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Can the Chinese trade surplus be reduced through exchange rate policy?

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Alicia García-Herrero[1] and Tuuli Koivu[2 3]

Can the Chinese trade surplus be reduced through exchange rate policy?

Abstract

This paper shows empirically that China's trade balance is sensitive to fluctuations in the real effective exchange rate of the renminbi, although the size of the surplus is such that exchange rate policy alone will be unable to address the imbalance. One of the main reasons why the reduction in the trade surplus is limited is that Chinese imports are reduced with a real appreciation of the renminbi. By estimating bilateral import equations, we find that it is imports from other Southeast Asian countries which fall. This result reflects the vertical integration of Southeast Asia with China through the 'Asian production network'. We find, in turn, that imports from Germany – which serve China's domestic demand – behave as one would expect, ie they increase with renminbi real appreciation. All in all, our results raise concerns on the impact of renminbi appreciation on Southeast Asia even if regional currencies do not follow the renminbi's upward trajectory.

Keywords: China, trade, exports, real exchange rate
JEL classification: F1, F14

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Alicia García-Herrero and Tuuli Koivu

Can the Chinese trade surplus be reduced through exchange rate policy?

Tiivistelmä

Tutkimuksessa osoitetaan, että muutokset Kiinan valuuttakurssissa vaikuttavat merkittävästi maan ulkomaankauppaan. Kauppataseen suurta ylijäämää ei kuitenkaan pystytä poistamaan yksistään valuuttakurssipolitiikalla, sillä reaalisen efektiivisen valuuttakurssin vahvistuminen supistaa paitsi Kiinan vientiä myös sen tuontia. Tutkimuksessa vertaillaan Kiinan ulkomaankauppaa erityyppisten maiden kanssa kahdenvälisten kauppayhtälöiden avulla. Vertailu osoittaa, että Kiinan valuutan vahvistuminen vaikuttaa eri maista Kiinaan suuntautuvaan tuontiin eri tavoin. Valuutan vahvistuminen vähentää tuontia niistä Aasian maista, jotka toimittavat Kiinan jatkojalostussektorille osia ja komponentteja, kun taas tuonti Saksasta palvelee suurelta osin Kiinan kotimaista kysyntää ja hyötyy renminbin vahvistumisesta. Kaiken kaikkiaan tulokset nostavat esiin kysymyksen, miten renminbin mahdollinen vahvistuminen vaikuttaisi laajemmin Aasian maiden talouskehitykseen.

Asiasanat: Kiina, ulkomaankauppa, valuuttakurssi

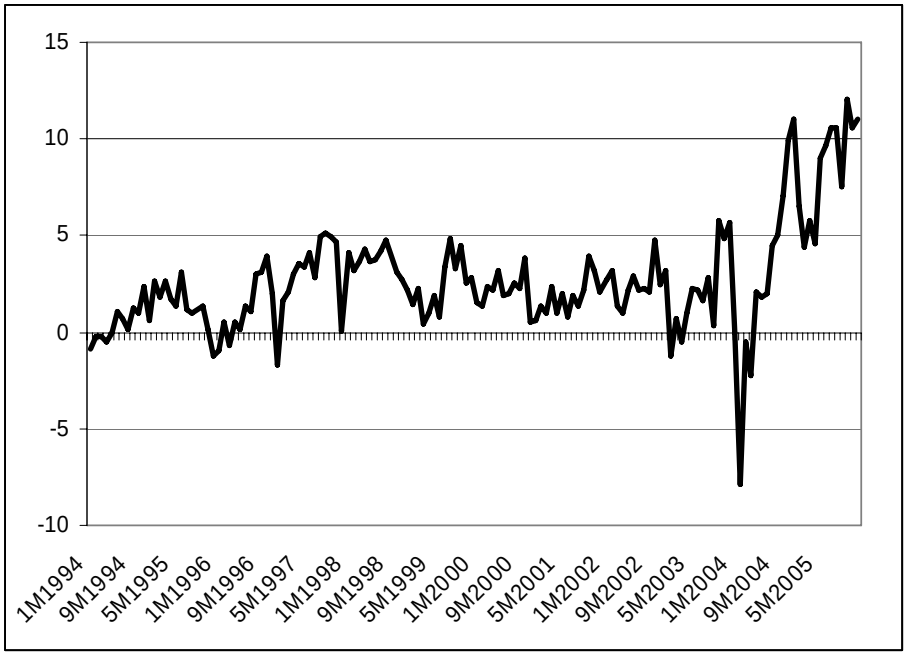
Mehrotra, Eiji Ogawa, Jimmy Ran, Chang Shu and Francisco Vazquez. We also appreciate able research

1 Introduction

China's share of world trade has grown extremely quickly in recent years. China is already the world's third largest exporter and might even outpace the United States in the near future if such fast export growth is maintained.

China's trade was very much in balance until recently. According to China's customs statistics, the trade surplus amounted to a mere 32 billion US dollars (or 1.7% of GDP) in 2004 (Chart 1). However, since 2005 the trade surplus has ballooned, and it reached nearly 180 billion US dollars in 2006, or close to 7% of China's GDP.[4]

Chart 1 China's trade balance, USD billion



Sources: China's customs statistics, CEIC.

The large size of the surplus makes the issue important not only for China but also for the rest of the world. China's rapidly growing surplus has been much debated in international policy fora. On one hand, there is the impression that Chinese policymakers are maintaining an overly depreciated exchange rate so as to profit from external demand and achieve a much-needed high growth rate. On the other hand, there are doubts that the exchange rate can be an effective tool in reducing the trade surplus, given that China is an economy in

assistance by Eric Chan and Enrique Martinez Casillas. Remaining errors are obviously the authors' own.

transition where prices may still play a smaller role in companies' decisions concerning supply and demand.

Notwithstanding the general interest in the issue, the existing literature on this topic is relatively scarce. The lack of appropriate data and long time-series has discouraged research on exploring the link between the renminbi exchange rate and foreign trade in China until very recently. Since the summer of 2003, when discussions on renminbi undervaluation came to the fore, research on China's exchange rate policy has blossomed. Much of it has focused on estimating the long-run equilibrium exchange rate or exploring what exchange rate regime best suits China's economy. While both questions are clearly relevant, we feel that the most urgent issue – particularly given the size of global imbalances and the pressure applied by industrial countries – is whether China should let its currency appreciate as a tool to reduce its huge trade surplus. The answer very much depends on how effective renminbi appreciation can be in terms of reducing exports and fostering imports.

Our paper analyses this question empirically using cointegration analysis. According to our results, China's trade surplus would shrink following a real appreciation of the renminbi, but the reduction would be limited. The relatively small impact – for the size of the imbalance – is mainly explained by the peculiar price elasticity we find for imports: namely, Chinese imports appear to fall following a real appreciation. By estimating bilateral import equations, we find that it is imports from other Asian countries which fall, while those of some industrial countries (Germany in particular) increase. This might be explained by the vertical integration of Southeast Asia and China's key role in the region's production network.

The rest of the paper is organized as follows. Section 2 reviews the existing literature. Section 3 describes the set up and the data used. Section 4 explains the methodology. Section 5 presents the empirical results on export and import equations as well as the results from the bilateral trade equations. Chapter 6 concludes.

[4] China's balance of payments trade statistics generally show slightly larger trade surpluses than the customs statistics.

2 Literature review

The existing literature on the impact on China's trade balance of a real appreciation of the renminbi can be divided into two groups according to the policy implications. The first– and larger – strand shows evidence that a real exchange appreciation reduces the trade balance, either through exports, imports or both. The second strand either finds no significant impact on the trade account or even a positive one.

Within the first strand, Cerra and Dayal-Gulati (1999) use an error correction model to estimate the price elasticities of China's exports and imports for the period 1983–1997 and find them to be negative and significant for exports (-0.3) and positive and significant for imports (0.7). In addition, they show that both elasticities increase over time. Table 1 summarizes the existing literature as well as the methodology used.

Dees (2001) improves on the previous analysis by separating China's exports and imports into two categories, those processed and the remainder. He finds that, in the long term, exchange rate appreciation decreases exports. He also reports that ordinary exports are more price sensitive than processed exports. In the short term, however, only world demand influences exports.

