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IS CHINA CHANGING ITS STRIPES? THE SHIFTING STRUCTURE OF CHINA'S EXTERNAL TRADE AND ITS IMPLICATIONS

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Is China Changing its Stripes?

The Shifting Structure of China's External Trade and its Implications

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Abstract

Using disaggregated trade data, this paper assesses how the expansion of China's production capacity and its changing production structure may be affecting its trade linkages with other countries. It argues that although processing trade still accounts for an important share of its total trade, China has moved away from traditional assembly operations and its exports have started to rely more on domestically sourced components, particularly in less sophisticated product categories. As a result, China's imports and exports have to a large extent delinked in recent times, with imports of parts and components increasingly driven by domestic production needs rather than final demand abroad. This increased domestic sourcing may be one of the important factors behind the recent increase in China's trade balance. In addition, as China moves up the value chain, both its imports and exports have become more sophisticated than in the past. This shift in the product composition of China's trade bundle could imply that its trade balance has become more sensitive to demand changes in foreign markets and to relative price changes. Indeed, the empirical results suggest that China is becoming more exposed to fluctuations in the strength of the global economy, and that changes in its exchange rate could have a bigger impact on the trade balance and the domestic economy than commonly believed. The paper also discusses some potential implications that this shift in China's trade and production structure is likely to have for other economies in the region, as well as for the world.

[1] The authors would like to thank, without implicating, Jahangir Aziz for his guidance and encouragement for exploring this topic. We also thank Steve Dunaway and Lamin Leigh for their suggestions and Xiangming Li for her helpful comments and data analyses. We thank Mehmet Ziya Gorpe for his excellent research assistance. The views expressed in this paper do not necessarily reflect those of the IMF or its China team.

I. INTRODUCTION

The rapid expansion of China's trade surplus has been a key development in the global economy in recent times. The rise has also been vigorously debated as it is unclear what caused it. Some view the burgeoning trade surplus as a clear sign of unfair price competitiveness of Chinese exports due to an undervalued renminbi, while others have argued that it reflects changes in China's economic structure and associated shifts in its role within regional and global production chains. Rather than being one more paper on the equilibrium level of China's exchange rate and trying to measure what impact this may have had on the trade balance, this paper focuses on the latter aspect and tries to shed some light on the debate by looking into the shifts that have taken place in China's trade structure.[2]

The results are quite telling, although still tentative. There is a caricature of China that we typically have in the back of our minds even when undertaking formal analyses, i.e., China is the assembly line of the world. And this caricature goes something like this: using China's abundant and cheap labor, its vast coastal factories assemble and process imported inputs from the West and other parts of Asia into final goods that are mainly sold abroad (often referred to as processing trade—a category coined by China's customs officials for tax purposes), with a small fraction retained for the domestic market. Most of these products are consumption goods or some low-end capital goods.. While the total volume of trade has increased in recent years, much of the rise reflects the increased use of China's processing capacity to meet final demand abroad. According to this conventional "world assembler"

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[2] See Dunaway, Leigh, and Li (2006), Coudert and Couharde (2005), and Goldstein (2004) for issues related to the estimation of China's equilibrium exchange rate.

view, as long as China retains its comparative advantage in cheap labor, movements in external demand and the exchange rate should have a very limited impact on its trade balance, as any change on the export side will be offset by a similar change on the import side. Indeed, relative price changes have typically been found to have relatively small effects on China's exports and trade balance in formal econometric analyses, which have been attributed to its role as a processing center (Shu and Yip (2006)).

Our analysis suggests that this caricature may be wrong. The structure of China's external trade in the last few years looks very different from that ten years ago, and while this caricature may have loosely fitted the Chinese economy then, it increasingly appears not to be the case. Domestic production capacity has increased substantially in recent years, which has enabled increased domestic sourcing of exports and weakened the traditional tight link between exports and imports, suggesting larger demand and price elasticities of China's exports and trade balance than typically assumed.

We demonstrate that the greater responsiveness of exports and trade balance to changes in demand and relative prices may go above and beyond the changes of China's role as a processing center, and reflect the changes in China's trade structure. For instance, while consumption goods used to dominate China's exports, their share has declined sharply. Exports of capital equipment and intermediate products have increased significantly over the past decade, accounting for more than 40 percent of China's total exports. Such a shift reflects the rising capacity of the country to produce more sophisticated products and could imply a change in demand and price elasticities for aggregate trade, if different products react differently to macroeconomic shocks. Indeed, we find that exports of more sophisticated products tend to be more sensitive to aggregate demand and price changes, suggesting that

China's exports and trade balance are likely to be more responsive to price and demand changes than estimated from historical averages.[3]

More specifically, we argue that although processing trade still accounts for an important share of China's total trade, it has moved away from traditional assembly operations with low domestic content. Instead, more domestically produced components are being used. As a result, China's imports and exports have to a large extent delinked in recent times, with imports of parts and components increasingly driven by domestic production needs rather than final demand abroad. We test this formally for a selected group of industries using a unique panel data set (together these industries account for around half of China's imports of parts and components). We then assess the extent to which the product composition of trade flows has changed over time and how this may have affected China's external trade, using detailed trade data. Our results suggest that it is important to use a disaggregated approach to study trade patterns as products at different technological levels react differently to external and domestic shocks. The empirical results cast strong doubts on the view that an average relationship estimated from historical data can be used to describe the current trade structure and its links to other macroeconomic variables, in an economy like China's where structural shifts are taking place at a rapid pace, and suggest that changing production capacity and structure should be accounted for in such analyses.

[3] The corollary to this is that equilibrium exchange rate analyses based on estimated trade dynamics may have overestimated the extent of renminbi undervaluation. While it may be true that the renminbi is undervalued, and this paper does not address this question as noted earlier, it is likely that the results of such exercises have been driven by the caricature about China's trade. Since in all these exercises, undervaluation is defined as the amount of relative price (in this case the exchange rate) changes alone needed to reduce the trade balance to a particular level, relative prices have to obviously move a lot because they have a small estimated effect on the trade balance to begin with.

A number of previous papers have examined shifts in China's trade structure. Lemoine and Unal-Kesenci (2002) discussed China's role in the international segmentation of production process and found that China's specialization pattern has enhanced technological transfer, including through increased local content in its processing trade. Hiratsuka (2005) studied the "catching up" process of manufacturing in East Asia and found that by 2001 China had advanced its catching up process (to the degree of becoming an exporter) mostly in nondurable goods and light machineries. Looking at more recent years, Gao and Ha (2006) noted that the China's trade structure has experienced large structural changes, with technologically sophisticated products such as machinery and transport equipments accounting for a growing share of exports, and more natural resource-based and high-tech products being imported.

This paper is also linked to previous work that stresses the importance of examining disaggregated data to better understand the factors driving trade patterns across countries (Feenstra and Rose (2000), Schott (2004), Hummels and Klenow (2005), and Schott (2006)). In particular, using product-level US import data, Schott (2004) found evidence consistent with specialization according to countries' factor endowments and technology within products, although there was no evidence of endowment-driven specialization across industries or even across products. This suggests that tests of trade theories using more aggregated data (at the industry level) may be problematic. In a more recent paper, Schott (2006) examined the relative sophistication of China's exports compared to OECD countries, and found that although China exports more products in common with OECD countries than would be expected given its level of development, the prices it receives for its exports have been declining over time. Rodrik (2006) compiled sophistication indices for products based on the weighted averages of per capita GDP of the countries that export them, and found that

China's export bundle is more sophisticated than would be expected from its level of economic development, and has become more sophisticated over time. In these studies, the primary focus is on studying differences in trade composition across countries. Building upon this earlier work, especially the methodology proposed by Rodrik (2006) in measuring the sophistication level by products, we explore what shifting product composition might imply for China's aggregate trade over time.

The rest of the paper is organized as follows. Section II motivates the paper by discussing recent developments in China's trade and production structure. In particular, we discuss China's burgeoning trade surplus and argue that it is at least partly linked to a slowdown in intermediate imports that has not been matched by a commensurate slowdown in final exports. This suggests that the domestic content of China's exports may be increasing and we provide some evidence that in certain sectors domestic sourcing has increased in recent years, especially for products of lower technological sophistication. In addition, we show that the export bundle has become more sophisticated over time, reflecting technological upgrade of domestic production; this in turn means that China now relies on more sophisticated imports for manufacturing. Motivated by these findings, Section III uses detailed trade data to conduct two separate sets of empirical analyses that allow us to formally test some of these hypotheses. The first part assesses the extent to which imports of intermediate products may have "delinked" from exports and have instead become more responsive to domestic demand, for a selected group of industries. The second part analyses the shifting product mix of China's trade and, by exploring the cross-sectional variation in the response of trade flows of products at different "sophistication levels" to macroeconomic shocks, infers what this is likely to imply for trade elasticities going forward. Section IV concludes with a discussion of potential policy implications of the empirical findings, as well as some suggestions for future research.

II. Recent Developments in China's External Trade

China's trade surplus has expanded sharply in recent years (Chart 1). During the past five years, the trade surplus has grown over 5 folds in dollar terms and more than tripled as a percent of GDP. The most significant increase occurred over the last two years, with China's trade surplus rising by over 5 percent of GDP. At end-2006, the trade surplus is estimated to have stood at around $215 billion (BOP basis) or more than 8 percent of GDP.

