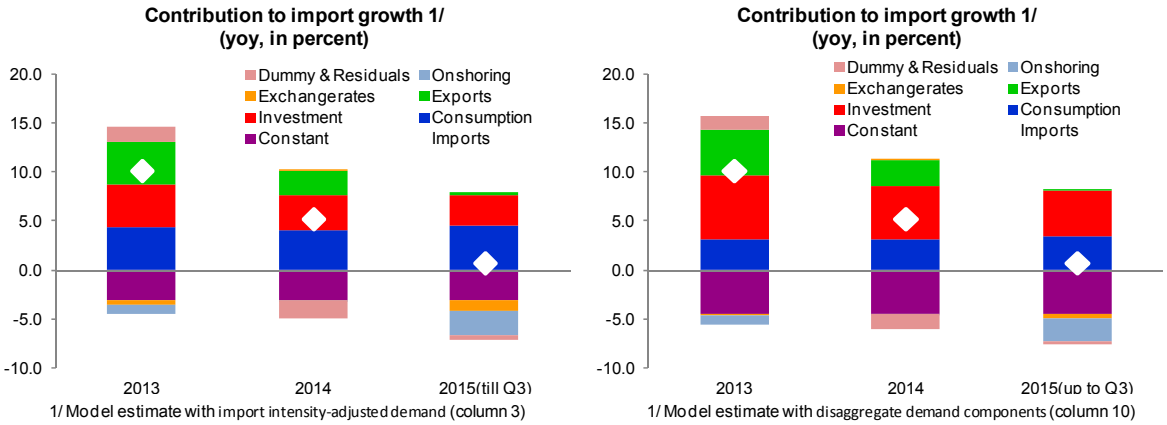
In this section, we quantify the relative role of different demand components in explaining the import slowdown over the last two years. Real import growth decelerated significantly by about 7¾ percentage points during this period, from 11 percent until 2013 down to 3¼ percent in 2014:Q1–2015:Q3; and weaker investment and exports are the main explanation.

The above model estimates (Table 2) imply that about 40–50 percent of this slowdown since 2014 is due to weaker investment. Weaker exports also account for about 40 percent of import slowdown: LHS chart below is from a model with IAD (column 3) and RHS chart is from a model with disaggregate demand components (column 10). Although above estimation results imply that the direct effect of exchange rates on imports is not statistically significant, a separate regression of exports shows that about a quarter of export slowdown during this period is due to stronger RMB, implying that about 10 percent of import slowdown is an indirect effect from stronger RMB through weaker exports.[11]



[11] See Appendix III for estimation of exports.

However, in 2015, re-acceleration of onshoring and weaker exports contributed to sharp import slowdown. Although the average pace of onshoring has been stable over the last decade, there was noticeable difference between 2014 and 2015. After being flat at about 22½ percent in 2014, a share of imported inputs for production/re-exports declined again by about 2¾ percentage points in 2015, dragging import growth by about 2¼ percentage points. Exports remained flat in 2015 (up to Q3), down from about 5 percent growth in 2014, contributing to import slowdown by about 2½ percentage points.



Rebalancing effect

As discussed in Section II, there is large uncertainty about the impact of rebalancing on import slowdown due to difficulties in identifying the counterfactural nonrebalancing path as discussed above. In particular, it is not clear how much is due to overall weaker demand and how much is due to rebalancing. Given this large uncertainty, we identify a few rebalancing paths below for a preliminary assessment of the effect of rebalancing on recent import slowdown.

One approach is to define the rebalancing as a compositional shift from investment to consumption over the last two years, leading to higher share of consumption and lower share of investment in real GDP. So the growth differential between consumption/investment and GDP can be attributed to rebalancing effect under this definition. Over the last two years, consumption grew faster than GDP by about 0.5 percentage points while investment growth was lower than GDP growth by about 0.4 percentage points. The above model estimates (Table 2, column 10) suggest that only about 0.1 percentage points (out of 7¾ percentage point slowdown) is due to this rebalancing: 0.2 ppt higher imports from more consumption but 0.3 ppt lower imports from

Table 11. Impact of Rebalancing on Import Slowdown 1/
(In percentage points)

