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Abstract

China's trade surplus remains huge. Researchers have reported that China's exports decimate manufacturing job abroad and stoke protectionist pressures. China's surplus is concentrated in the electronics sector. Much of the value-added of China's exports of smartphones, tablet computers, and consumer electronics goods comes from processors, sensors, and other parts and components (p&c) produced in Taiwan, South Korea, Japan, and the Association of Southeast Asian Nations (ASEAN). This paper finds that exchange rates in countries supplying p&c are crucial for understanding China's electronics exports. A concerted appreciation of East Asian currencies is needed to rebalance the region's exports. However, because of underdeveloped financial markets, the U.S. dollar remains the most important currency in the currency baskets of many East Asian economies. Countries resist appreciation against the dollar to maintain competitiveness vis-à-vis neighboring economies. This paper considers ways to overcome this coordination failure and develop stronger consumption-oriented economies in the region.

Keywords: Global value chains, Exchange rate policy, East Asia
JEL classification: F14, F23, F42

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1. Introduction

Acemoglu, Autor, Dorn, Hanson, and Price (2014) observed that U.S. manufacturing jobs losses after China joined the World Trade Organization (WTO) in 2001 have been "stunning," amounting to 33 percent of total U.S. manufacturing jobs. Measuring the direct impact of imports from China on U.S. industries and indirect effects from input-output linkages and drops in aggregate demand, they found that competition with China's imports caused more than 2.4 million job losses between 1999 and 2011. Autor, Dorn, and Hansen (2013) reported that job losses in the U.S. following China's WTO Accession in 2001 occurred in sectors most exposed to competition from China. In addition, they found that these job losses were not offset by gains in other sectors. Pierce and Schott (2016) reported that the sharp drop in U.S. manufacturing employment after 2000 was linked to the surge in imports from China after the U.S. granting Permanent Normal Trade Relations to China in 2000 and China joined the WTO in 2001.

The resulting dislocation is feeding protectionism. Che *et al.* (2016) reported that counties in the U.S. that face more competition from China are far likelier to support protectionist politicians. Autor, Dorn, Hanson and Majlesi (2016) found that U.S. congressional districts that are more exposed to imports from China tended to replace moderate representatives with more extreme candidates from either party. Anger among those harmed by foreign competition is evident by Britain's vote to exit the European Union (EU) and by the rise of populist politicians in the US and the EU. In Britain, Colantone and Stanig (2016) found that British regions that are exposed to Chinese import competition tended to vote to leave the EU. In the US every major candidate for president in 2016 has espoused protectionism, including tariff walls against China. Thus import competition from China is threatening free trade.

Before joining the WTO, China's exports were largely labor-intensive goods such as toys and textiles. After 2001, however, China's exports of electronics goods accelerated. China's WTO accession gave foreign investors confidence to shift production to China, and intricate production networks developed. These networks became more and more centered on China as the final production point for electronics exports.

Figure 1 shows China's exports of final electronics goods (FEG) and those of the world's next three leading FEG exporters. FEG include computers, telecommunications equipment, and consumer electronics goods.[2] After 2001 China became the leading exporter, and by 2014 the value of China's FEG exports exceeded the value of FEG exports from the next 16 leading FEG exporters combined. Since 2010, more than 80 percent of China's merchandise trade surplus has arisen from FEG trade, and in all but one year since 2010 China has had the largest overall merchandise trade surplus in the world.[3] China's surplus with the U.S. is particularly large, having increased monotonically (except in 2009) from $83 billion in 2001 to $367 billion in 2015. This surplus is also concentrated in electronics goods. Would an appreciation of the renminbi, as many demand, affect China's FEG exports?

The answer is complicated because China's electronics exports contain value added from East Asian supply chain countries. Exchange rates in these countries should thus influence FEG exports.

In previous work Ahmed (2009) developed a formal theoretical model to explain China's processed exports. Processed exports are final goods produced using inputs that are imported duty free. This contrasts with ordinary exports which do not have this special customs status. Ahmed posited that processed exports are produced using parts and components imported from

[2] Final electronic goods correspond to the HS classification numbers 8469-73, 8517-22, 8525-39, 8543-48.
[3] These data come from the CEPII-CHELEM database.