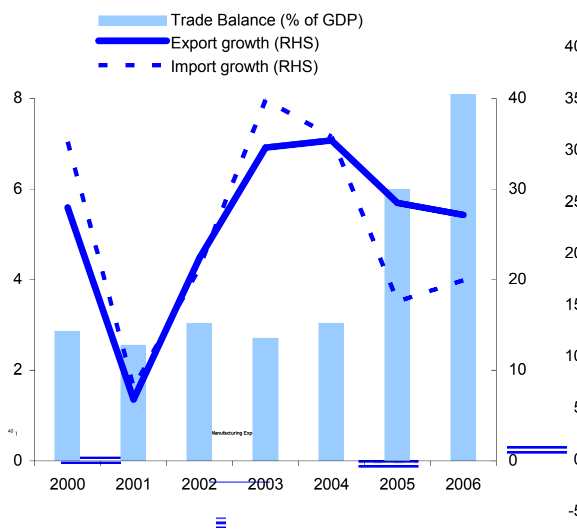
While its deficit in primary products continues to expand gradually, its manufacturing trade surplus has risen sharply, primarily reflecting an increase in net exports of machinery and transport equipment and manufactured goods. The five most important contributors to the expansion in the trade surplus over the last two years were electronics (1.8 percent of GDP), machinery (1 percent of GDP), iron and steel (0.9 percent of GDP), textiles and clothing (0.8 percent of GDP), organic chemicals (0.3 percent of GDP), and automobiles (0.2 percent of GDP).[4] Indeed, while consumption goods (including clothing, toys, etc) used to dominate China's exports, their share in total exports has declined more than 20 percentage points over the past decade. Exports of capital goods and parts and components have risen sharply, accounting for more than 40 percent of total exports, compared to their share of 10-15

[4] The trade balance in steel products, traditionally in deficit, moved into surplus for the first time in 2006.

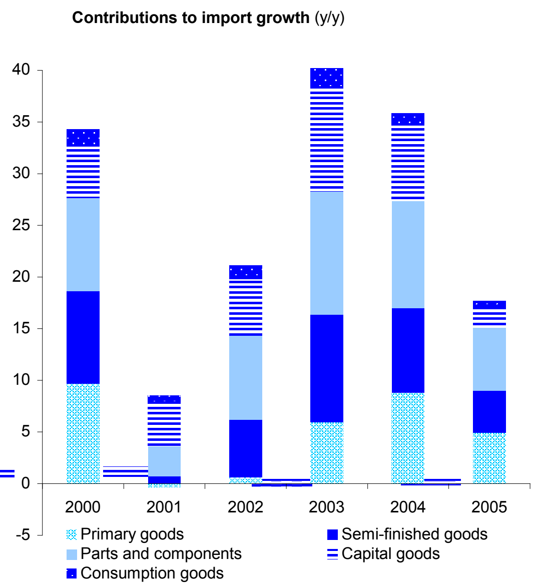
percent a decade ago. Such a shift at the broad economic sector level points to the changing

Chart 1. China: Recent Trade Developments

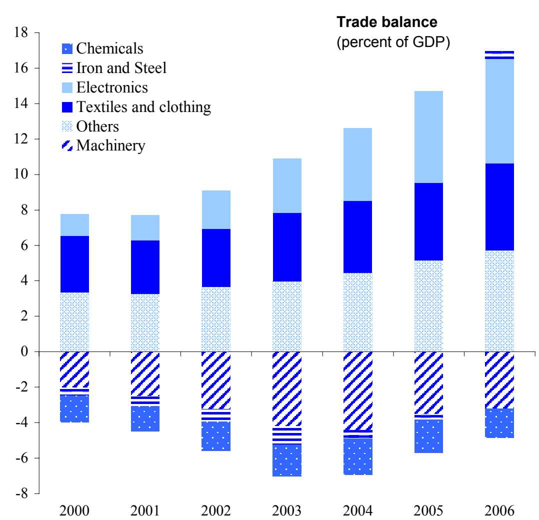
China's trade surplus has expanded sharply in recent years, as import growth has started to lag export growth by significant margins...



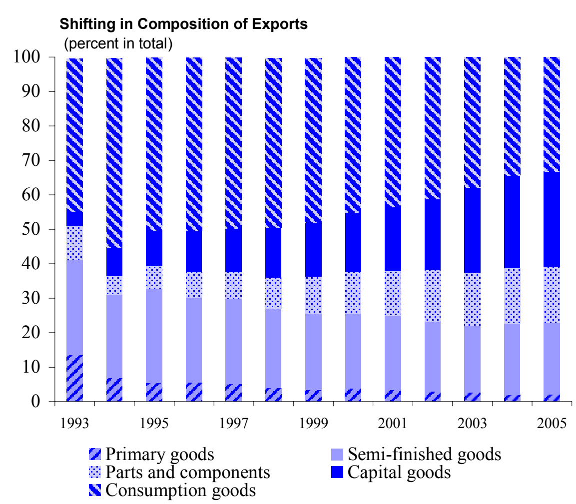
… as imports of primary, intermediate products and capital goods have slown dramatically.



In terms of products, the biggest contributors to the improvement in the trade balance have been electronics, machinery, iron and steel, textiles and chemicals...



The share of consumption goods in total exports has declined, while share of capital equipments and parts and components has risen.



Sources: CEIC, UN Comtrade, Chinese authorities and staff estimates.

trade and production structure in China towards more capital intensive and technologically advanced products.

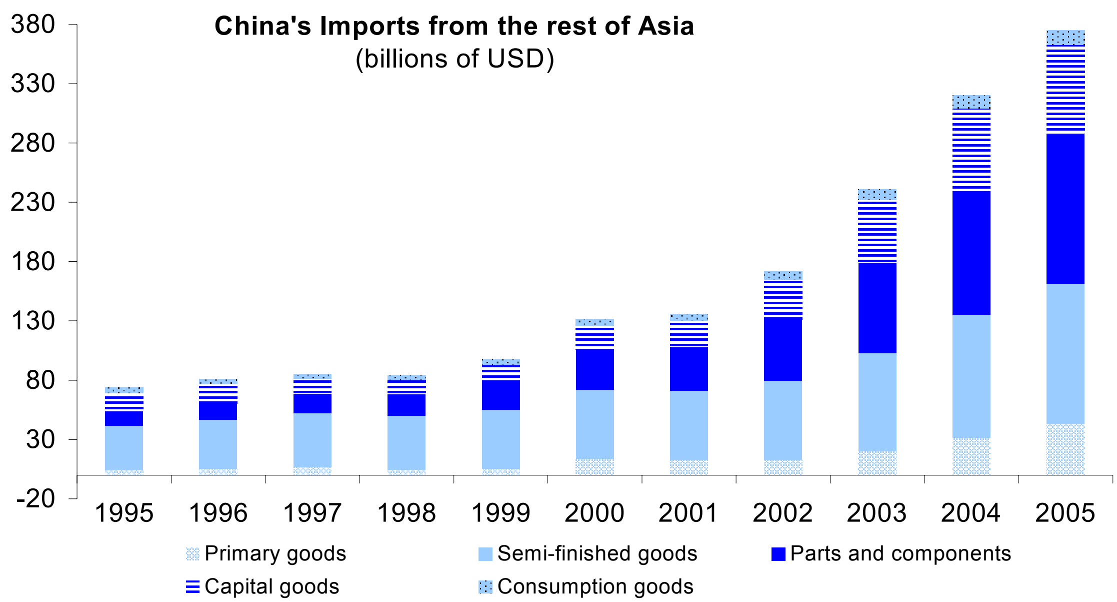
The rapid expansion in the trade surplus has mainly been driven by a significant slowdown in imports. For the first time since the late 1990s, import growth has started to lag export growth by large margins. In particular, imports of intermediate goods have slowed considerably, with parts and components and semi-finished goods accounting for almost half of the slowdown in import growth between 2004 and 2005. Such a slowdown has had a direct impact on China's trade with the rest of Asia and may be altering its role in regional production chains (Chart 2). While its trade surplus with the US and the EU continues to grow, its trade deficit with the rest of Asia, traditionally an offset, has shrunk over the last two years. This has raised concerns in some Asian economies, especially those where exports to China have been an important driver of recent economic growth.