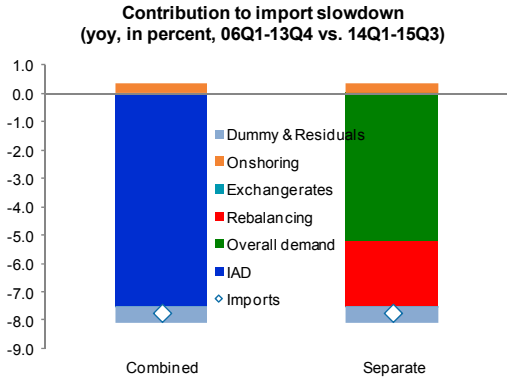
Import slowdown	7.7
Weaker demand	4.0
Consumption	1.0
Investment	0.8
Exports	2.2
Rebalancing	4.0
Consumption	-0.2
Investment	3.3
Exports	0.9
Exchange rates	0.1
Onshoring	-0.3
Dummy & Residuals	0.0

1/ Between 06Q1-13Q4 and 14Q1-15Q1

less investment. So, the impact of narrowly defined rebalancing appears to be very limited.

The impact is much larger if we define rebalancing more broadly. Overall GDP growth slowed noticeably since 2011, from close to 10 percent to below 8 percent, with a significant slowdown in exports. Investment growth also slowed to single digits while consumption growth began to outpace overall GDP growth. With this development in mind, we can alternatively define the average growth rate of individual demand components in 2012–13 as a benchmark pace of rebalancing and attribute deviations from these paces during 2014–15 to overall weaker demand. Under this alternative definition, about a half of import slowdown can be accounted for by continued progress in rebalancing.

Alternatively, we can identify the gap between GDP growth and IAD growth over the last two years as a rebalancing. As we discussed in Section II, Chinese economy's overall GDP growth has moderated to about 7–7¼ percent in 2014–15 but IAD growth was slower than GDP growth. In this scenario, we attribute the impact of slower GDP growth to the effect of overall weaker demand and capture further slowdown in IAD growth compared to GDP growth as an effect of rebalancing. In this case, Above model estimates (Table 2 column 3) suggest that about 30 percent of import slowdown has been due to rebalancing effect.



1/ The gap between GDP and IAD growth for 14Q1-15Q3 is attributed to the rebalancing effect.

VI. Conclusion

Chinese imports have slowed significantly in recent years, raising concerns about china's role as an engine of global growth and trade. Several factors are contributing to this slowdown, mostly importantly including:

- Slower growth: moderating domestic demand following the unwinding of the massive stimulus put in place since the global financial crisis as a measure to cushion external shocks;
- Composition shift in import demand: less intensive import demand for a given pace of growth as the economy moves to a model driven increasingly by consumption and services (which are relatively less import intensive) rather than investment and exports; and
- "Onshoring": China substitutes for imports with its own production, combined with a large real effective appreciation which has eroded price competitiveness of Chinese exports, which is one of main sources for Chinese imports.

Key findings can be summarized below:

- Weaker investment has been the main factor accounting for about 40-50 percent of the import slowdown over the last two years;

- Weaker exports also account for about 40 percent of slowdown, of which about a quarter is due to stronger exchange rate eroding competitiveness in export sector;

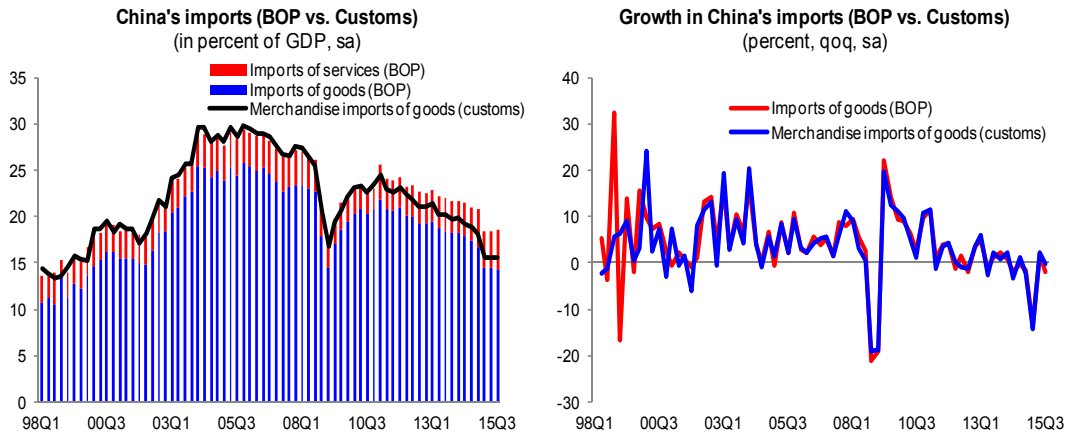
- Substitution of imported intermediate inputs with domestic production has not been an additional drag over this period but it continues to slow import growth at a constant pace; and