In the same vein, Yue and Hua (2002) use provincial annual data and show a reduction in exports with a real exchange appreciation. As Cerra and Dayal-Gulati, but with more recent data, Yue and Hua show that Chinese exports are becoming more price-sensitive.

Bénassy-Quéré and Lahrèche-Révil (2003) simulate the impact of a 10% renminbi real depreciation and report an increase in China's exports to OECD countries and a reduction in China's imports from emerging Asia, provided other regional exchange rates remain unchanged.

Eckaus (2004) uses aggregate annual data for 1985–2002 to discover that the appreciation of the renminbi decreases China's exports to the United States and the share of Chinese imports in total US imports. The latter would point to a substitution effect from other exporters to the United States, but the result must be treated with care due to the small number of observations and the use of export and import values instead of volumes.

Lau, Mo and Li (2004) estimate China's exports to and imports from the G3. In the long run, an appreciation of the real effective exchange rate is found significant in lowering exports. In contrast, neither ordinary imports nor imports for processing seem to be af-

fected by the REER. In any event, the results are difficult to interpret since it is not clear how they discount exports and imports, and the number of observations is very low (quarterly data from 1995 until 2003).

Thorbecke (2006) uses a gravity model to study the effect of exchange rate changes on triangular trading patterns in Asia and disaggregates exports into intermediate, capital and final goods. His results indicate that a 10% renminbi appreciation reduces Chinese final exports by nearly 13%. However, the appreciation would not significantly affect Chinese imports from the United States.

Voon, Guangzhong and Ran (2006), in turn, use sectoral data for the period 1978 to 1998 and incorporate the degree of overvaluation of the renminbi when estimating China's export equations; they report a fall in exports to the United States as a consequence of real exchange rate appreciation.

Finally, Shu and Yip (2006) estimate the impact of exchange rate movements on the Chinese economy as a whole and find that currency appreciation can reduce exports due to an expenditure-switching effect, resulting in a moderate contraction in aggregate demand.

Surprisingly, other papers offer a somewhat different view on how exchange rate policy may affect China's trade surplus. In particular, Kamada and Takagawa (2005) use a simulation model to estimate the effects of China's exchange rate reform and show that a 10% revaluation would boost Chinese imports slightly, while the impact on exports would be tiny. However, their OLS estimations on China's import equation do not show the real exchange rate having a significant effect on the volume of imports. Unfortunately, they do not estimate China's export equation. According to their results, exports boost imports, which may indicate that there could be an indirect impact from the exchange rate on imports via exports.

Jin (2003) estimates the relationship between real interest rates, real exchange rates and China's balance of payments and concludes that a real appreciation tends to increase the balance of payments surplus.

Finally, Cerra and Saxena (2003) use sectoral data to study the behaviour of Chinese exporters and find that renminbi appreciation has actually boosted exports, particularly in recent years. In any event, their results – as any other with sectoral data – should be treated with care, since only about half of Chinese exports are covered in the sectoral data and no quality adjustment is reported for their unit price data.

The most recent attempt to estimate import and export equations for China is that of Marquez and Schindler (2006). Instead of import and export volumes, they estimate the impact of real exchange rate changes on China's share of total world trade. This is to avoid employing proxies for China's export and import prices. As Dees (2001) and Lau Mo and Li (2004), they break down exports and imports into two groups: ordinary and processing trade. Again, real appreciation of the renminbi seems to lower exports but also imports, at least for ordinary trade. While interesting, the results are not robust to different lags, particularly for processed imports and exports. There are two additional problems in using their analysis for the question we are seeking to answer. In the first place, estimated impacts are on import and export shares, so no inference can be drawn regarding the trade account. Secondly, no cointegration techniques are used, so that only short-run elasticities can be estimated.

All in all, the existing results are either old, relatively faulty in terms of data and econometric methodology and/or can hardly be used to infer policy conclusions regarding the impact of a renminbi revaluation on China's trade balance. In this paper, we use more recent data and improve the empirical methodology so as to better assess whether a real appreciation of the renminbi could reduce China's trade surplus. In addition, we enrich our analysis by estimating bilateral export and import equations. This helps us to crosscheck our results as well as to explore which trading partners would benefit and which lose from a renminbi appreciation. As we shall show later, such an exercise is particularly relevant in the case of China, given its peculiar trade structure.

3 Set up and data

To determine the sensitivity of Chinese exports and imports to changes in the renminbi's real exchange rate, we estimate the price elasticity of import and export volumes.

The general empirical framework for this kind of analysis is the following pair of equations:

$$X_t = \alpha_0 + \alpha_1 REER_t + \alpha_2 Y_t^* + \sum_{i=3}^{n} \alpha_i controls_t + \varepsilon_t$$

$$M_t = \beta_0 + \beta_1 REER_t + \beta_2 Y_t + \sum_{i=3}^{n} \beta_i controls_t + \varepsilon_t$$

where X_t stands for the volume of exports from China, M_t for the volume of imports into China, $REER_t$ for the real effective exchange rate of the renminbi, Y_t^* for foreign demand and Y_t for China's domestic demand. Therefore, α_1 is the price elasticity of exports, α_2 is the income elasticity of exports, β_1 is the price elasticity of imports and β_2 is the income elasticity of imports.

Given the importance of processing for China's trade, we distinguish between imports used for processing goods to be re-exported and ordinary imports. In the same way, we differentiate between processed and ordinary exports. Processing trade comprises imports of components for assembly into exportables, exports of components for assembly outside China and exports of goods assembled using imported components. Ordinary trade, in turn, refers to goods which are not subject to further processing and not assembled from imported components. Processing trade accounts for about half of China's trade. Charts 1 and 2 in the Appendix show the trend in ordinary and processed exports and imports: both grew much faster from 2001 onwards, in conjunction with China's WTO entry.

An important difficulty in working with Chinese trade data is that export or import values and volumes cannot be disentangled, as no export and import price indices exist. We therefore need to use proxies. For import prices we calculate the index of China's twenty-five most important trade partners' export prices and deflate China's imports with this index (data sources can be found in Table 1 in the Appendix). As a proxy for export prices, we use China's consumer price index (CPI). The reason why we take such a general price measure is that neither a producer price index nor a wholesale price index exists for our whole sample. In any event, as a robustness test, Hong Kong's export prices into China are used as proxy for China's export prices and the results are maintained.[5]

The real effective exchange rate (REER) is drawn from the IMF's international financial statistics. It is constructed as follows.

$$REER = \prod_{i=1}^{N} \left(rer_i\right)^{w_i}$$

[5] The underlying assumption is that most of Hong Kong's exports are Chinese products and that Hong Kong's mark-up of these goods remains relatively constant.

where N stands for the number of currencies included in the index, w_i is the weight of the i^{th} currency and $rer_{i,t}$ is the bilateral real exchange rate against each of China's trading partners.[6] As shown in Chart 3 in the Appendix, the REER experienced a very steep appreciation from 1994 until 1997 and then tended to fall until very recently. The question is whether – and to which extent – the sharp increase in exports can be explained by such real depreciation.

From the theoretical literature, we expect the price elasticity for exports to be negative, as Chinese products compete in the world market. The expected sign for the price elasticity of imports is less clear, at least in the Chinese case. A real appreciation should foster imports if the gained purchasing power is stronger than the reduced demand due to the associated fall in exports. Which effect is stronger will very much depend on the import structure. In fact, if imports are substitutes for Chinese products, the price elasticity should be positive (ie an appreciation should increase imports). In turn, imported parts and components for the export industry may be affected negatively by a renminbi appreciation if the latter reduces exports.

Foreign demand is measured by world imports and deflated by the global import price index. For China's domestic demand we take industrial production, deflated by the CPI. Industrial production is preferred to GDP because it is available at a monthly frequency. The expected sign for the income elasticity is positive for both exports and imports.

We choose a few additional controls that could be relevant to the Chinese case. Firstly, value-added tax rebates offered to exporting companies are included in the export equation since they should foster exports. In the same vein, import tariffs are an additional regressor in the import equation. These have been reduced at a very fast pace since WTO entry, coinciding with the surge in imports.