In explaining these trends, many commentators and policy makers point to rising domestic production capacity and capability, which has reduced China's import needs in some sectors (Chart 3). The typical examples cited are steel and chemical materials, where the rapid investment undertaken during 2003 and 2004 has significantly increased production capacity. Enhanced production capacity is also thought to be at play in a number of other sectors of intermediate products, including electronic components, and industrial equipment. Foreign direct investment has often played a major supportive role in this process.[5] It is unclear, however, exactly how widespread this type of import substitution has been across

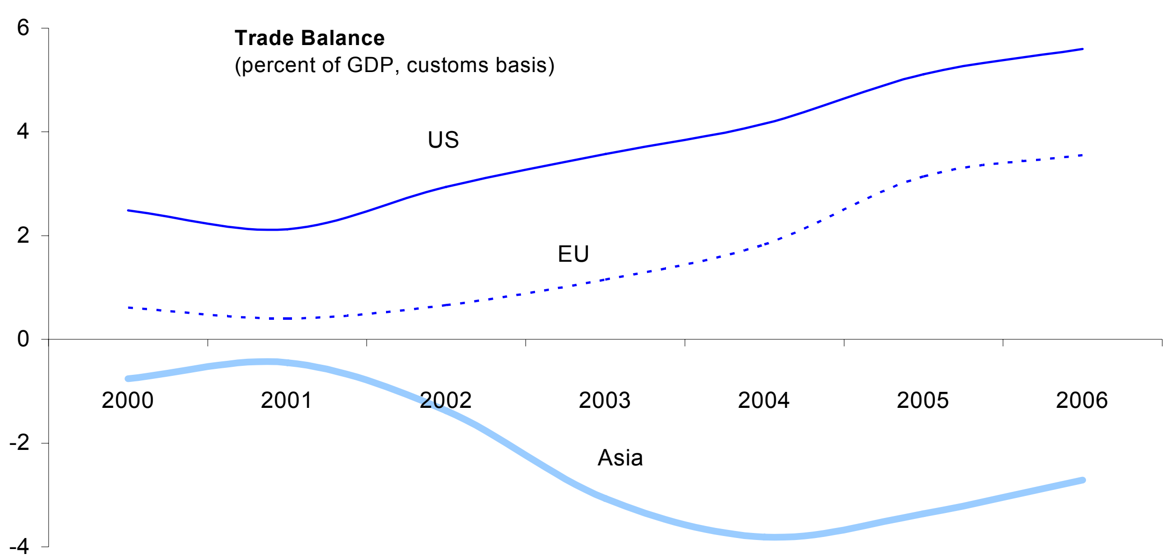
[5] For example, FDI into the chemicals industry from the US increased from around $37 million in 1999 to $520 million in 2005. Over the same period, FDI flows from Taiwan POC increased from $538 million to $2.4 billion in the electronics sector and from $28 million to $373 million in the precision instruments sector.

Chart 2. China: Recent Trends in Regional Trade

China's trade with the rest of the region has flourished over the last decade, as cross-border prodction networks have seen it importing large amounts of intermediate goods from the rest of Asia and contributed to the dramatic increase in intra-regional trade...



…however, its traditional deficit with the rest of the region, which has reflected the workings of these cross-border producion networks, has begun to shrink in recent years as China's imports of capital and intermediate goods from th rest of Asia have moderated.



Sources: CEIC, WITS, Chinese authorities and staff estimates.

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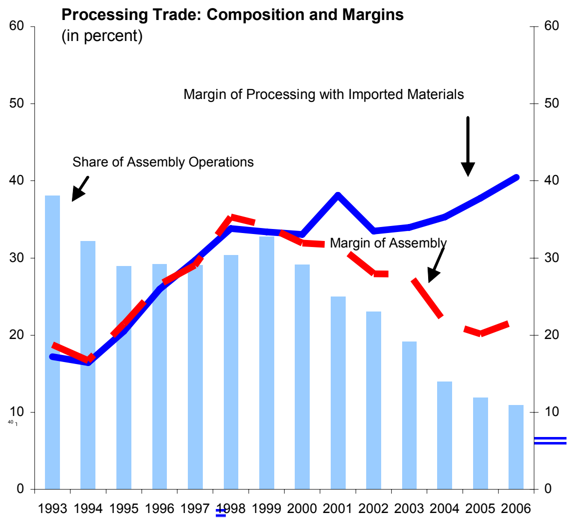
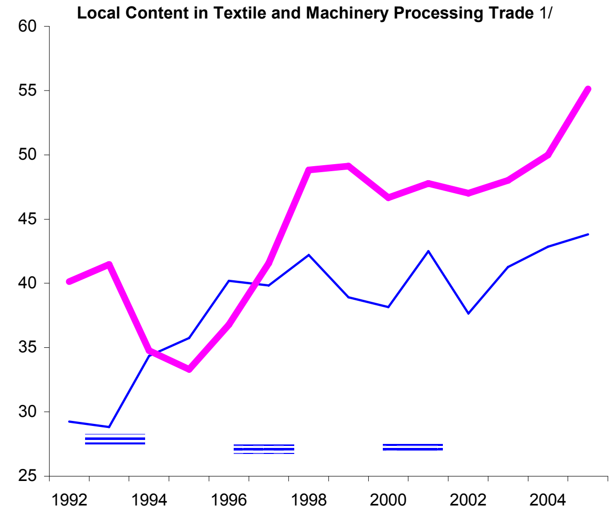
Chart 3. China: Recent Trends in Processing Trade and Domestic Content

While processing trade remains significant, it is moving towards more profitable activities with greater scope for domestic value added...

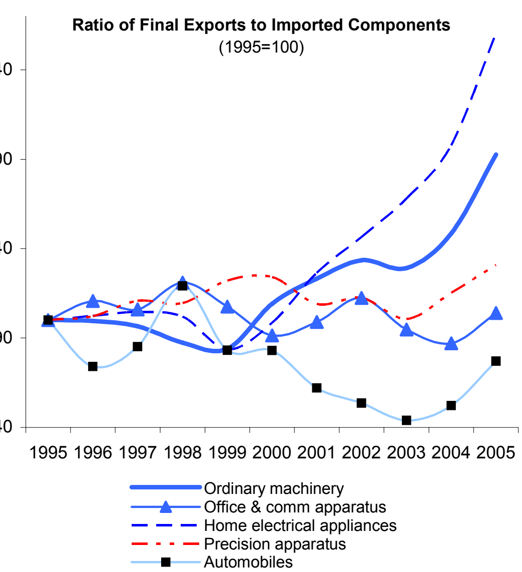


…and higher margins suggest a pick up in the domestic content of processing activites.

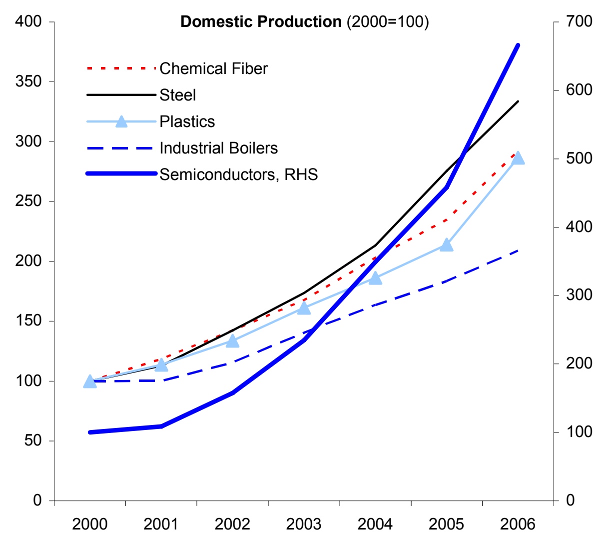


1/ Defined as processing trade balance divided by processing exports.

Increased local content is also suggested by the fact that exports of final goods have grown faster than their associated imported inputs in recent years, especially for low tech products…



… as idomestic production of a number of intermediate goods has expanded sharply in recent years, supported by FDI flows.



Sources: CEIC, UN Comtrade, Chinese authorities and staff estimates.

different sectors. It is especially intriguing as technological upgrade typically takes place in stages rather than in leaps, as it takes time to adopt and adapt to new technologies. We turn to some more evidence below.

The rising trade surplus also reflects shifts in the global production network, as more stages of production have shifted to China. Processing trade margins[6] have risen significantly over the last decade, especially those in traditional industries such as textile, suggesting an increase in domestic sourcing. By comparison, the increase in the "local content"[7] of machinery processing has been less stark, especially in recent years (Chart 2, top right panel).

While processing trade remains significant, ordinary exports have been rising as a share of total trade, and, as explained below, the boundary between processing and ordinary trade is blurring. The share of processing trade in total exports has remained well above 50 percent since the mid-1990s, although it has fallen somewhat in recent years, while the share of processing trade in total imports has decreased from close to 50 percent to around 40 percent. At the same time, the types of processing trade have changed overtime, towards operations with greater scope for domestic content. The share of assembly operations—which tend to have minimal local content—has declined sharply, accounting for around 10 percent of the

[6] Defined as processing trade balance divided by processing exports.

[7] The calculation of "local content" of processing trade by sectors is made difficult by the fact that the imports by one sector may be input for another sector. For instance, it cannot be ruled out that some of the imported chemical goods are used for textile production and exports. However, for the machinery sector (both electrical machines and non-electrical machines), it is likely that most of the imports are used for processing in the same sector. Thus the processing trade margin could be a reasonable reflection of the local content in this sector. Chart 2 uses these margins as proxies for the local content in exported products in the textile and machinery sector. The "local content" of the textile sector may be overstated if there are remaining inputs included in other sectors. However, to the extent that such omissions do not vary greatly over time, the calculated ratio should reflect the general trend of the sector.

trade balance in processing trade in 2006, compared to more than 30 percent in the late 1990s. On the other hand, processing with imported materials (which could be potentially less reliant on imported inputs and therefore resemble ordinary trade) has increased in importance, and the rising margin of this category is consistent with the notion that inputs are being increasingly sourced domestically.