- There is large uncertainty about the impact of rebalancing on the import slowdown due to difficulties in identifying the counterfactual nonrebalancing path. Our preliminary assessment based on several different rebalancing paths suggest that around half of recent import slowdown could be attributable to Chinese economy's ongoing rebalancing away from investment and exports toward more consumption.

APPENDIX I. TRADE DATA FROM THE NATIONAL ACCOUNTS

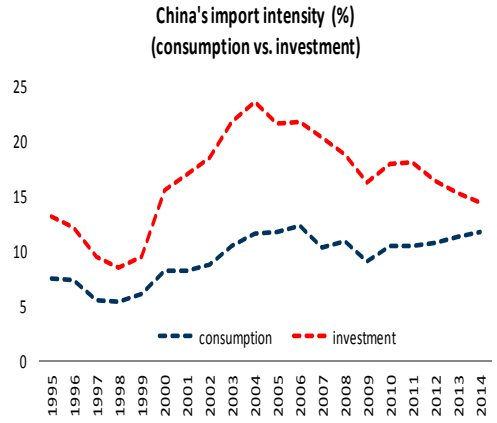
Given the absence of official data for real GDP by expenditure, we use the national account data from the IMF's *World Economic Outlook* database, which includes the IMF staff's estimates of the Chinese real GDP by expenditure. IMF staff estimate real GDP by expenditure with breakdown into private and public components as well as goods and services components of trade. This is achieved by exploring additional information from the balance of payments and customs trade data while being anchored by available official real GDP data, such as overall real GDP growth and contribution to overall growth by final consumption, investment, and net exports. The balance of payments data are used to break nominal net exports into exports and imports (further into goods and services as well) and export and import prices from customs data are used to deflate goods trade series. U.S. consumer price index is used as a deflator for services trade series. Real consumption and investment are derived by deflating the corresponding nominal components by CPI and PPI, respectively.

As usual, imports of goods from balance of payments are somewhat different from merchandise imports from customs data. Customs data are census-based ones by compiling the documents collected by the customs at the border. Balance of payments data adjust census-based goods trade to bring the data in line with the concepts and definitions used to prepare the international and national accounts. These adjustments are necessary to supplement coverage of the census-based data, to eliminate duplication of transactions recorded elsewhere in the international accounts, to value transactions according to a standard definition, and to allow for the goods trade totals to be summed with services trade totals for a more accurate account of total trade. In China, nominal imports from customs data used to be larger than those in the balance of payments by more than 15 percent before the global financial crisis and by about 10 percent in more recent periods. However, in growth terms, they show very similar developments since 2000.



APPENDIX II. ALTERNATIVE MEASURE OF IMPORT INTENSITY

Alternative source to estimate the import intensity by different expenditure components, in particular for consumption and investment, is Trade in Value-Added (TiVA) database by the OECD–WTO. Hong and others (2016) construct the import contents of Chinese consumption and investment by using value added data for years when it is available, and by interpolating such series using the growth rate of the share of gross imports used for consumption or investment for the other years. Specifically, for years 1995, 2000, 2005, and 2008–2011, import intensity is measured as domestic value added of trade partners ultimately absorbed by China for consumption or investment in percent of Chinese consumption or investment respectively. Then they calculate the share of gross imports used for consumption or investment through 2014 by multiplying the share of gross imports related to consumption and investment based on end use categories in total Chinese gross imports with imports from Chinese national accounts side. The growth rates of the latter estimated series' are used to interpolate the interim years (i.e., 1996–99, 2001–04, 2006–07) and to extrapolate outer years (i.e., 2012–14). This alternative measure also shows that the import intensity has been on declining trend for investment over the past decade while relatively stable for consumption. The import intensity of investment, which increased by more than 10 percentage points between mid-1990s and mid-2000s, has declined by about 8 percentage points over the last decade.