Secondly, on the supply side, we introduce a third variable in the export equation: a measure of capacity utilization. This should help take into account supply constraints that could hinder export growth. Capacity utilization is defined as the difference between industrial production and its trend, the latter being calculated using a Hodrick-Prescott filter.

Thirdly, the stock of foreign direct investment (FDI), deflated by the CPI, is introduced to both the export and the import equations. In principle, a rise in FDI should in-

[6] For more details, see Bayoumi et al. (2005).

crease China's exports in as far as FDI is geared towards the export industry. We also expect a positive coefficient for imports, since foreign companies are more likely to use imported machines, components and parts in their production than Chinese companies. It should be noted, though, that FDI data is only available from 1997 onwards, which creates problems for finding a cointegrating vector other than by shortening our sample. This is why FDI will in the end only appear in one of the estimated equations, namely that for ordinary imports.

Finally, a deterministic trend is included in both export and import equations when it is statistically significant. The trend variable should help capture productivity improvements and the on-going reforms in the Chinese economy, which we cannot easily measure otherwise.

We use monthly deseasonalized data for the period 1994–2005. While aware that our research period is rather short, it would make little sense to start before 1994, as China was at that time basically a planned economy.[7] In fact, 1994 was a very productive year in terms of reforms towards a more market-oriented economy. Some of them are especially relevant to the question we have posed ourselves. Namely, the two exchange rate systems were unified, mandatory planning for imports was eliminated and licensing requirements and quotas were reduced. Moreover, the renminbi started to be convertible on the current account, while private sector development benefited from the new company law.

The continuous move towards a market economy allowed China to enter the WTO in December 2001. Due to the many years of preparation for accession and the transition period after membership, it is very difficult to estimate when, and how much, China's WTO membership has affected Chinese exports and imports. However, we test if China's foreign trade has become more price sensitive with the reforms by dividing our sample into two periods: from 1994 to the end of 1999 and from the beginning of 2000 (when WTO membership essentially became certain) to the end of 2005. In addition, we do find a structural break in 2000 for exports and imports[8], which supports our strategy.

[7] According to the OECD Economic Survey (2005), the share of transactions conducted at market prices among producer goods increased to 78% in 1995, from 46% in 1991. At the same time, the share of prices fixed by the state dropped from 36% to 16%.

[8] The exception is ordinary exports, for which the structural break was found in 1998. However, the same year is chosen to separate the two periods for the sake of homogeneity.

4 Methodology

We use cointegration techniques to estimate the price elasticity of imports and exports in China. This is because several of the variables of interest, in particular export and import volumes, are found to be non-stationary. Furthermore, such methodology allows us to separate between short-run and long-run elasticities. We are clearly more interested in the latter, since we would like to determine how permanent could be the effect on the trade account of a real appreciation of the renminbi.

We use a reduced form for export and import equations for both processed and non-processed goods. A reduced form equation is preferred to avoid simultaneous equation bias which would result from estimating supply and demand functions alone. However, to avoid potential problems with omitted variables, we include supply and demand determinants in the reduced form equation.

We first test the order of integration of the variables included in our analysis. We use Augmented Dickey Fuller (ADF) tests for the existence of a unit root (Table 3 in the Appendix). Most of the variables are found to be non-stationary in levels but stationary in first differences. There are a few exceptions, however: capacity utilization, which appears to be I(0), and domestic demand and FDI into China, which are not stationary even in first differences. However, the latter result might be due to the relatively large number of lags suggested by the Akaike information criteria. If we have only one lag, as suggested by the Schwarz criterion, we can reject the unit root in both cases even at a 1% level.

As a second step, we test for the existence of cointegration vectors using the Johansen procedure. We do find one cointegrating vector for all groups of variables tested (Table 4 in the Appendix).[9] The finding of a cointegrating vector for each type of export and import allows us to estimate a regression of the lagged determinants and their differences through a non-linear least square approach, as proposed by Phillips and Loretan (1991).[10] Such an approach will yield unbiased and consistent estimates of the parameters to be estimated.

[9] When FDI is included, two or more cointegrating vectors are found, except in the case of ordinary imports. When FDI is introduced as a short-run determinant of exports and imports, it is not found to be significant. Results are available upon request.

5 Results

We ran regressions on export and import equations for our full sample, ie 1994–2005, and for the shorter one, from 2000 onwards.[11] In both cases, we distinguish between processed and ordinary trade.

The results for the export equations can be found in Table 2. Long-run price elasticities of China's exports – both processed and ordinary – are negative and significant in our full sample and also since WTO entry. When appropriately transformed (see Table 4), the long-run elasticities are -1.3 for processed exports and -1.8 for ordinary exports for the full sample and only slightly lower for the shorter time frame (-1.6 and -1.2, respectively). Our results are very close to previous long-run estimates for China (-1.5 for total exports according to Lau, Mo and Li, 2004 and -1.3 for Shu and Yip, 2006). They are also similar to the estimated export price elasticities for major industrial countries (-1.5 and -1.6 for the United States and the United Kingdom, respectively, according to Hooper et al., 1998). In addition, the short-run elasticities are found significant for several of the lagged variables.

[10] This approach tackles the simultaneity problem by including lagged values of the stationary deviation from the cointegrating relationship.
[11] As a preliminary step, we use Chow tests to assess whether there is a structural break in our series. We do find one in the year 2000 for both exports and imports.

Table 2 China's export equations

	Dependent variable			
	Full sample		From WTO onwards	
	D_ordinary exports	D_processed exports	D_ordinary exports	D_processed exports
LR coefficients				
C	2.759	2.936**	5.308***	3.006**
	(1.764)	(1.476)	(1.821)	(1.500)
world imports$_{t-1}$	0.025	0.010	0.651***	0.896***
	(.215)	(.169)	(.214)	(.206)
REER$_{t-1}$	-0.385**	-0.330***	-1.334***	-1.112***
	(.163)	(.122)	(.225)	(.215)
ordinary exports$_{t-1}$	-0.213***		-0.811***	
	(.058)		(.122)	
processed exports$_{t-1}$		-0.258***		-0.934***
		(.069)		(.146)
trend	0.003***	0.004***	0.009***	0.011**
	(.001)	(.001)	(.001)	(.002)
dummy 02/04			-0.238***	
			(.047)	
dummy 01/03				0.114***
				(.031)
SR coefficients				
D_world imports$_t$	0.224	0.702***	0.502***	0.831***
	(.288)	(.229)	(.186)	(.150)
D_world imports$_{t-1}$	0.375	0.422	-0.070	-0.006
	(.389)	(.314)	(.194)	(.168)
D_world imports$_{t-2}$	0.057	0.072		
	(.360)	(.288)		
D_world imports$_{t-3}$	0.306	0.009		
	(.277)	(.221)		
D_REER$_t$	-0.697	-0.483	-0.995**	-0.823**
	(.512)	(.410)	(.430)	(.344)
D_REER$_{t-1}$	1.080**	0.773*	1.552***	1.080**
	(.534)	(.432)	(.454)	(.377)
D_REER$_{t-2}$	-0.494	-0.815*		
	(.547)	(.438)		
D_REER$_{t-3}$	0.716	0.627		
	(.540)	(.434)		
D_capacity utilization$_t$	0.524***	0.578***	0.796***	0.634***
	(.186)	(.148)	(.151)	(.107)
D_capacity utilization$_{t-1}$	0.528**	0.035	0.538***	0.273*
	(.232)	(.185)	(.140)	(.144)
D_capacity utilization$_{t-2}$	0.109	-0.045		0.124
	(.230)	(.178)		(.113)
D_capacity utilization$_{t-3}$	0.083	0.038		
	(.194)	(.150)		
D_ordinary exports$_{t-1}$	-0.338***		0.003	
	(.082)		(.099)	
D_processed exports$_{t-1}$		-0.229**		0.068
		(.089)		(0.104)
Sample period	1/1995-12/2005	1/1995-12/2005	1/2000-12/2005	1/2000-12/2005
Number of obs.	132	132	72	72
R^2 adjusted	.33	.47	.64	.78

Standard errors in parentheses. * Indicates significance at 10% level, ** at 5% level and *** at 1% level.