Another indirect measure of local content is to compare the imports of parts and components—a large share of which are used for processing and assembly—and exports of associated final products for a number of industries. In many sectors—notably home electrical appliances, ordinary machinery, and to a lesser extent, higher-tech products such as precision apparatus—exports of final products have continued to grow strongly, despite the recent slowdown in imports of intermediate inputs associated with their production. Hence, these trends support the hypothesis of increasing local content in exports, particularly within sectors that have low technical content. They also suggest that the shift occurring in China's trade structure may be intimately linked to product sophistication. In what follows we examine some trends in the technological sophistication of China's trade.

Share of Processing Trade by Main Industries (in percent)

	1995	2000	2005
Exports			
Textiles	29.0	20.1	9.1
Non-Electric Machinery	7.7	15.2	28.7
Electrical Machinery	20.6	28.0	33.3
Other Manufacturing	15.9	15.0	12.2
Other products	26.8	21.7	16.7
Share of processing exports in total exports	49.5	55.2	54.7
Imports			
Chemicals & Allied Industries	6.7	6.0	4.5
Plastics / Rubbers	12.2	10.9	7.7
Textiles	24.5	15.9	6.2
Non-Electric Machinery	4.4	6.7	8.3
Electrical Machinery	18.5	33.1	44.6
Other Manufacturing	7.1	7.2	14.4
Other products	26.7	20.3	14.2
Share of processing imports in total imports	44.2	41.1	41.5

Within processing trading, there has been a sharp sectoral shift, with China increasingly moving up the technology ladder. The share of textile exports has declined dramatically to account for less than 10 percent of processing exports, while that of machinery exports has risen to over 60 percent from around

20 percent in early 1990s. The same sectoral shift has occurred on the import side, with textile imports accounting for only 6 percent of total processing imports, whereas machinery imports (including electronics) account for more than 50 percent, most of which is in the category of electrical machineries and electronics.

More directly, there is evidence that technological upgrading of products has supported domestic sourcing in many sectors (Chart 4). Not surprisingly, China tends to import more sophisticated goods than those it exports.[8] The overall sophistication of China's exports has risen significantly over the last decade, while overall import sophistication has increased at a slower pace. The overall indices, nevertheless, may mask important sectoral differences.

An examination of industrial sectors suggest that domestic production capability is near or even exceeding imported goods in intermediate products, such as manufacturing materials, chemicals, and non-fuel crude materials. This is consistent with the observation that the recent large investment in steel and chemicals have resulted in a vast expansion in domestic production capacity and a sharp slowdown in imports of these products. The flattening of the import sophistication index also reflects the fact that the share of raw materials (which are

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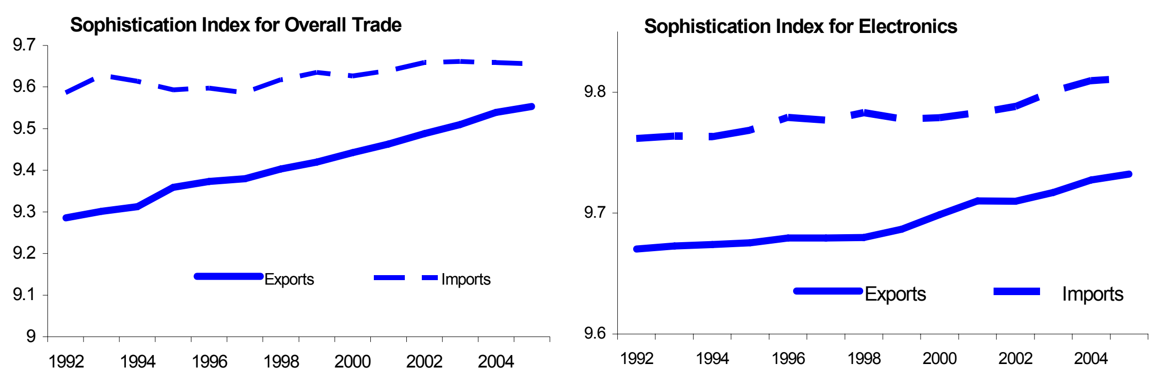
[8] We adopt the "Rodrik index" to examine to what extent the imported products can be substituted with domestically produced products. The indices are calculated as a weighted average of the sophistication indices across products, with the weights determined by trade shares (See Rodrik (2006) for details). The sophistication level of each product is measured by the weighted average of per capita GDP (PPP basis) of the countries that export this product, with the weights determined by the revealed comparative advantage of each country. While Rodrik calculated these indices for China's exports, he did not consider the product mix on the import side. For our purpose, we first calculate the sophistication index of China's exports. The range of products exported by China provides a measure of the production capability in the country. We then calculate the same index for China's imports. The comparison of the sophistication level between imports and exports provides one gauge of the technological feasibility of domestic sourcing. Domestic sourcing is potentially possible in sectors where the sophistication of imports is near that of exports but is more difficult in sectors where the sophistication of imports remains well above that of exports.

low in terms of sophistication) has increased in recent years, suggesting China is extending its production chain and producing more intermediate goods at home. However, for more sophisticated sectors, particularly electronics, the revealed production capability of China continues to lag behind imported goods, and the gap has not shown much sign of narrowing even after the large investment during 2003-2004. To be sure, both the average sophistication levels of exports and imports are rising in more sophisticated sectors, suggesting that these sectors have also benefited from technological progress, and product structure is being upgraded. More advanced goods, however, require even more sophisticated inputs, which are not being made domestically. As the gap is not narrowing, it appears that China is still some distance away from producing most of the required inputs for these more sophisticated final goods.

Chart 4. China: Sophistication of Production and Trade

"The sophistication Index" suggest that both exports and imports have increased their sophistication level over time, although the difference has been shrinking

But the gap remains significant in more advanced sectors such as electronics



III. Evaluating Trade Equations Using Sectoral Data: Some Potential Explanations for the expansion in China's Trade Surplus

The response of trade flows to macroeconomic shocks is typically estimated by exploring the relationship between aggregate trade volumes and macroeconomic variables. Bayoumi

(1999) is one example of how such estimation is performed. Along these lines, several papers have tried to estimate trade elasticities in China. Cerra and Daya-Fulaiti (1999) and Cerra and Saxena (2003) estimated the price elasticity of China's exports and suggested that exports have become more responsive to prices. Shu and Yip (2006) directly examined the impact of an exchange rate appreciation on China's trade balance and found that an appreciation can reduce exports by generating expenditure switching. Although it is generally accepted that China's economic structure is changing, for tractability of time series analysis and following the standard literature, these studies typically assume a stable relationship between aggregate trade flows and macroeconomic variables.

In this section, we explore how changes in China's production structure may have affected its trade flows and their responses to macroeconomic shocks over time. As such changes are occurring continuously, standard models based on aggregate data and assuming stable relations over time may yield inaccurate results. Accordingly, our empirical analysis is conducted from two angles. First, we examine the relationship between imports of parts and components and exports of associated final products for a group of industries where these can be matched. In our sample, we find that imports of parts and components have delinked from exports of final products in recent years. At the same time, imported inputs have become more strongly associated with domestic demand. This supports the hypothesis that China's expanding domestic production capacity has weakened the close association between imports and exports in recent years, as industries are increasingly able to source their inputs domestically. Second, we examine the changes in the product composition of China's traded products and how product characteristics—in particular their sophistication level—may have affected the response of trade flows to aggregate shocks. We find that for more sophisticated products, both exports and imports are more sensitive to aggregate demand shocks, while exports are also more sensitive to real exchange rate changes. Given its rising sophistication level, it is possible, therefore, that China's aggregate trade has become increasingly sensitive to demand and price fluctuations, even without further price and trade regime changes (Cerra and Daya-Fulaiti (1999) attributed the increasing responsiveness of exports to prices during the 1980s and 1990s to these factors).

A. The Delinking of Imports from Exports

A central theme of this paper is that China's increasing domestic production capabilities may account for much of the slowdown in intermediate imports that has contributed to the rapid expansion in its trade surplus in recent years. In the absence of detailed production data that can be mapped to disaggregated trade data, this conjecture is hard to test directly. However, this hypothesis has other, potentially testable implications. In particular, it would be reasonable to expect that, at least in some sectors, this evolution in China's production structure may be diminishing the traditional role that foreign demand (through traditional processing trade with low domestic content) has played in determining trade patterns. Hence, we would expect that in those sectors, the intimate relationship that processing trade creates between imports of intermediate products (such as parts and components) and exports of associated final goods has weakened. At the same time, the role of domestic demand in determining import patterns could be increasing as China's economic structure evolves. In other words, imports and exports may be delinking in those sectors, with the consequence that macroeconomic shocks may have more potent effects on China's trade balance and its domestic economy.