APPENDIX III. ESTIMATION WITH SEASONALLY-ADJUSTED SERIES

For robustness, we re-run the regressions using quarter-on-quarter growth rates. All series are seasonality adjusted using X12. Table A1 reports results using imports of goods and services, while Table A2 shows results using imports of goods only as dependent variables, both from national accounts, for the post-WTO period (2002:Q1 to 2015:Q3). The results are broadly in line with what we obtained from year-on-year growth rates. Across different specificaitons: both domestic and external demands are important factors driving import dynamics; coefficient estimates on real effective exchange rates are are either opposite signs or statistically not significant; the models with IAD series improves the goodness-of-fit, compared to the one with conventional GDP series; estimated import elasticity for investment is higher than those for consumption and exports; and on shoring drags on import growth.

Table A1. Aggregate Imports of Goods and Services from National Accounts
(2002:Q1–2015:Q3)

Table A1.
Aggregate imports of goods and services from national accounts (2002Q1 - 2015Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.847***	1.847***	1.807***							
	(4.137)	(4.735)	(4.526)							
GDP				2.106***	2.196***	2.198***				
				(3.360)	(3.162)	(3.204)				
Domestic demand							2.281***	2.293***		
							(5.686)	(5.794)		
Consumption									0.712**	0.717**
									(2.343)	(2.469)
Investment									1.127***	1.127***
									(5.165)	(5.266)
Exports							0.623***	0.624***	0.567***	0.577***
							(5.960)	(6.221)	(5.809)	(6.010)
CPI-based REER		0.053			-0.269		0.034		-0.079	
		(0.239)			(-0.981)		(0.164)		(-0.378)	
PPI-based REER	-0.040		-0.025	-0.277		-0.203		0.052		-0.028
	(-0.122)		(-0.082)	(-0.612)		(-0.569)		(0.230)		(-0.119)
Onshoring	0.912***	1.033***	1.013***	2.036***	2.155***	2.223***	0.450	0.451	0.591**	0.609**
	(2.896)	(3.899)	(3.991)	(5.928)	(4.683)	(4.890)	(1.431)	(1.433)	(2.064)	(2.109)
GFC dummy		-0.014	-0.014		-0.038	-0.037	-0.015	-0.016	-0.023	-0.023
		(-0.346)	(-0.356)		(-0.979)	(-0.983)	(-0.578)	(-0.592)	(-0.808)	(-0.787)
Constant	-0.014	-0.012	-0.011	-0.011	-0.009	-0.010	-0.039***	-0.039***	-0.027**	-0.028**
	(-0.945)	(-1.090)	(-0.975)	(-0.639)	(-0.542)	(-0.585)	(-3.018)	(-3.123)	(-2.128)	(-2.226)
Observations	55	55	55	55	55	55	55	55	55	55
Adjusted R-squared	0.643	0.641	0.640	0.395	0.426	0.418	0.708	0.709	0.686	0.685

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2. Aggregate Imports of Goods from National Accounts