The long-run positive effect on Chinese exports from the increase in world demand is very small and not statistically significant in our full sample, but it does become highly significant after WTO membership for both ordinary and processed exports. This result is in line with the idea that China was facing enormous barriers to profiting from other countries' growth before WTO entry. For the most recent sample, the income elasticity of Chinese exports is very close to 1, as one would expect (0.8 for ordinary exports and 1 for processed ones).[12]

As for the control variables, capacity utilization is found significant and with the expected sign. Namely, higher capacity utilization – which should go hand in hand with a larger supply of goods – raises exports. This is true in both sample periods and is even more persistent for ordinary exports.

The results for imports are shown in Table 3. Interestingly, the price elasticity of imports is negative and generally significant. In other words, a renminbi real appreciation tends to reduce imports rather than to increase them. This is the case with imports for processing (at least in the most recent sample) and ordinary imports and is in line with the results of Marquez and Schindler (2006). Such negative price elasticity implies that imports are more sensitive to lower external demand induced by real appreciation of the renminbi than to a rise in purchasing power. Such a result probably reflects the vertical integration which characterizes trade links in Southeast Asia and the key role that China plays therein.

The long-run income elasticity is found significant only in the case of imports for processing and with a relatively low coefficient (0.5).[13] In other words, China's domestic demand does not seem very relevant in explaining the growing trend of Chinese' imports. Again, this is in line with the idea that external demand is a major determinant of Chinese imports.

The stock of FDI appears to have a long-run positive effect on ordinary imports. The lack of a single cointegrating vector for processed exports or any kind of imports does not allow us to draw conclusions on how they are affected by FDI.

[12] We notice that this result is closely linked to the trend variable in the regression. If we exclude trend from the export regressions, an increase in world demand significantly increases Chinese exports. The introduction of the trend is justified by its statistical significance and the results from misspecification tests.

[13] In the case of ordinary imports, the income elasticity becomes positive and significant for 1994–2005 if we omit the trend variable from the regression.

Finally, for the full sample we also find a significant impact of import tariffs in the long-run. For imports for processing, the coefficient is negative, as one would expect, but it is positive for ordinary imports.[14]

Table 3 China's import equations

	Dependent variable			
	Full sample		**From WTO onwards**	
	D_ordinary imports	**D_imports for processing**	**D_ordinary imports**	**D_ imports for processing**
LR coefficients				
c	4.844*	0.677	-1.291	5.110***
	(2.546)	(.977)	(1.718)	(1.814)
domestic demand$_{t-1}$	-0.095	0.228***	0.015	0.033
	(.145)	(.074)	(.094)	(.161)
REER$_{t-1}$	-0.754*	0.067	-0.624**	-0.605**
	(.390)	(.145)	(.249)	(.270)
import tariffs$_{t-1}$	0.238**	-0.094*		-0.087
	(.111)	(.057)		(.096)
fdi$_{t-1}$			0.622***	
			(.220)	
ordinary imports$_{t-1}$	-0.543***		-0.464***	
	(.109)		(.099)	
imports for processing$_{t-1}$		-0.440***		-0.669***
		(.100)		(.158)
trend	0.012***	0.003***		0.008***
	(.003)	(.004)		(.003)
dummy 01/2003			0.237***	
			(.055)	
SR coefficients				
D_domestic demand$_t$	1.133***	1.158***	0.866***	1.155***
	(.325)	(.135)	(.188)	(.156)
D_domestic demand$_{t-1}$	0.387	0.284		0.440**
	(.381)	(.176)		(.217)
D_domestic demand$_{t-2}$	-0.092	-0.059		
	(.326)	(.172)		
D_domestic demand$_{t-3}$		0.024		
		(.154)		
D_domestic demand$_{t-4}$		0.118		
		(.128)		
D_REER$_t$	0.296	-0.192	-0.992	-0.979**
	(.934)	(.363)	(.625)	(.481)
D_REER$_{t-1}$	-1.048	1.213**	1.536**	1.763***
	(.934)	(.382)	(.685)	(.526)
D_REER$_{t-2}$		-0.998***		-0.622
		(.384)		(.495)
D_fdi$_t$			0.152	
			(1.940)	
D_fdi$_{t-1}$			2.275	
			(1.746)	
D_fdi$_{t-2}$			-3.632**	
			(1.560)	
D_fdi$_{t-3}$			-3.328**	
			(1.557)	
D_ordinary imports$_{t-1}$	-0.334***		-0.188**	
	(.087)		(.086)	
D_imports for processing$_{t-1}$		-0.149**		-0.055
		(0.073)		(.123)
Sample period	12/1994-12/2005	2/1995-12/2005	1/2000-12/2005	1/2000-12/2005
Number of obs.	133	131	72	72
R^2 adjusted	.50	.63	.69	.74

Standard errors in parentheses. * Indicates significance at 10% level, ** at 5% level and *** at 1% level.

[14] Import tariffs could not be included as a short-run variable because we only had annual data on tariffs and thus changes were rare throughout the sample.

Table 4. Long-run price and income elasticities

		Ordinary exports	Processed exports	Ordinary imports	Imports for processing
Price elasticity	1994–2005	-1.8	-1.3	-1.4	(0.15)
	2000–2005	-1.6	-1.2	-1.4	-0.9
Income elasticity	1994–2005	(0.1)	(0.1)	(-0.2)	0.5
	2000–2005	0.8	1.0	(0.0)	(0.0)

Values in parentheses are not statistically significant.

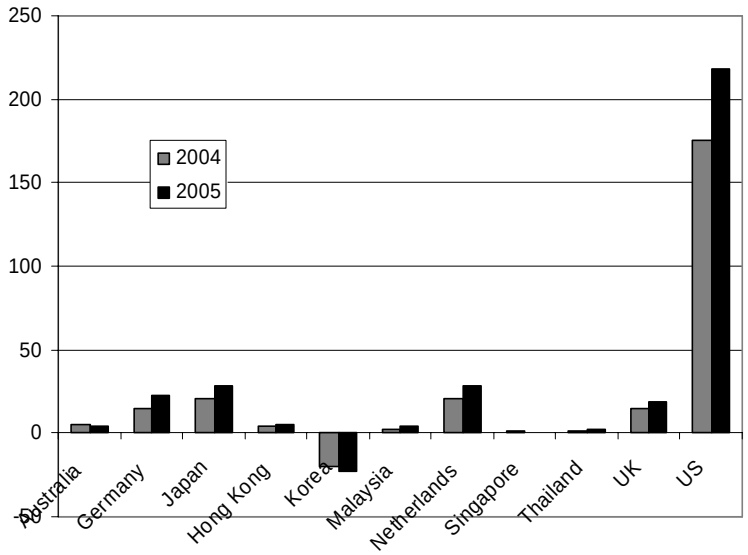
In order to have a rough idea of how effective the exchange rate tool can be in China, we assume a 10% real appreciation of the renminbi and apply the price elasticities estimated for export and imports since WTO entry was known. On that basis – which is obviously a very simple exercise – exports would have fallen 14% and imports 12% in 2005. All in all, the trade surplus would have been reduced by 26% with a 10% renminbi real appreciation.

To have a better understanding of the results, particularly the reasons for the reduction in imports after a real appreciation, we now focus on bilateral trade. If a real appreciation causes a reduction in imports from all of China's main trade partners, we could argue that an appreciation reduces demand in China due to the associated fall in exports. But if we found that countries' exports to China react to an appreciation in different ways, it would indicate that there is a differential impact of a real appreciation of the renminbi across countries depending on the composition of their exports to China.

The reason why we expect the latter to be the case is China’s key role in the Asian production chain, with increasing imports of components from other Southeast Asian countries, which are then transformed and re-exported to the rest of the world. Such vertical integration implies that exports from Southeast Asian countries are becoming complements rather than substitutes so that they can be negatively affected by a fall in external demand for them, particularly if it is the final exporter, as in the case of China.

The large differences in China’s bilateral trade balances across countries reflect the peculiar nature of Chinese trade: while China is in deficit or close to balance with most Asian countries, it has very large surpluses with most European countries and even more so with the United States (Chart 2).