Estimation

As documented in Section II, there is much anecdotal and indirect evidence of dramatic shifts in China's trade and production structure that would support the "delinking" hypothesis. However, to formally test the hypothesis that final exports may have delinked from imported inputs in recent years, and that domestic demand may be playing an increasingly important role in determining import patterns, we considered the following regression:

$$M_{it} = \alpha + \beta X_{it} + \phi DD_{it} + \gamma \left(\frac{P_{it}}{P_{it}^{F}} \right) + (\eta_i + \varepsilon_{it}) \qquad (1)$$

, where M_{it} denotes imports of intermediate product *i* at time *t* (e.g., computer parts), X_{it} denotes exports of the final product associated with those imported inputs (e.g., computers)[9], DD_{it} denotes domestic demand for that final product, and $\left(\frac{P_{it}}{P_{it}^{F}} \right)$ is a relative price term representing the price of the imported input in China relative to its world price. We allow the error term to have two components: a time invariant product specific-effect η_i and a residual idiosyncratic error term ε_{it}.[10] All variables, except for the relative price term, are deflated and measured in real terms.

If foreign demand is an important determinant of import patterns (as implied under conventional processing trade, i.e. pure assembly with minimal local content), we would expect the coefficient on the export variable β to be positive. Similarly, if imports are associated with domestic demand (as one would normally expect in an economy where pure assembly operations account for a small part of trade) , ϕ should be positive. In addition to their signs, we will be interested in the evolution of the magnitude these coefficients over

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[9] In other words, foreign demand for the final good produced with those inputs.

[10] In our empirical work, we also allow for the presence of time-specific effects.

time, to assess whether the strength of the relationship between imports and foreign demand on the one hand, and domestic demand in China on the other, has changed. At the same time, higher relative prices in China should be associated with an increase in imports, so that we expect γ to be positive.

Notice that alternative assumptions about the properties of the error term $(\eta_i + \varepsilon_{it})$ will determine which econometric methodology is likely to be most appropriate. Accordingly, in our empirical work, we will present results using a range of estimation procedures and assess their robustness across alternative specifications.

Data

We use disaggregated trade data at the five-digit level based on SITC Revision 2, as reported in the UN Comtrade Database. Comtrade reports the nominal value of imports and exports on an annual basis between 1992 and 2005. A key requirement of our approach is the ability to relate imported intermediate products with specific final exports. Within the SITC classification system, we are able to directly relate 105 pairs of inputs and associated outputs within codes 7 (machinery and transport equipment), 87 (professional instruments) and 88 (photographic equipment). Together, these account for, on average, around half of total imports of parts and components or roughly 15 percent of total imports over this time period. Due to this relatively limited coverage of China's imports, the trends we identify in our empirical work are not necessarily representative of manufacturing or processing trade as a whole. Nevertheless, they are suggestive and it is important to note that this dataset was not selected in any deliberate way. Rather, all the pairings of intermediate and final goods that were obviously possible using the SITC classifications and descriptions were included in our sample (the description of the dataset and summary statistics of our main variables are available upon request). Roughly a quarter of these pairs fall within the electronics sector, with the remaining falling under machinery and transport equipment. These import and export values are deflated using the SITC-specific US import price indices, our proxy for world prices. Our estimate of domestic demand for the final product is derived by adding total manufacturing imports to total domestic industrial production (obtained from CEIC) and subtracting total manufacturing exports. We also experiment with some alternative measures, including estimates of domestic demand derived at the sectoral level as well as an aggregate measure of domestic demand from national accounts data. These measures of domestic demand are again deflated and expressed in real terms, using the manufacturing producer price index in China (obtained from CEIC) and the GDP deflator, respectively. Finally, we measure relative prices as the ratio between Chinese prices as captured by sectoral production price indices and world prices as proxied by US sector-specific import price indices. This measure is also adjusted for changes in the RMB/USD exchange rate and tariff reductions that were implemented in China during this time period. Our panel is balanced and consists of data related to 105 imported parts over the period 1993-2005, for a total of 1365 observations.

Empirical Results

In Table 1, we begin by estimating the model given in (1) in logs on the full sample, which allows us to interpret estimated coefficients on our regressors as elasticities. All standard errors reported in this section are robust to heteroskedasticity. Column 1 presents some simple pooled OLS results, and while we find all three regressors to be correctly signed, only exports are significant. However, in the presence of product-specific effects, the OLS estimator would be inefficient and potentially inconsistent. In column 2, we allow for uncorrelated individual effects, and use the random effects estimator. These estimates have smaller standard errors, suggesting some gain efficiency by allowing for product-specific effects. Moreover, all three regressors are correctly signed and highly significant. However, the random effects model is rejected by the Hausman test at the 1 percent level. In column 3, therefore, we allow the product-specific effects to be correlated with our regressors and estimate the model using the fixed effects estimator. The parameter estimates are close to those in column 3, and all regressors are highly significant.[11] However, we found evidence of first-order serial correlation in the residuals in this specification. Finally therefore, in column 4, we estimate the model using first-differenced OLS, another transformation that eliminates the time-invariant product-specific effects.[12] [13] While diagnostic tests could not formally reject the hypothesis that our log export and import variables do not have unit roots, there is some concern about their power in panels. In this context, a further advantage of the first-differencing transformation is that it could induce stationarity and thus control for any unit (or near unit) roots in our panel. We find that all three regressors are again correctly signed and highly significant. The robustness of our basic results across different panel estimation strategies is encouraging, and for most of the rest of this section we will concentrate on presenting results using our preferred fixed effects and first-differenced OLS estimators.

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[11] Under the classical assumptions, and allowing for correlated product-specific effects, the fixed effects estimator is consistent. In addition, since our dependent variable and regressors display significant time series ('within') variation, it is also likely to be efficient.

[12] In addition to being consistent under weaker assumptions, the first-differenced OLS estimator would be more efficient than the fixed effects estimator if the classical assumption that the idiosyncratic error term ε_{it} is serially uncorrelated is invalid and it follows a random walk process instead.

[13] Notice that this transformation also forces us to lose the first year of our panel, so that the sample is slightly smaller (1260 observations between 1994 and 2005).

In Table 2, we present some sub sample results where we divide our sample by time period. We will be testing whether there is any evidence of heterogeneity in our parameter estimates across these sub samples, and in particular whether the relationship between imported inputs, associated final exports and domestic demand has changed in the more recent time period. Columns 1 to 3 report results using the fixed effects estimator on the model in log levels. Column 1 re-estimates the model presented in column 3 of Table 1, omitting the first year of our dataset. This allows us to decompose the sample into two equal six year time periods, i.e. 1994-1999 and 2000-2005, with both sub samples consisting of 630 observations. While the standard errors are understandably larger in column 1 than those in column 3 of Table 1, the parameter estimates are not significantly different and confirm our earlier conclusions. However, the two sub samples display markedly different properties. In particular, while the coefficient on exports is highly significant and of similar magnitude in both time periods, the estimated coefficient on domestic demand displays significant heterogeneity. While its coefficient is insignificantly different from zero in the earlier period, it is both highly significant and much larger in the latter period. Relative prices remain correctly signed and significant across the sub samples. The point estimates on exports and domestic demand are more than three standard deviations away across sub samples, and more formal tests of parameter heterogeneity also strongly reject the hypothesis that these coefficient estimates are the same across the two time periods. Columns 4 to 6 repeat the same specifications using the first-differenced OLS estimator, which is more appropriate due to the presence of first-order serial correlation in the residuals of the fixed effects model. The results are robust to this alternative estimation strategy, with evidence of significant parameter heterogeneity across our sub samples. Indeed, they are even starker in this formulation: with the coefficient estimates suggesting that in a reversal of earlier patterns, in recent years domestic demand growth has become strongly associated with, and export growth completely disassociated from, import growth.[14][15] In other words, conditional on domestic demand, there fluctuations in final exports convey no information relevant for explaining imported intermediate inputs in the latter half of our sample. This is not what one would expect under the conventional view of China as no more than a large assembly plant, under which imports and exports should be closely associated.

Finally, we present some additional robustness checks on these basic results in Table 3. In particular, we re-estimate the specifications presented in Table 2 while allowing the domestic demand variable to be endogenous by using an IV estimation strategy. We instrument our measure of aggregate derived domestic demand with real domestic credit. As the table shows, our results are robust to this alternative empirical strategy, with the coefficient estimates closely resembling those in Table 2, no evidence of weak instruments, and a Hausman test not rejecting the validity of the IV model in log levels.[16]

Taken together, our results suggest that within our sample, imports have delinked from exports, and have become more responsive to domestic demand in recent years. These findings are consistent with the hypothesis that the role of foreign demand in determining import patterns in China has diminished in recent years and that domestic (production and

[14] We experimented with a variety of alternative domestic demand and relative price variables, including real GDP, sector-specific derived domestic demand, the real effective exchange rate and aggregate relative prices for the manufacturing and machinery sector as a whole, and found the results to be robust.

[15] We obtained qualitatively similar results as those reported in Tables 1 and 2 using sector specific domestic demand variables that varied across products and including dummies to control for time-effects, although the explanatory power of our regressions was generally lower.

[16] We experimented with other instruments for domestic demand, including lagged values and domestic demand estimated from National Accounts Data, as well as treating the export variable to also be endogenous and instrumenting it with its own lags, and found similar results.