Asian supply chain countries. He then showed that appreciations of either the renminbi or the currencies in Asian supply chain countries would cause processed exports to fall.

Ahmed (2009) also used quarterly data and an autoregressive distributed lag model to explain China's exports over the 1996Q1 – 2009Q2 period. He found that a 10 percent appreciation of the CPI-deflated renminbi relative to non-Asian countries reduces processed exports by 17 percent and that a 10 percent appreciation relative to Asian supply chain countries increases China's processed exports by 15 percent. These results imply that an appreciation throughout the supply chain would have a much larger effect on China's processed exports than an appreciation of the renminbi alone.

Thorbecke (2016) found that exchange rates in supply chain countries affected processed exports. Using dynamic ordinary least squares (DOLS) and quarterly data over the 1993q3-2014Q4 period, he reported that a 10 percent appreciation of the CPI-deflated renminbi real effective exchange rate would reduce processed exports by 21 percent and that a 10 percent appreciation of real effective exchange rates in supply chain countries would reduce processed exports by 24 percent. He also found income elasticities of 1.9.

Cheung, Chinn, and Qian (2012) used the CPI-deflated real effective exchange rate and DOLS estimation over the 1994Q3-2010Q4 period to estimate export elasticities. They found that a 10 percent RMB appreciation would reduce processed exports by between 9 and 12 percent and ordinary exports by between 13 and 19 percent. They also reported that income elasticities exceed unity for processed exports but are ambiguous for ordinary exports.

Recently, as Kang and Liao (2016) documented, processed exports have fallen steadily as a share of China's overall exports. In 1999, processed exports equaled 57 percent of total exports. By 2015 this ratio had dropped to 35 percent and during the first four months of 2016 was below 33 percent. More and more of China's exports, including electronics goods such as smartphones, are shipped as "ordinary" exports instead of processed exports.

This paper thus eschews the traditional categories of ordinary and processed exports that Ahmed (2009), Cheung, Chinn, and Qian (2012), Thorbecke (2016) and others have investigated and focuses instead on China's final electronics exports. The results indicate that FEG exports are especially sensitive to exchange rates in supply chain countries and less responsive to renminbi changes. Since China's surplus is now concentrated in electronics goods, these results imply that renminbi appreciations unaccompanied by appreciations in Asian supply chain countries may not correct China's surplus.

The next section discusses the data and methodology. Section 3 presents the results. Section 4 discusses how East Asia can alter its export-oriented growth model and develop a stronger consumption driven economy. Section 5 concludes.

2. Data and Methodology

Exports can be modeled as a function of the real exchange rate and real GDP:

$$ex_t = \alpha_{10} + \alpha_{11}\ rer_t + \alpha_{12}\, y_t{}^* + \varepsilon_t \qquad (1)$$

where ex_t represents real exports, rer_t represents the real exchange rate, and $y_t{}^*$ represents real GDP in the importing country.

For China's FEG exports, it is necessary to take account of the fact that their price competitiveness should also depend on exchange rates in the countries providing electronic parts and components. To do this we can construct a weighted average of exchange rates in supply chain countries. Since 2000, 93 percent of China's imports of electronic parts and components (ep&c) on average have come from Taiwan, South Korea, Malaysia, Japan, Singapore, the

Philippines, the U.S., Thailand, and Germany. [4] Figure 2 shows how the shares from these economies have evolved over time. As discussed below, exchange rates in these countries are used to construct a weighted exchange rate in supply chain economies.

For exports, panel data on China's final electronics exports to leading importers since China joined the WTO are employed. The leading importers over this period are: Australia, Brazil, Canada, France, Germany, Hungary, India, Indonesia, Italy, Japan, Malaysia, Mexico, Netherlands, Poland, Singapore, South Korea, Spain, Taiwan, Thailand, and the United States. Countries that imported small quantities over part of this period are excluded because they can have very large percentage changes from year to year due to idiosyncratic factors such as one new importer setting up a business rather than due to the macroeconomic variables in equation (1). These very large changes arising from idiosyncratic factors can produce unreliable results.