Chart 2. China's bilateral trade balances with selected countries, USD billion



Source: Direction of trade sStatistics.

To estimate bilateral price elasticities for exports and imports, we calculate the bilateral real exchange rate between the renminbi and the currency of each of China's ten largest export and import partners.[15] As in the previous exercise, the CPI is used as a deflator. Imports from other countries to China are converted into volumes by using their export price indices. For Chinese bilateral exports, in contrast, the CPI is the best deflator one can obtain. The demand for China's exports is proxied by GDP growth in each of its export partners. We also introduce the stock of bilateral FDI as a control variable.

Following the same procedure as for the aggregate export and import equations, we conduct unit root tests for all bilateral variables. Most of them are I(1). In addition, one cointegration vector was found for each bilateral import and export equation. Again, we estimate bilateral export and import volumes in a regression with the lagged regressors and their differences.[16]

[15] In formulating the bilateral equations, we do not use China's trade data but the trade partners' statistics to alleviate the incorrect account of China's trade with Hong Kong. China's statistics show a large amount of exports to Hong Kong, which in reality only transit via Hong Kong to other countries. In any event, the data we use has other well-known caveats. For example, due to reasons of taxation and its large ports, the Netherlands is often signed as a final destiny although the goods might continue on to other European countries. This explains the significance of the Netherlands as one of China's major trade partners and also its large trade deficit with China. In reality, the bilateral equation on the trade between China and the Netherlands reflects the dynamics of trade between China and Europe more generally.

[16] All reported equations pass tests for serial correlation and normal distribution of residuals.

The results for the largest export countries are very similar across countries and, therefore, also in our aggregate estimations.[17] The appreciation of the renminbi real exchange rate against that of each of China's major partners reduces Chinese exports. The long-run coefficients are significant for all major destinations except Hong Kong, which is not surprising given the difficult interpretation of trade data between China and Hong Kong. After transformation (see Table 7), the export price elasticity appears to be highest for exports to the United States – nearly 5.

We also find that economic activity in China's partners increases China's exports, as one would expect. Bilateral income elasticities are very significant for all countries except Japan. Furthermore, they are extremely high for some countries, particularly the United States. This result shows the importance of demand factors in explaining the growing trade imbalance between the United States and China.

In many cases, our measure of productivity gains, the trend variable, is also positive and significant. When possible, we include Chinese inward FDI from each of these destiny countries. FDI into China from the United States seems to foster Chinese exports to the United States. The opposite is true for Hong Kong and the United Kingdom.

Results for bilateral import equations are much less homogenous, as shown in Table 6.[18] First, our estimated long-run price elasticities show that a real appreciation of the renminbi reduces Asian countries' exports to China (except for Malaysia). The coefficient is significant for Korea and Thailand, although not very large (Table 7). In turn, the long-run price elasticity for German exports to China is positive and highly significant. Finally, such long-run price elasticities are not significant for the United States, among other countries.[19]

As for income elasticities, they are positive and significant for US exports to China, and for those of Germany, Japan and Korea, but not for emerging Asian countries, such as Malaysia, Taiwan or Thailand, or even Australia. All in all, our results support the view that it is China's domestic demand that is driving imports from major industrial countries, and it is demand for Chinese exports that is driving imports from emerging Asia.

[17] We do not report the equation on China's exports to Italy and Taiwan as they do not pass the standard tests mentioned in footnote 9.
[18] Out of China's ten most important import sources, we drop Singapore due to econometric problems and Russia due to the lack of reliable export prices.
[19] When we estimated China's bilateral import equation with the euro area excluding Germany, the price elasticity was positive and significant but the regression had problems in passing the LM test for residuals' serial correlation.

Table 7 shows the transformed long-run price and income elasticities for China's bilateral export and import equations. Both price and income elasticities are higher for China's exports than for China's imports, which explains the growing trade surplus. For most countries, price elasticities are close to those estimated for China's aggregate exports and imports. The very high demand elasticities of Chinese exports to some countries are very much in line with results from earlier studies, such as that of Lau, Mo and Li, 2004.

Table 5 China's bilateral export equations

	US	HK	Japan	Germany	Korea	Netherlands	UK	Singapore
LR coefficients								
c	-66.291***	-2.676	-4.409	-55.852***	-11.487***	-41.379***	-75.340***	-6.851
	(13.043)	(2.510)	(8.904)	(15.407)	(3.674)	(10.938)	(10.329)	-4.676
GDP^i_{t-1}	9.901***	0.745***	0.990	5.076***	1.561***	6.087***	7.275***	1.680***
	(1.884)	(.250)	(.762)	(1.387)	(.368)	(1.520)	(.987)	(-0.533)
RER^i_{t-1}	-3.875***	-0.129	-0.637***	-0.798***	-0.560***	-0.961***	-0.466***	-1.375*
	(1.119)	(.284)	(0.138)	(.222)	(.143)	(.253)	(0.086)	(.743)
FD^i_{t-1}	1.404***	-0.177*					-0.299***	
	(.279)	(.103)					(0.047)	
$exports^i_{t-1}$	-0.780***	-0.614***	-0.886***	-0.368***	-0.700***	-0.817***	-0.811***	-0.941***
	(.112)	(.128)	(.175)	(.094)	(.143)	(.187)	(106)	(.221)
trend	-0.022***	0.003*	0.009***		0.004***			0.011***
	(.005)	(.001)	(.002)		(.001)			(.000)
dummy*	-0.189***			-0.209***	0.339***		-0.218***	
	(.033)			(.062)	-0.084		(.046)	
SR coefficients								
$D\_GDP^i_t$	0.788	0.044	0.571	3.549	0.220	-4.021	4.304*	0.951
	(1.805)	(.454)	(1.199)	(2.577)	(.748)	(3.137)	(2.303)	(.706)
$D\_GDP^i_{t-1}$	-10.709***	-0.087	-0.962	0.294	-0.723	-9.267**	-3.790*	0.009
	(2.038)	(.467)	(1.235)	(2.455)	-0.806	(3.642)	(1.962)	(.737)
$D\_GDP^i_{t-2}$	-7.500***	0.243	0.747	2.408	-0.258	-3.335	-0.764	0.243
	(1.836)	(.439)	(1.173)	(2.452)	(.709)	(3.537)	(1.918)	(.675)
$D\_GDP^i_{t-3}$	-4.560**			-8.488***			-2.244	
	(1.865)			(2.440)			(2.345)	
$D\_rer^i_t$	-3.748**	0.500	-0.931***	-0.525*	-0.530**	-0.861**	-1.030***	-1.825**
	(1.492)	(.859)	(.205)	(.307)	(.203)	(.423)	(.213)	(.777)
$D\_rer^i_{t-1}$	0.558	-0.274	0.426*	0.370	0.186	0.765	-0.159	1.237
	(1.512)	(.883)	(.218)	(.317)	(.253)	(.509)	(.225)	(.757)
$D\_rer^{i-2}_t$	-1.084	0.921	0.178	0.638*	-0.357	0.044	0.345	0.485
	(1.630)	(.881)	(.222)	(.330)	(.244)	(.467)	(.223)	(.758)
$D\_rer^i_{t-3}$		1.466**		0.696*			-0.019	1.171*
		(.737)		(.306)			(.225)	(.666)
$D\_FDI^i_t$	1.303	1.080	-0.346	0.554	-0.095	-1.950	-0.364	-1.322
	(1.530)	(.837)	(1.248)	(.970)	(.923)	(1.341)	-0.489	(2.072)
$D\_FDI^i_{t-1}$	0.897	-0.815	0.778	0.880	2.200**	1.789	-0.987*	2.824
	(1.522)	(.830)	(1.221)	(1.044)	(.934)	(1.337)	(.500)	(2.035)
$D\_FDI^i_{t-2}$	-0.642	1.201	2.649*	0.879	0.120	0.035	0.937	0.631
	(1.564)	(.819)	(1.318)	(1.049)	(.946)	(1.246)	(.495)	(2.029)
$D\_FDI^i_{t-3}$				-0.254			0.564	
				(1.003)			(.459)	
$D\_FDI^i_{t-4}$				-1.958**				
				(.908)				
$D\_Cutilization_t$	-0.606***	0.651***	-0.335**	-0.195	0.487**	-0.057	0.033	0.073
	(.123)	(.140)	(.158)	(.210)	(.217)	(.251)	(.122)	(.254)
$D\_Cutilization_{t-1}$	0.401**	0.502***	0.168	-0.011	0.145	-0.115	0.062	-0.157
	(.158)	(.161)	(.195)	-0.274	(.253)	(.295)	(.148)	(.298)
$D\_Cutilization_{t-2}$	0.126	0.118	-0.080	-0.433	-0.021	-0.047	0.064	-0.397
	(.151)	(.130)	(.188)	(.268)	(.215)	(.233)	(.151)	(.273)
$D\_Cutilization_{t-3}$				0.049			0.022	
				(.213)			(.120)	
$D\_exports^i_{t-1}$	-0.001		-0.142	-0.280***	-0.197**	-0.055	0.018	-0.070
	(.102)		(.121)	(.103)	(.084)	(.138)	(.086)	(.154)
Sample period	1/01-12/05	4/95-12/05	1/00-12/05	1/99-12/05	4/95-12/05	1/01-12/05	5/95-12/05	1/01-12/05
Number of obs.	60	129	72	84	129	60	128	60
R^2 adjusted	.85	.56	.66	.45	.56	.42	.54	.45