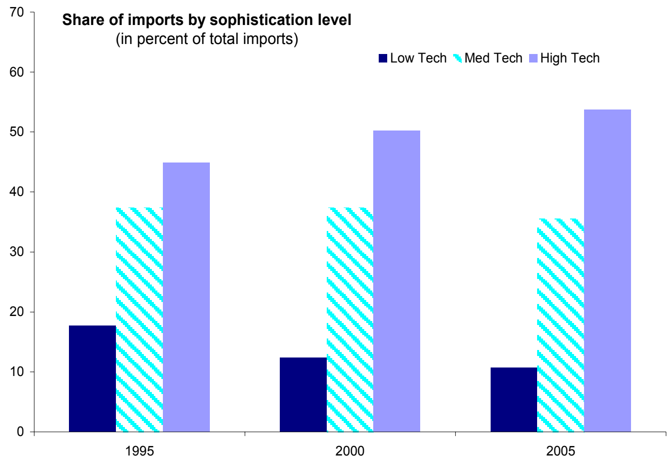
consumption) needs are becoming more relevant, much as you would expect in a typical economy with limited processing trade. Interestingly, we found weaker evidence of parameter heterogeneity across time within the electronics sub-sector of our sample. This suggests that the relative sophistication of the technology embodied in various sectors may also be an important determinant of the pace at which exports could be delinking from imports in China, a hypothesis that is explored further in the next section.

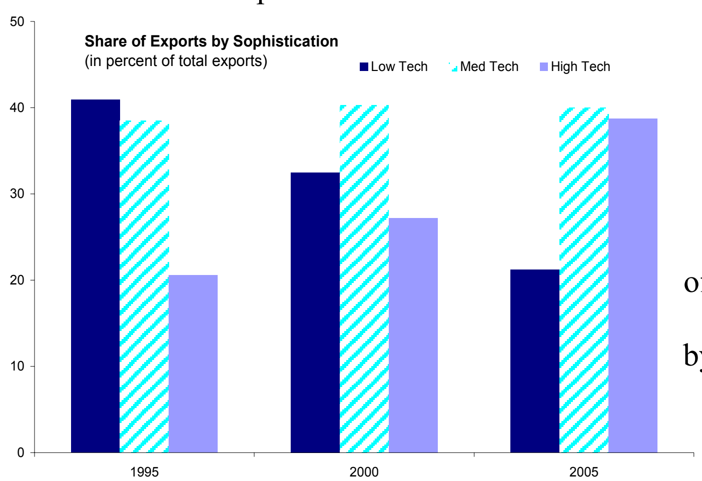
B. Product Sophistication and Trade Flows

This section directly tests the hypothesis that China's changing production and trade structure is an important factor affecting its aggregate trade. The "sophistication index" early discussed provides a useful measure to capture the structural change at the detailed product level. In the following analysis, we examine whether products of different technical sophistication level tend to respond differently to foreign and domestic demand, and to the fluctuation in the trade weighted real exchange rate. If so, in a fast changing economy such as China, the reaction of aggregate imports and exports to macroeconomic shocks may change overtime simply because the changes in the product composition, even if everything else is held still.

It is conceivable that exports and imports of products with different sophistication level react differently to aggregate demand shocks and exchange rate changes. Analysis in the previous section suggests that China is improving its production technology and starts to source more inputs domestically rather than imports. The less sophisticated a product it is, the easier it may be to find comparable domestic substitute. Thus imports of more sophisticated products could be more responsive to a change in domestic demand, while the rising capacity enables greater import substitution at the lower end. For the same reason, imports of more sophisticated products could be less responsive to relative price changes than imports of those at the lower end. On the export side, sophisticated goods could be more responsive to foreign demand changes than more basic goods (the "luxury" goods effect). Sophisticated goods could be more (or less) responsive to exchange rate changes, if producers of these goods have less (or more) pricing powers in the world market. While we do not explore these reasons explicitly, the empirical results from the estimation may help shed lights on these factors.

To motivate the discussion, we first examine the shift in trade sophistication in China over time. As discussed in Section II, the sophistication index shows that the average sophistication of China's external trade—imports and exports—has risen. To see this more clearly, we look at the change of trade shares by the range of product sophistication. We divide the products into three percentiles of sophistication. The "low tech" range corresponds to products with the sophistication index less or equal to the 30th percentile of all products. The "medium tech" corresponds to products with the sophistication index between 30th to 70th percentiles. "The high tech" corresponds to those with the index above the 70th percentile. Both exports and imports have shifted towards more sophisticated products in China's exports over the last decade. On the export side, the change has most taken place as the "high tech" product exports has risen, replacing the "low tech" category. The share of the former in total exports increased by 20 percentage points over the period, matched by a near 20 percentage point decline in the share of the latter. The share of the middle range in total exports has remained largely unchanged. The shift of imports demonstrated a similar pattern although the changes were smaller by comparison. As a result, "high tech" category accounted for slightly below 40 percent of total exports and over 50 percent of total imports in 2005. As China has increased its imports of primary products in recent years, and such products tend to be low in their sophistication level, the increase in the





average sophistication of imports for other sectors (mostly machineries) must have been even greater.

Data and Estimation

We estimate a panel of trade equations for product groups represented by the five-digit categories in SITC 2nd revision during 1993-2005, taking into account the "sophistication levels" of these products. Agricultural and miscellaneous products are excluded for the analysis (thus the dataset includes all products corresponding to the 2-digit SITC 2nd revision between 21 and 89). We choose two specifications for exports and imports. In the first specification, exports and imports correspond to trade volumes. In the second specification, exports and imports are dollar denominated trade value, divided by China's dollar GDP. The trade volume and trade value data are all obtained from the UN Comtrade Database. We use normalized trade value as the dependent variable in the second specification in order to improve our data coverage. For about 6 percent of the observations during the sample period, Comtrade reports value but not volume data. The missing values appear to occur randomly over time, for instance, some products could be associated with positive volumes for some years while missing volumes for other years, even if values are positive for all years. This problem is compounded when the estimation is based on the growth of volume, resulting in more than 10 percent shrinkage of the sample size. Trade value as a share of GDP thus provides more comprehensive coverage for the sample. In addition, export and import shares in percent of GDP are of some direct interest to researchers who study the link of trade and current account as shares of GDP and changes in demand and exchange rates.[17]

[17] Lee and Chinn (2002) provides one example of such studies.

To start, the first set of trade equations are specified as:

$$x_{i,t} = a_1 + a_2 fd_t + a_3 rer_t + a_4 s_i + a_5 s_i * fd_t + a_6 s_i * rer_t + \alpha_i + \chi_t + \varepsilon_{i,t} \quad (3)$$

for exports, and

$$m_{i,t} = b_1 + b_2 dd_t + b_3 s_i + b_4 fd_t + b_5 rer_t + b_6 s_i * dd_t + b_7 s_i * rer_t + \beta_i + \gamma_t + \nu_{i,t} \quad (4)$$

for imports.

$x_{i,t}$ and $m_{i,t}$ represent export and import volume, respectively for product i and year t. dd_t is the real domestic demand at year *t*, calculated as the nominal domestic demand divided by the level of producer prices. Nominal domestic demand is calculated as the difference of industrial production and trade balance. fd_t is the level of external demand, calculated as the real GDP of China's trading partners weighted by their importance in the trade with China.[18] rer_t is China's trade weighted real effective exchange rate. All of these variables are in first difference of logarithm. s_i is an index that represents the sophistication level of product i, which takes on three values of 0, 1 and 2, corresponding to "low tech", "medium tech", and "high tech" as described in the previous paragraphs. s_i varies by product but not over time. α_i and β_i are cross-sectional fixed effects for export and import equations of product i, to control for product specific characteristics, and χ_t and γ_t are time effects for export and import equations of time t to control for time specific shocks. In particular, the inclusion of time effect χ_t and γ_t allows for the possibility that some time varying variables that are

[18] Alternatively, we use world import for sector *i* (normalized by other countries' GDP). Such a specification enhances the power of the regression significantly as seen from a much higher R^2. The associated coefficients are related to penetration of China's products in the world market. Such penetration is larger for less sophisticated products.

relevant for exports and imports (such as real interest rate) may be missing from the simple specification of (3) and (4). The variable fd_t is included in the import equation to capture the impact on China's imports from exports through the processing trade, above and beyond the impact of other variables included in the regression. $\varepsilon_{i,t}$ and $\nu_{i,t}$ are idiosyncratic errors that are independently and identically distributed across products and years.

We include interaction terms $s_i * dd_t$ in the import equation and $s_i * fd_t$ in the export equation, and $s_i * rer$ in both equations. Therefore, income elasticity of exports for product i is $a_2 + a_5 s_{it}$, exchange rate elasticity of exports for product i is $a_3 + a_6 s_i$. Similarly, income elasticity of imports for product i is $b_2 + b_6 s_i$, and exchange rate elasticity of imports for product i is $b_5 + b_7 s_i$. As our main interest is how the product sophistication may affect the elasticities rather than the absolute size of the elasticities, we focus on the significance, sign and magnitude of parameters a_5, a_6, b_5, and b_7. One or several statistically significant coefficients on these interaction terms would suggest that products react differently for a given macroeconomic shock. For countries where trade structure is undergoing significant changes overtime, trade elasticities at the aggregate level must have shifted overtime. It is worth noting that we have abstracted from an estimation of the average income and exchange rate elasticity across products in the above exercise, and only focus on how such elasticities may be different across products. For instance, using aggregate date, Shu and Yip (2006) demonstrated that at an aggregate level, export increases when foreign demand increases, and decreases when the real effective exchange rate appreciates. This can be considered as our benchmark for the "average elasticity" of exports.