Final electronics goods are defined to include exports of computers, telecommunications equipment, and consumer electronics. These data are measured in U.S. dollars and obtained from the CEPII-CHELEM database. The lion's share of these exports falls in the categories of computers and telecommunications equipment. Since these data are measured in U.S. dollars and since China's exports of FEG represent imports by countries such as the U.S., these data are deflated using U.S. import price deflators. The deflator used is a weighted average of U.S. import price deflators for computers and for telecommunications equipment, where the weights change each year depending on the shares of computer and telecommunications equipment in exports. The deflator data come from the U.S. Bureau of Labor Statistics. [5]

Data on the bilateral real exchange rates between China and the importing countries and real GDP in the importing countries come from the CEPII-CHELEM database. The real

[4] Electronic parts and components come from the HS classification numbers 8540, 8541, and 8542.
[5] The website for the Bureau of Labor Statistics is www.bls.gov.

exchange rate variable measures the units of consumer goods in the exporting country needed to buy a unit of consumer goods in the importing country (see Bénassy-Quéré, Fontagné, and Lahrèche-Révil, 2001). An increase in the exchange rate represents an appreciation of the renminbi. The real GDP variable is measured in U.S. dollars.

Data on weighted bilateral exchange rates between the leading suppliers of electronic parts and components to China and the countries purchasing final electronics goods from China can be calculated using the formula:

$$wrer_{j,t} = \sum_{i} w_{i,t} * rer_{i,j,t} \, . \qquad (2)$$

where $wrer_{j,t}$ is the weighted exchange rate between the nine economies supplying electronic components to China and country *j* purchasing final electronic goods from China at time *t*, $w_{i,t}$ is the value of electronic components exported from supply chain economy *i* to China divided by the value of electronic components exported from all nine supply chain economies to China at time *t*, and $rer_{i,j,t}$ is the bilateral real exchange rate between supply chain economy *i* and country *j* purchasing FEG from China. An increase in $wrer_{j,t}$ represents an appreciation in supply chain countries relative to the country purchasing the final goods.

To specify the econometric model a battery of panel unit root tests and Kao residual cointegration tests are performed. They indicate, unsurprisingly, that there is a positive trend term for FEG exports. They also point to cointegrating relationships between the variables. Panel dynamic ordinary least squares (DOLS), a technique for estimating cointegrating relations, is thus employed.

The estimated model takes the form:

$$FEG_{j,t} = \beta_0 + \beta_1 wrer_{j,t} + \beta_2 rmb_{j,t} + \beta_3 y_{j,t}{}^{*} + \sum_{k=-p}^{p} \alpha_{1,k} \Delta wrer_{j,t-k} + \sum_{k=-p}^{p} \alpha_{2,k} \Delta rmb_{j,t-k} \qquad (3)$$

$$+ \sum_{k=-p}^{p} \alpha_{3,k} \Delta y_{j,t-k}{}^{*} + u_{i,j,t},$$

$$t = 1, \cdots, T; \qquad j = 1, \cdots, N.$$

Here $FEG_{j,t}$ represents final electronics goods exports from China to country *j*, $wrer_{j,t}$ represents weighted exchange rates between the countries providing electronic parts and components to China and country *j* importing final electronics goods from China, $rmb_{j,t}$ represents the bilateral real exchange rate between China and importing country *j*, and $y_{j,t}*$ represents real GDP in country *j*. Country *j* fixed effects are always included in the estimation and linear trends are sometimes included. Because of the strong upward trend in FEG exports from China, the focus is on results with a trend term included. The Mark and Sul (1999) approach is used to allow for heterogeneity in the long run variances. The number of lags and leads are determined for each cross section by the Schwarz Information Criterion.

Following Kang and Liao (2016), the estimation begins in 2002. As they noted, China underwent a structural shift around this time that was associated with its WTO accession. The data on FEG exports are available from the CEPII-CHELEM database until 2014. The sample period thus extends from 2002 to 2014.

3. Results

Table 1 presents the results. The preferred specification is in column (1). This includes both exchange rate variables, real GDP in the importing countries, country fixed effects, and linear time trends.