Standard errors in parentheses. * indicates significance at 10% level, ** at 5% level and *** at 1% level.
Dummy: United States 10/02, Germany 12/01, Korea 8/96 and United Kingdom 4/99.

Table 6 Bilateral import equations

	Dependent variable: imports to China from country i							
	Japan	**Korea**	**US**	**Taiwan**	**Germa-ny**	**Austra-lia**	**Malaysia**	**Thailand**
LR coefficients								
c	0.260	-1.235**	6.322	-2.372	-0.483	1.365	-5.647	-0.968
	(.279)	(.523)	(10.746)	(2.661)	(.375)	(1.039)	(5.590)	(.934)
China's ind. production$_{t-1}$	0.233***	0.182**	0.386**	0.146	0.365***	0.235	-0.069	0.071
	(.078)	(.088)	(.157)	(.104)	(.094)	(.163)	(.267)	(.104)
rer$^{i}_{t-1}$	-0.023	-0.163*	-1.069	-0.451	0.245***	-0.016	0.150	-0.434**
	(.080)	(.084)	(1.786)	(.416)	(.090)	(.144)	(.866)	(.213)
FDI$^{i}_{t-1}$	0.066	0.327***	0.030	0.684		-0.313*	1.467***	1.098***
	-0.043	(.084)	(.384)	(.449)		(.166)	(.465)	(.289)
China's imports$^{i}_{t-1}$	-0.245***	-0.425***	-0.676***	-0.155*	-0.397***	-0.647***	-0.609	-0.473***
	(.076)	(.097)	(.146)	(.086)	(.082)	(.102)	(.133)	(.097)
trend						0.009**		
						(.004)		
dummy*		0.257***	0.233***	-0.426***	-0.355***	-0.473***		
		(.072)	(.073)	(.146)	(.103)	(.122)		
SR coefficients								
D_ind.prod$^{ch}_{t}$	0.415***	0.615***	0.398**	1.200***	0.109	0.217	0.148	
	(.123)	(.132)	(.187)	(.240)	(.183)	(.214)	(.215)	
D_ind.prod$^{ch}_{t-1}$	0.125	0.158	0.454**	-0.463*	0.156	0.129	-0.244	
	(.126)	(.167)	(.189)	(.277)	(.225)	(.209)	(.232)	
D_ind.prod$^{ch}_{t-2}$		0.057			0.160			
		(.157)			(.221)			
D_ind.prod$^{ch}_{t-3}$		0.083			0.227			
		(.130)			(.182)			
D_rer$^{i}_{t}$	-0.439***	-0.039	6.677**	-0.328	-0.212	0.236	2.040	-0.199
	(.226)	(.190)	(3.198)	(.853)	(.393)	(.380)	(2.042)	(.575)
D_rer$^{i}_{t-1}$	0.324	-0.116	0.319	0.652	-0.168	-0.080	-0.834	1.542**
	(.226)	(.208)	(3.132)	(.842)	(.402)	(.399)	(1.979)	(.594)
D_rer$^{i}_{t-2}$	0.096	0.055	6.546***	1.578*	-0.274			
	(.222)	(.205)	(2.259)	(.812)	(.401)			
D_rer$^{i}_{t-3}$	-0.376*	0.324*			-0.122			
	(.219)	(.189)			(.384)			
D_FDI$^{i}_{t}$	-0.926	1.724*	0.050	7.166**	2.401**	0.593	1.441	0.683
	(.856)	(.940)	(3.265)	(2.837)	(.924)	(.938)	(2.256)	(1.802)
D_FDI$^{i}_{t-1}$	-0.030	0.402	-6.638**	4.184	-0.617	-0.294	-1.211	-4.474**
	(.849)	(.929)	((3.169)	(2.889)	(.992)	(.395)	(2.339)	(1.179)
D_FDI$^{i}_{t-2}$		-1.028		-3.252	-0.412			
		(.860)		(2.694)	(.982)			
D_FDI$^{i}_{t-3}$		-0.894		2.746	-1.806*			
		(.814)		(2.756)	(.946)			

D_China's imports$^{i}_{t-1}$	-0.249*** (.085)	-0.296*** (.089)	-0.138 (.108)	-0.258*** (.096)	-0.352*** (.076)	-0.089 (.086)	-0.041 (.117)	-0.077 (.099)
Sample period	3/95-12/05	5/95-12/05	1/01-12/05	1/98-12/05	5/95-12/05	1/01-12/05	3/99-12/05	3/99-12/05
Number of obs.	130	128	60	96	128	60	82	82
R^2 adjusted	.27	.48	.61	.60	.43	.42	.31	.36

Standard errors in parentheses. * indicates significance at 10% level, ** at 5% level and *** at 1% level.
Dummy: Korea 1/03, United States 8/01, Taiwan 1/98, Germany 11/98, Australia 9/95.

Table 7 Bilateral long-run price and income elasticities

	Export equation			Import equation	
	RER	**Demand**		**RER**	**Demand**
US	-5.0	12.7	**Japan**	(-0.1)	1.0
Hong Kong	(-0.2)	1.2	**Korea**	-0.4	0.4
Japan	-0.7	-1.1	**US**	(-1.6)	0.6
Germany	-2.2	13.8	**Taiwan**	(-2.9)	(0.9)
Korea	-0.8	2.2	**Germany**	0.6	0.9
Netherlands	-1.2	7.45	**Singapore**	-	-
UK	-0.6	9.0	**Russia**	-	-
Singapore	-1.5	1.8	**Australia**	(0.0)	(0.4)
Taiwan	-	-	**Malaysia**	(0.2)	(-0.1)
Italy	-	-	**Thailand**	-0.6	(-0.2)

Values in parentheses are not statistically significant.

To better understand the diverse results found for Chinese imports, we examine the composition of China's imports from each of its major trading partners (Table 8). Australia basically exports energy and raw materials to China, which might explain the lack of significance of both price and income elasticities. Germany's exports to China are mainly machinery, electronics and cars for domestic demand. These are all products for which a competitiveness gain – through a renminbi real appreciation –can help tilt the balance in their favour. Although Japan's export structure to China is very similar to that of Germany, its exports are not sensitive to changes in the renminbi-yen real exchange rate, only to China's domestic demand. Such lack of price sensitivity might be explained by the potential substitutability between Japan's sizable FDI in China and Japanese exports to China. US exports to China, whose price elasticity is not found significant, consist mainly of aircraft, machinery and semiconductors. These are products for which there are no clear substitutes in China and, in some cases, not even elsewhere. Finally, imports from Southeast

Asia are very concentrated on electronics, which are then re-exported from China. This kind of import is, therefore, very dependent on China's external demand.