(2002:Q1–2015:Q3)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
IAD	1.540***	1.551***	1.506***							
	(3.165)	(3.524)	(3.442)							
GDP				1.974***	2.189***	2.053***				
				(3.243)	(3.238)	(3.073)				
Domestic demand							2.113***	2.065***		
							(5.675)	(5.752)		
Consumption									0.630**	0.585**
									(2.096)	(2.120)
Investment									1.017***	0.988***
									(4.439)	(4.301)
Exports							0.564***	0.566***	0.509***	0.516***
							(5.715)	(6.011)	(5.163)	(5.407)
CPI-based REER		-0.143			-0.391		-0.188		-0.287	
		(-0.561)			(-1.428)		(-0.931)		(-1.346)	
PPI-based REER	-0.313		-0.300	-0.488		-0.424		-0.241		-0.321
	(-0.870)		(-0.879)	(-1.100)		(-1.188)		(-1.033)		(-1.286)
Onshoring	1.536***	1.673***	1.624***	2.459***	2.588***	2.620***	1.085***	1.084***	1.240***	1.258***
	(3.696)	(4.007)	(4.186)	(8.511)	(6.207)	(6.510)	(3.917)	(4.041)	(4.340)	(4.438)
GFC dummy		-0.015	-0.012		-0.035	-0.032	-0.012	-0.009	-0.019	-0.016
		(-0.339)	(-0.310)		(-0.861)	(-0.853)	(-0.479)	(-0.396)	(-0.676)	(-0.583)
Constant	-0.005	-0.004	-0.003	-0.008	-0.009	-0.007	-0.033***	-0.033***	-0.021	-0.020
	(-0.334)	(-0.302)	(-0.252)	(-0.485)	(-0.569)	(-0.437)	(-2.707)	(-2.749)	(-1.632)	(-1.618)
Observations	55	55	55	55	55	55	55	55	55	55
Adjusted R-squared	0.633	0.618	0.628	0.497	0.510	0.508	0.736	0.739	0.700	0.701

Robust t-statistics in parentheses

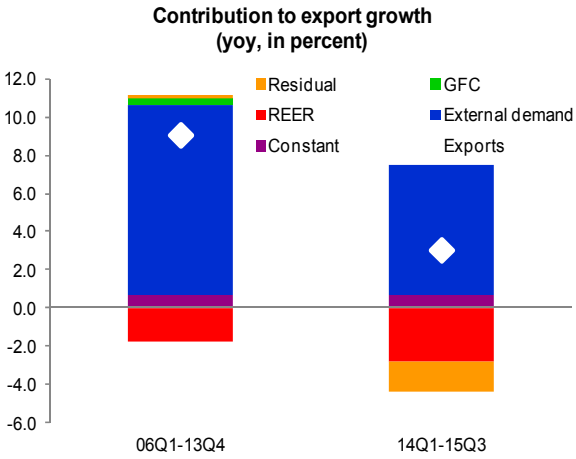
*** p<0.01, ** p<0.05, * p<0.1

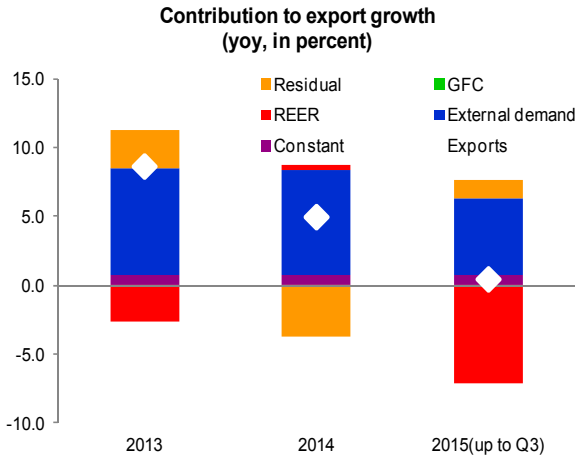
APPENDIX IV. CONTRIBUTION TO THE EXPORT SLOWDOWN

Table. Aggregate Exports of Goods and Services from National Accounts

(2002Q1-2015Q3)	Model 1	Model 2	Model 3	Model 4
External demand	2.884***	2.889***	3.142***	3.007***
	(7.180)	(4.163)	(4.323)	(8.004)
CPI-based REER		-0.771***		-0.771***
		(-7.235)		(-7.259)
PPI-based REER	-0.809***		-0.827***	
	(-5.097)		(-5.414)	
GFC		-0.011	0.027	
		(-0.283)	(0.696)	
Constant	0.018	0.026	0.007	0.021
	(1.116)	(0.947)	(0.261)	(1.415)
Observations	55	55	55	55
Adjusted R-squared	0.723	0.751	0.720	0.755

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1





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