The second set of equations are the same as (3) and (4) except that the dependent variables are nominal value of exports and imports of product i at year t as shares of China's annual GDP. The first differences of logs in dd_t, fd_t, and rer_t are replaced by the annual growth of the level variables. Again, our main interest is the coefficients on the interaction terms a_5, a_6 and b_5, b_7. However, given that this specification is less commonly used than the equations of trade volumes, we also estimate the model without the time effect and interaction terms, to establish the links of the variables. We then include the interaction terms to test the significance of a_5, a_6 and b_5, b_7.[19]

Empirical Results

Table 4 and Table 5 report the estimation results for the first specification. We focus on the coefficients on the interaction terms: a_5, a_6 and b_6, b_7. Since our regression contains cross-section and time fixed effects, those variables that are constant across observations (dd_t, fd_t, and rer_t) or those variables that are constant over time (s_i) drop from the regressions. Robust estimates of the standard errors are reported.

In the export equation, the more sophisticated a product is, the more its exports tend to increase in response to a given increase in foreign demand, and the more its exports tend to drop for a given appreciation of the real effective exchange rate. Both a_5 and a_6 are statistically significant at the 5 percent level. In the import equation, the more sophisticated a product is, the more its imports tend to increase in response to a rise in domestic demand,

[19] The coefficients reported in Table 6 and Table 7 do not include the time effects. Including time effects in the regressions yields very similar results.

although it tends to increase less (or decrease more) in response to a given appreciation of the real effective exchange rate. However, while b_6 and b_7 are individually significant (i.e., when the other interaction term is not included in the regression), b_6 becomes insignificant when both are included in the regression. We re-estimate the model for the period 1994-2002, excluding the most recent period with the significant investment boom, which may have weakened some of the relations. We find both interaction terms become statistically significant.

Table 6 and Table 7 report the estimation results from the second specification.[20] The first column in Table 6 and Table 7 estimate (3) and (4) without the interaction terms. The baseline suggests that import-to-GDP ratio increases when domestic demand and foreign demand increases, and when there is a real appreciation in the exchange rate, and export-to-GDP ratio rises when foreign demand increases and when there is a real depreciation.

We then add the interaction terms as discussed above. The coefficients of the interaction terms a_5, a_6 and b_6, b_7 are reported in the second to fourth column. On the export side, similar to the first specification, the more sophisticated a product is, the more export as a share of GDP will drop for a given appreciation of the real effective exchange rate. While export-to-GDP increases more in response to a rise in foreign demand for more sophisticated products, the coefficient is not statistically significant. On the import side, again, the more sophisticated a product is, the more the import-to-GDP ratio tends to increase in response to a

[20] Panel unit root tests reject the hypothesis that the dependent variables export and import to GDP ratios have unit roots.

rise in domestic demand, and the coefficient b_6 is significant at the 5 percent level. The response of the import-to-GDP ratio to a change in exchange rate is not statistically significant when both interaction terms are included in the regression.

In both specifications, the response of exports to a change in real effective exchange rate is found to be affected by the sophistication of the products. The more sophisticated a product is, the more its exports (volume or the share to GDP) tend to decline for a given appreciation in the real effective exchange rate. This may reflect the fact that producers of more sophisticated products have less pricing power in the world market, and therefore are less able to pass through the exchange rate changes to the foreign market. There is also evidence that income elasticity of export is greater for more sophisticated goods. This is consistent with the fact that exports of China have moved towards more investment goods which tend to fluctuate more with foreign economic cycles (Dark and Hawkins (2005)) and that more sophisticated consumer goods tend to have higher income elasticity than necessary goods. Results on the import side suggest imports of more sophisticated products respond more to domestic demand changes. The results are both statistically significant for import volume for the sample period before the recent investment boom, and for import-to-GDP ratio for the full sample. This is consistent with the notion that import substitution is greater at the lower end of technological sophistication with improved domestic production capacity and an increase in demand tends to be met by domestic production than being imported, while demand for more sophisticated products tends to be met by imports. There could also be "luxury goods" effect where high-end products are associated with higher income elasticity. However, the fact that such effect becomes weaker when the recent period of high investment is included suggests domestic production capacity that enables import substitution might be a more relevant explanation. Imports of more sophisticated goods tend to increase less for a given appreciation in the real exchange rate, possibly driven by the fact that many of the sophisticated products still cannot be produced at home and therefore less responsive to a change in the exchange rate. The coefficient, however, becomes statistically insignificant in the specification of import-to-GDP ratio.

IV. Conclusion: Implications and Direction for Future Research

This paper shows that significant shifts have taken place in China's production and trade structure over the last decade. In particular, the traditional tight link between imports and exports created by processing trade may be weakening as a result of increased domestic production capabilities supported by large FDI inflows. Moreover, product composition has shifted significantly in both exports and imports, as China has continued to upgrade its production capability while demanding increasingly more sophisticated products from abroad. The shift towards more high-end products implies that China's exports and trade balance could become more sensitive to foreign demand and relative price changes than in the past. While these results are still tentative, they cast doubts on traditional views about China's trade structure. This new structure, in turn, gives rise to a number of interesting implications that challenge conventional wisdom both about the vulnerabilities of the Chinese economy and its role and influence in the broader regional context.

In terms of implications for China's own economy, our results suggest that its trade balance may have become more sensitive to movements in foreign demand and relative prices than commonly assumed. The evidence presented in this paper—that imports and exports have become less linked than before, and export structure has moved towards products that are more demand and price elastic—provide a microeconomic basis for this prediction. Therefore, China is likely to be more vulnerable to external shocks than typically assumed. In particular, a real appreciation or a slowdown in the US could have a stronger impact on China's net exports and growth. This underscores the need to hasten the rebalancing of China's growth, away from potentially volatile net exports that are increasingly vulnerable to exchange rate and demand shifts towards a more sustainable path driven by domestic demand. The next step in this line of research could be to take these shifts in production and trade structure into account while undertaking empirical analysis with aggregate data, perhaps by allowing for structural breaks and various forms of instability such as heterogeneity based on sophistication, in estimated trade equations.

This new paradigm also has important regional implications in terms of intra-Asian trade flows and the evolution of regional production networks. In recent years, China has displaced the US as the largest export market for an increasing number of Asian countries and been pivotal in boosting intra-regional trade and FDI, particularly in the form of intermediate goods channeled through multinationals as part of cross-border chains. Indeed, intermediate products account for almost three-fifths of the increase in intra-regional trade within Asia over the last decade. However, as China begins to specialize in more parts of this production chain, its imports of intermediate goods from the region could start to fall. On their own, these trends could decrease intra-regional trade linkages. However, the potential expansion of China's domestic market create new opportunities for the regional economies, particularly in terms of higher-tech products that China is unlikely to be able to produce domestically in the near future. These developments thus highlight the need for regional economies to advance their technological innovation and move up the quality chain. At the same time, to the extent that China's comparative advantage evolves and its labor costs rise as a consequence, this could present an opportunity for the lower-income countries in South–East Asia to take China's place at the lower end of these networks.

In the global market, while China's rapidly expanding domestic demand is commonly held as a major factor in driving up the price of primary commodities, notably oil, it could be moving rapidly from being a price taker to a price setter for intermediate goods. Hence, just as it has helped to hold down the price of unskilled labor and labor-intensive manufacturing goods, it might start to exert a further dampening influence on global inflation through its effects on the supply (and hence price) of intermediate goods. A closer examination of the implications of China's shifting production and export structure for regional production networks and prices in global markets would seem to be a fruitful area for further research.

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Table 1. Testing Delinking of Imports and Exports: Full Sample, Alternative Specifications

	1		2		3		4	
	OLS		**Random effects**		**Fixed effects**		**First differences**	
	coef	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**
$\ln X_{it}$	0.544**	0.056	0.307**	0.024	0.268**	0.025	0.084**	0.020
$\ln DD_{it}$	0.071	0.102	0.372**	0.047	0.419**	0.048	0.655**	0.164
$\ln \left(\frac{P_{it}}{P_{it}^{F}} \right)$	0.297	0.247	0.496**	0.124	0.540**	0.124	1.098**	0.245
Constant	4.165*	1.902	1.766	0.921	1.445	0.909	-0.018	0.033
Number of observations	1365		630		630		1260	
Number of products	105		105		105		105	
R2_overall	0.43		0.40		0.39		0.03	
R2_within			0.49		0.49			
R2_between			0.42		0.42			
			Rejected by Hausman test 1/					

* significant at 5%; ** significant at 1%

1/ Null hypothesis for the Hausman test is that the coefficients in the fixed-effects and random-effects specifications are not systematically different. A rejection of the null implies that the random effects are correlated with the other regressors, and hence the estimates from the random-effects specification are biased.