Table 8 Imports to China from selected countries as a share of total imports in 2005

	Agricultural products	Mineral products	Chemicals	Textiles	Base metals	Machinery	Electronics	Vehicles	Optical instruments
Australia	4.5	**52.8**	10.2	8.2	**12.7**	1.9	0.8	1	0.4
Germany	0.2	0.2	6.9	0.6	7.8	**35.9**	**13.1**	**11.9**	6
Japan	0.2	1.5	8.8	3.7	**11.4**	**21.5**	**30.0**	4.5	8.7
Korea	0.6	4.7	10.2	3.8	9.7	9.5	**33.6**	2.8	**14.8**
Malaysia	6.4	2.6	4.1	0.7	1.8	8.6	**63.0**	0.1	1.3
Taiwan	0.1	0.9	7.4	4.5	10	9.7	**38.7**	0.5	16.1
Thailand	6.1	5.9	4.4	2.6	2.9	**27.5**	**26.5**	0.3	1.3
US	8.6	2	**11.3**	4.3	6.7	**17.1**	**17.5**	8.9	7.8

Source: CEIC.

6 Conclusions

During the past few years, there has been growing discussion both in China and in international fora on the desirability of a real appreciation of the renminbi. Many have argued that exchange rate policy would not serve the purpose of reducing China's ballooning trade surplus. This paper shows empirically that China's trade balance is sensitive to fluctuations in the real effective exchange rate. In fact, estimating long-run elasticities of Chinese exports and imports to changes in the renminbi's real effective exchange rate for the period from 1994 to end-2005, we find strong evidence that a real appreciation reduces exports in the long-run in quite a substantial way. This is the case for both processed exports (ie transformed and re-exported goods) and ordinary exports. However, real exchange appreciation also reduces imports, particularly since 2000, when China's accession to the WTO became certain. This explains why the overall impact of exchange rate policy on the trade account is relatively small; a rough estimate would be a 26% reduction for a 10% real appreciation of the renminbi. While the correction of the trade surplus is welcome, this result essentially illustrates that exchange rate policy alone cannot solve the growing imbalance of the Chinese economy, namely its ballooning trade surplus. Accompanying policies are, therefore, needed.

Given that the limited impact of exchange rate policy hinges on the unusual reaction of imports to appreciation of the renminbi, we explore the issue further by estimating

bilateral import equations. Price elasticities for Chinese imports from Southeast Asian countries are negative and generally significant (in particular for Korea and Thailand). This result may be explained by China's key role in the Asian production network. Such a network, based on vertical integration, makes products from different Asian countries more of a complement than a substitute, so that a fall in China's external demand because of a real appreciation of the renminbi also reduces their exports to China. The positive and significant price elasticity found for German exports to China suggests that a real appreciation of the renminbi could have a very different impact on China's trading partners depending on the structure of their exports to China.

These findings raise concerns over Asia's possible response to a sudden appreciation of the renminbi. In fact, the negative impact we find on some Southeast economies would, in principle, be larger if Asian currencies were to follow the renminbi's upward trajectory.

Although this study only concentrates on the trade surplus – so that the conclusions cannot be comprehensive – it does serve to note the importance of investigating further potential domino effects from a real appreciation of the Chinese currency and different combinations of exchange policies in Asia.

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Appendix

Table 1 Data sources

Variable	Explanation	Frequency	Source	Method
Processed exports	The volume of China's processed exports	Monthly	CEIC	Original data in USD millions. Converted to renminbi and deflated by CPI. Seasonally adjusted.
Ordinary exports	The volume of China's ordinary exports	Monthly	CEIC	Original data in USD millions. Converted to renminbi and deflated by CPI. Seasonally adjusted.
Imports for processing	The volume of China's imports for processing	Monthly	CEIC	Original data in USD millions. Converted to renminbi and deflated by China's import price index. Seasonally adjusted.
Ordinary imports	The volume of China's ordinary imports	Monthly	CEIC	Original data in USD millions. Converted to renminbi and deflated by China's import price index. Seasonally adjusted.
China's bilateral exports	The volume of China's bilateral exports	Monthly	Direction of trade, CEIC	Data from China's trade partners' side. Original data in USD was converted to renminbi and deflated by China's CPI. Seasonally adjusted.
China's bilateral imports	The volume of China's bilateral imports	Monthly	Direction of trade, CEIC	Data from China's trade partners' side. Original data in USD was deflated by trade partners' export prices. Seasonally adjusted.
World imports	World total import excl. China	Monthly	IFS	In USD, deflated by world import price index, seasonally adjusted.
Demand in bilateral export equations	Real GDP	Quarterly	Bloomberg	The quarterly data on real GDP in China's main export countries was interpolated into a monthly data.
China's domestic demand	We use industrial production as a proxy for domestic demand	Monthly	CEIC	Deflated by CPI, seasonally adjusted.
REER	Real effective exchange rate	Monthly	IFS	CPI-based measure
Bilateral RER	Bilateral real exchange rate	Monthly	IFS	CPI-based measure
Capacity utilization	Estimate for output gap	Monthly		Business cycles estimated by using Hodrick-Prescott filter on industrial production data
Import tariffs	Weighted average import tariffs	Annual	IMF Occasional Paper, WTO	The authors calculated the weighted average for 2001–2005 with the help of WTO tariff data. Data for 1999–2000 was interpolated, as it was not available.
VAT rebates	Value-added tax rebates on exports	Annual	WTO	The sum of value-added tax returned to the exporters
FDI	Accumulation of foreign direct investment into China	Monthly	CEIC	Original data in USD millions. Converged to renminbi and deflated by CPI. Seasonally adjusted.
Bilateral FDI	Accumulation of bilateral direct investment into China	Monthly	CEIC	
	China's import prices	Monthly	IFS, own calculations	Index was calculated by taking weights of China's 25 most important trading partners and their export price indices. 2000=100

Table 2 Correlation matrices

	Ordinary exports	World imports	REER
Ordinary exports	1		
World imports	0.89	1	
REER	0.04	0.44	1

	Processed exports	World imports	REER
Processed exports	1		
World imports	0.96	1	
REER	0.23	0.44	1

	Ordinary imports	Domestic demand	REER	Import tariffs
Ordinary imports	1			
Domestic demand	0.94	1		
REER	0.07	-0.13	1	
Import tariffs	-0.9	-0.86	-0.31	1

	Imports for proces-sing	Domestic demand	REER	Import tariffs
Imports for processing	1			
Domestic demand	0.96	1		
REER	0.1	-0.13	1	
Import tariffs	-0.95	-0.86	-0.31	1

Table 3 Augmented Dickey-Fuller test of unit roots

Series	Det. term	Lagged differences	Test stat.
Processed exports	constant, trend	4	-0.71
D_processed exports	constant	2	-10.74***
Ordinary exports	constant, trend	2	-1.35
D_ordinary exports	constant	1	-11.47***
Imports for processing	constant, trend	4	-1.49
D_imports for processing	constant	2	-10.87***
Ordinary imports	constant, trend	13	-1.94
D_ordinary imports	constant	12	-3.54***
World imports	constant, trend	8	-2.79
D_world imports	constant	7	-3.78***
Domestic demand	constant, trend	4	0.12
D_domestic demand	constant	7	-2.23
REER	constant, trend	1	-2.55
D_REER	constant	0	-8.80***
capacity utilization	constant	1	-5.45***
D_capacity utilization	constant	3	-8.08***
FDI	constant	0	-1.99
D_FDI	constant	5	-1.94

* indicates significance at 10% level, ** at 5% level and *** at 1% level

Table 4 Unrestricted cointegration rank test results (Trace test)

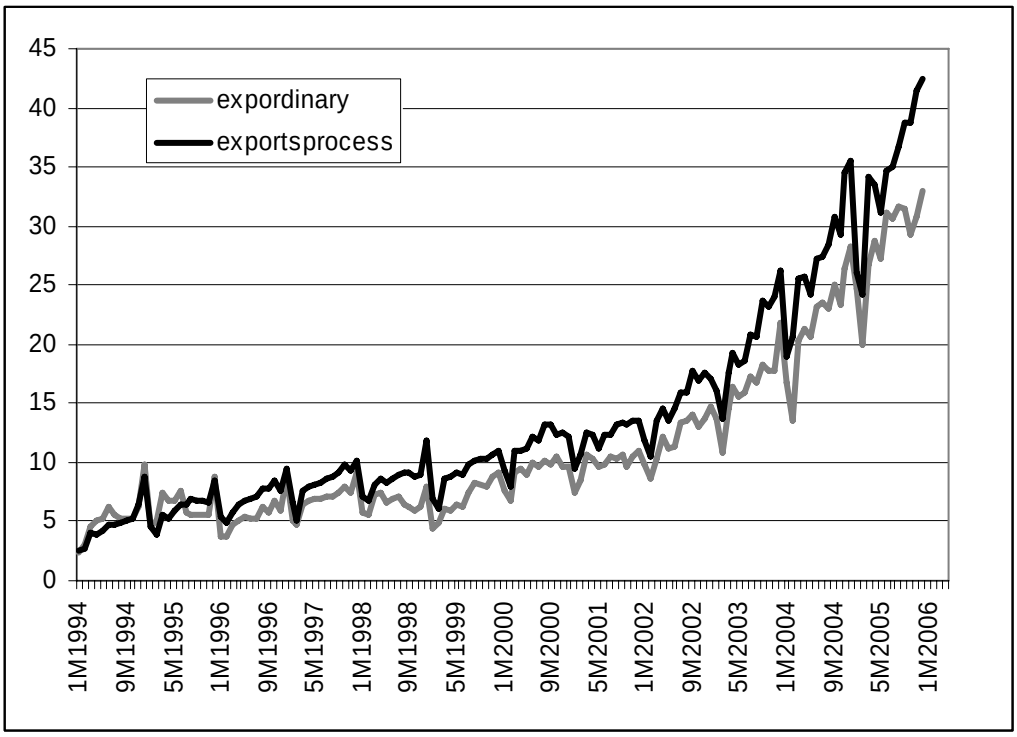
Unrestricted cointegration rank test results (Trace test) for 1994–2005

Processed exports, REER and world imports		
	λ_{trace} -statistic	10% critical value
H0: r=0	42.06*	39.76
H0: r≤1	18.06	23.34
H0: r≤2	3.55	10.67
Ordinary exports, REER and world imports		
	λ_{trace} -statistic	10% critical value
H0: r=0	41.46*	39.76
H0: r≤1	18.41	23.34
H0: r≤2	4.24	10.67
Imports for processing, REER, import tariffs and domestic demand		
	λ_{trace} -statistic	10% critical value
H0: r=0	71.51***	60.09
H0: r≤1	36.31	39.76
H0: r≤2	13.40	23.34
H0: r≤3	3.95	10.67
Ordinary imports, REER, import tariffs and domestic demand		
	λ_{trace} -statistic	10% critical value
H0: r=0	70.93***	60.09
H0: r≤1	28.79	39.76
H0: r≤2	15.51	23.34
H0: r≤3	6.28	10.67

* Indicates significance at 10% level, ** at 5% level and *** at 1% level.

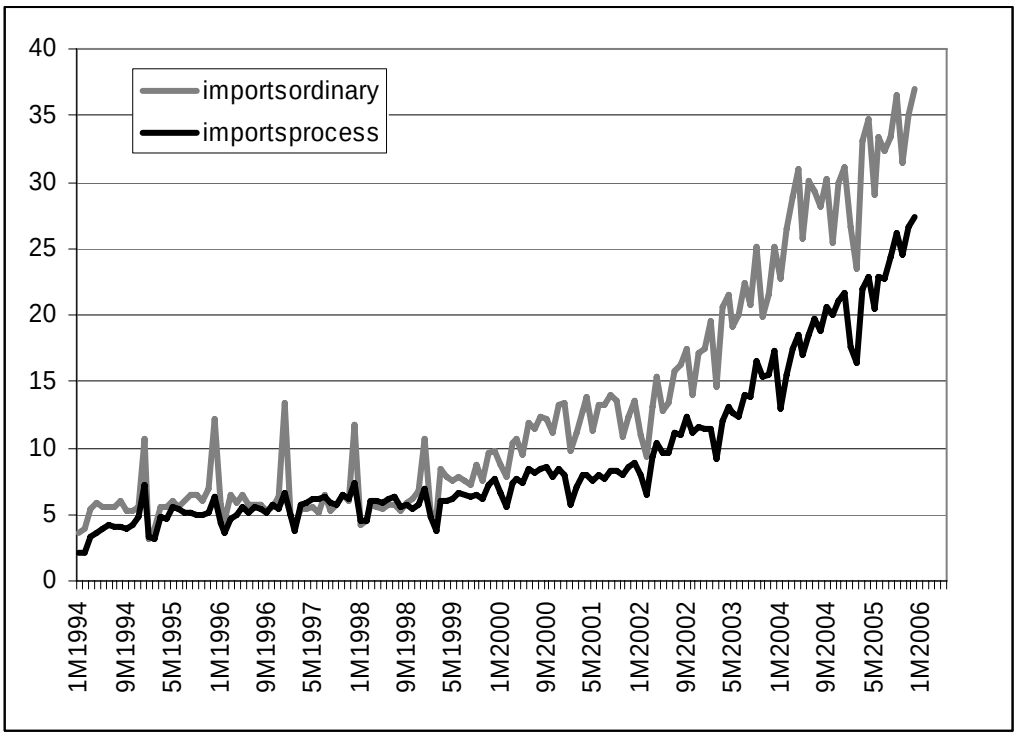
We have used a Johansen cointegration test with the option intercept and trend in CE – no trend in VAR.

Chart 1 Ordinary and processed exports, USD billion



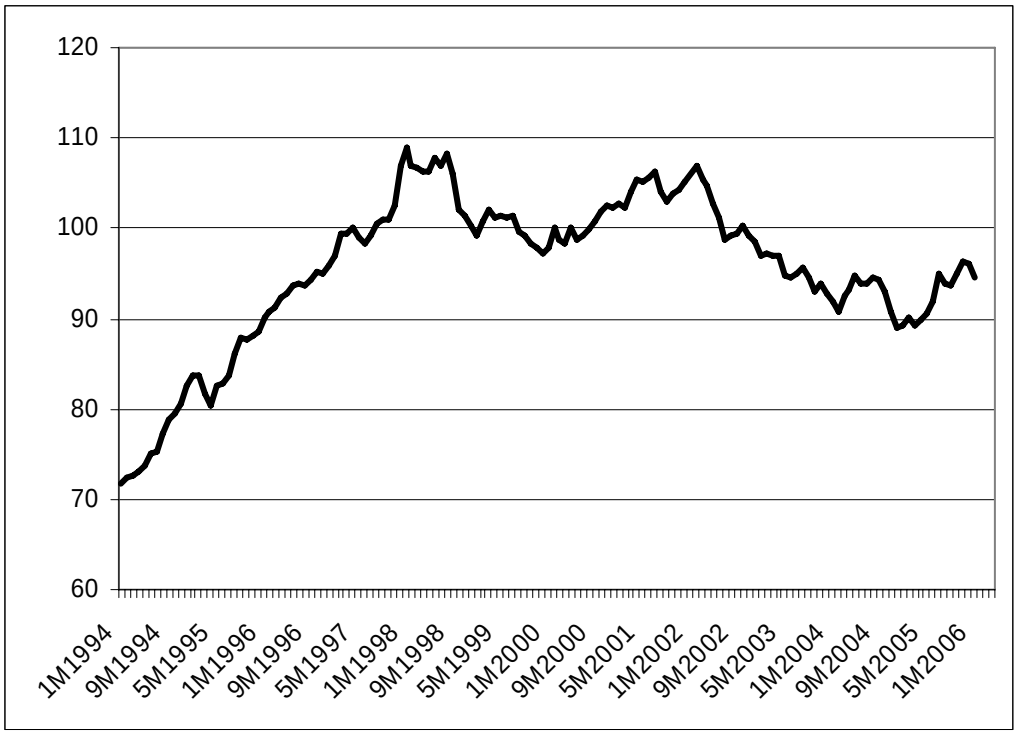
Source: CEIC.

Chart 2 Ordinary imports and imports for processing, USD billion



Source: CEIC.

Chart 3 Real effective exchange rate of China



Source: IFS.

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