Table 2. Testing Delinking of Imports and Exports: Sub Sample Analysis

	1		2		3		4		5		6	
	Levels						First Differences					
	1994-2005		1994-99		2000-05		1994-2005		1994-99		2000-05	
	coef	se	coef	se	coef	se	coef	se	coef	se	coef	se
ln X_{it}	0.236**	0.026	0.152**	0.034	0.114**	0.035	0.084**	0.020	0.120**	0.029	0.017	0.031
ln DD_{it}	0.511**	0.051	0.108	0.227	0.794**	0.063	0.655**	0.164	0.150	0.272	1.649**	0.307
ln $\left(\frac{P_{it}}{P_{it}^{F}}\right)$	0.516**	0.123	0.745**	0.153	0.634	0.357	1.098**	0.245	0.537	0.395	0.663	0.388
Constant	0.054	0.945	8.597*	4.238	-3.533*	1.439	-0.018	0.033	0.023	0.049	-0.154*	0.063
Number of observations	1260		630		630		1260		630		630	
Number of products	105		105		105		105		105		105	
R2_overall	0.37		0.33		0.27		0.03		0.04		0.06	
R2_within	0.49		0.18		0.52							
R2_between	0.43		0.37		0.45							
p-value on homogeneity test 1/					0.02						0.01	

* significant at 5%; ** significant at 1%

1/ Null hypothesis for the parameter homogeneity test is that the coefficients in the two sub sample regressions are not systematically different.

Table 3. Robustness Checks: Sub Sample Analysis using IV Estimation

	1		2		3		4		5		6	
	Levels						First Differences					
	1994-2005		1994-99		2000-05		1994-2005		1994-99		2000-05	
	coef	se	coef	se	coef	se	coef	se	coef	se	coef	se
ln X_{it}	0.266**	0.027	0.152**	0.034	0.113**	0.036	0.078**	0.021	0.122**	0.029	-0.011	0.031
ln DD_{it}	0.415**	0.057	0.099	0.191	0.796**	0.067	2.180**	0.682	0.105	0.248	1.056**	0.409
ln $\left(\frac{P_{it}}{P_{it}^{F}}\right)$	0.596**	0.125	0.748**	0.170	0.631	0.359	2.944**	0.839	1.132	0.865	0.640	0.390
Constant	1.641	1.038	8.767	5.405	-3.563*	1.495	-0.297*	0.126	-0.050	0.106	-0.038	0.082
Number of observations	1260		630		630		1260		630		630	
Number of products	105		105		105		105		105		105	
First-stage F statistic on instrument 2/	4518.9						75.9					
p-value on Hausman test 3/	0.003						0.151					

Instrumenting ln DD with ln (domestic credit)
* significant at 5%; ** significant at 1%

1/ R squareds are not reported as they do not have the standard interpretation.
2/ First-stage F -statistic tests for weak instruments, under the null hypothesis that the coefficients on the instruments are zero.
3/ Null hypothesis for the Hausman test is that the coefficients in the fixed effects/first differenced and IV regressions are not systematically different. A rejection of the null implies that the fixed effects/first differenced estimate is biased.

Table 4: Export Elasticities and Product Sophistication

	Sample period: 1994-2005						Sample period: 1994-2003					
	Demand Interaction only		Exchange Rate Interaction Only		Both Demand and Exchange Rate Interactions		Demand Interaction only		Exchange Rate Interaction Only		Both Demand and Exchange Rate Interactions	
	coef	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**
dln_FD x SL (a5)	1.7**	0.75			1.6**	0.75	2.1**	0.86			2.1**	0.86
dln_RER x SL (a6)			-0.3*	0.18	-0.3*	0.18			-0.5*	0.24	-0.5*	0.24
_cons	0.2***	0.04	0.3***	0.03	0.2***	0.04	0.1***	0.04	0.3***	0.04	0.2***	0.05
Number of observations	17,320		17,320		17,320		12,903		12,903		12,903	
Number of Sectors	1,528		1,528		1,528		1,523		1,523		1,523	

* significant at 10%; ** significant at 5%; *** significant at 1%

1/ The dependent variable is the log first differenced exports. The regressors are log first differenced real effective exchange (dln_RER) log first differenced foreign demand level (dln_FD), and interaction terms with the product sophistication level (SL). SL is represented by the dummy variables that describes the product as "low tech", "medium tech", or "high tech", as discussed d in the text.
The regression is performed at the 5-digit level of SITC 2nd revision for all products excluding agricultural goods. Robust standard deviation is reported in the table. The model includes fixed effects for the cross sections and time effects for years.
The observations include nonagricultural and non-miscellaneous products, corresponding to products with the first two digit SITC code less than 90 and greater than 20.

Table 5: Import Elasticities and Product Sophistication Level

	Sample period: 1994-2005						Sample period: 1994-2003					
	Demand Interaction only		Exchange Rate Interaction Only		Both Demand and Exchange Rate Interactions		Demand Interaction only		Exchange Rate Interaction Only		Both Demand and Exchange Rate Interactions	
	coef	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**
dln_DD x SL (b6)	0.3***	0.10			0.1	0.2	0.7***	0.17			0.4**	0.2
dln_REER x SL (b7)			-0.6***	0.16	-0.5*	0.3			-0.9***	0.22	-0.5**	0.3
_cons	0.2***	0.03	0.3***	0.03	0.2***	0.0	-0.1**	0.04	-0.0	0.04	-0.1	0.0
Number of observations	17,507		17,507		17,507		13,016		13,016		13,016	
Number of Sectors	1,532		1,532		1,532		1,525		1,525		1,525	

* significant at 10%; ** significant at 5%; *** significant at 1%

1/ The dependent variable is the log first differenced imports. The regressors are log first differenced real effective exchange (dln_RER) log first differenced foreign and domestic demand (dln_FD and dln_DD), and interaction terms of dln_DD and dln_RER with the product sophistication level (SL). SL is represented by the dummy variables that describes the product as "low tech", "medium tech", or "high tech", as discussed d in the text. The regression is performed at the 5-digit level of SITC 2nd revision for all products excluding agricultural goods. Robust standard deviation is reported in the table. The model includes fixed effects for the cross sections and time effects for years.
The observations include nonagricultural and non-miscellaneous products, corresponding to products with the first two digit SITC code less than 90 and greater than 20.

Table 6: Export-GDP Ratio and Product Sophistication Level

	No interaction (1)		Demand interaction (2)		Exchange rate interaction (3)		Demand and exchange Rate Interactions (4)	
	coef	sd	coef	sd	coef	sd	coef	sd
RER_CH	-0.1***	0.0	-0.1***	0.0	0.1***	0.03	0.1***	0.0
FD_CH	0.7***	0.1	0.5**	0.1	0.7***	0.10	0.5**	0.1
FD_CH x SL			0.1	0.1			0.1	0.1
RER_CH x SL					-0.2***	0.03	-0.2***	0.0
_cons	11.2***	0.3	11.2***	0.3	11.2***	0.32	11.2***	0.3
Number of observations	0		19,579		19,579		19,579	
Number of Sectors	0		1,534		1,534		1,534	

* significant at 10%; ** significant at 5%; *** significant at 1%

1/ The dependent variable is the ratio of exports and GDP. The regressors are annual percentage changes of real effective exchange (RER_CH), annual growth of foreign demand (FD_CH), and interaction terms with the product sophistication level (SL). SL is represented by the dummy variables that describes the product as "low tech", "medium tech", or "high tech", as discussed d in the text.

The regression is performed at the 5-digit level of SITC 2nd revision. The observations include nonagricultural and non-miscellaneous products, corresponding to products with the first two digit SITC code less than 90 and greater than 20. Coefficients are scaled up by 1000, and thus represent 1/1000 percentage point changes. The regression includes fixed effects for the cross section. Robust standard errors are reported.

Table 7: Import-GDP Ratio and Product Sophistication Level

	No interaction (1)		Demand interaction (2)		Exchange rate interaction (3)		Demand and exchange Rate Interactions (4)	
	coef	**sd**	**coef**	**sd**	**coef**	**sd**	**coef**	**sd**
DD_CH	0.3***	0.14	0.1	0.04	0.3**	0.04	0.0	0.04
FD_CH	0.4***	0.67	0.4**	0.14	0.4**	0.14	0.4***	0.14
RER_CH	0.1***	0.24	0.2**	0.05	0.3***	0.06	0.1***	0.05
DD_CH x SL			0.2***	0.05			0.2***	0.07
RER_CH x SL					-0.2***	0.05	0.1	0.08
_cons	6.4***	1.52	6.9***	0.80	6.9***	0.81	6.9***	0.80
Number of observations	0		19,718		19,718		19,718	
Number of Sectors	0		1,534		1,534		1,534	

* significant at 10%; ** significant at 5%; *** significant at 1%

1/ The dependent variable is the ratio of imports and GDP. The regressors are annual percentage changes of real effective exchange (RER_CH), annual growth of domestic demand(DD_CH), annual growth of foreign demand (FD_CH), and interaction terms with the product sophistication level (SL). SL is represented by the dummy variables that describes the product as "low tech", "medium tech", or "high tech". The regression is performed at the 5-digit level of SITC 2nd revision. The observations include nonagricultural and non-miscellaneous products, corresponding to products with the first two digit SITC code less than 90 and greater than 20. Coefficients are scaled up by 1000, and thus represent 1/1000 percentage point changes. The regression includes fixed effects for the cross section. Robust standard errors are reported.