The results in column (1) indicate that there is a strong relationship between exchange rates in supply chain countries and China's electronics exports. A 10 percent appreciation of the weighted exchange rate in supply chain countries would cause final electronics goods exports from China to fall by 14.5 percent. The coefficient is significant at the one percent level. In every other specification in Table 1 an appreciation of $wrer$ is also associated with a large decrease in FEG and the coefficient is always significant at the one percent level.

The results in column (1) point to a weaker relationship between the renminbi and FEG exports. A 10 percent appreciation of the renminbi would cause final electronics goods exports from China to fall by 7.6 percent. The coefficient is significant at the ten percent level. In one other specification in Table 1 an appreciation of the RMB is associated with a decrease in FEG and in two specifications an appreciation of the RMB is associated with increases in FEG.

The coefficient on GDP in the importing countries is positive in every specification and statistically significant in every case except for column (1). For the specification in column (1) there is a lot of multicollinearity between GDP, the time trend, and the two exchange rate variables. This might cloud inference. The results in column (2) and (3) point to income elasticities of approximately unity.

Table 2 presents results separately for the two main categories of final electronics goods, telephones and computers. The preferred specification including all three variables is presented in column (1) for telephones and in column (4) for computers. Results are presented for specifications including time trends in the other columns, and results without trends are available on request.

Interestingly, the results in columns (1) and (4) indicate that the exchange rates in supply chain countries matter much more than the renminbi for telephone exports and that the renminbi matters more than exchange rates in supply chain countries for computer exports. In column (1) the results imply that a 10 percent appreciation of *wrer* would cause a 19.5 percent decrease in phone exports. The coefficient on *wrer* is significant at the 1 percent level. In contrast, there is no evidence in column (1) that an appreciation of the renminbi would affect phone exports. In column (4) the results indicate that a 10 percent appreciation of the RMB would cause a 15.3 percent decrease in computer exports. The coefficient on the renminbi is significant at the 1 percent level. The results also indicate that a 10 percent appreciation of *wrer* would cause computer exports to fall by 8.3 percent, but the coefficient on *wrer* is only significant at the 10 percent level. In addition, in every specification the GDP elasticity for telephone exports is higher than the corresponding GDP elasticity for computer exports.

How can we understand these findings? Computers may have become more commoditized than smartphones over the sample period, and thus compared to phones less of the value added of computers may have come from cutting edge parts imported from advanced Asian economies. Some support for this hypothesis comes from Figure 3 that presents price indices for computers and for phones. Figure 3 indicates that computer prices have fallen logarithmically by almost 100 percent over the sample period while telephone prices have fallen logarithmically by less than 40 percent. The collapse in computer prices suggests that computer producers have no pricing power and that these goods have become commoditized. In contrast telephone prices have not collapsed, suggesting that goods such as smartphones still have advanced features that enable producers to maintain some pricing power. These technologically advanced features such as accelerometers or gyroscopes are likely to be produced partly in developed Asian economies such as Japan, South Korea, and Taiwan. This could explain why exchange rates in upstream countries matter more for telephone exports than for computer exports. The higher income elasticities for phones than for computers in Table 2 also suggest that China's telephone exports are higher end products as compared to China's computer exports.

4. Discussion

East Asian countries have been running large trade and current account surpluses (CAS). China's combined surplus in processing and ordinary trade, correcting for "imports" produced in China, equaled $752 billion in 2015. Taiwan's CAS has on average exceeded 10 percent of GDP since 2009. Korea's CAS has been at least 6 percent of GDP since 2013. Singapore's CAS has been at least 17 percent of GDP since 2009. Japan's CAS, though low in 2013 and 2014, jumped to 2.9 percent of GDP in 2015. These surpluses largely arise within intricate production networks centered in East Asia (see, e.g., Thorbecke, 2016). As discussed in Section1, several authors have reported that these massive surpluses in manufacturing trade have decimated employment abroad and fueled extremist policies.

The electronics sector is now the predominant sector within East Asian supply chains, and 80 percent of China's trade surplus arises from trade in final electronics goods. Taiwan, Korea, and other upstream countries ship parts and components to China where they are used to make final electronics goods for re-export. The work above indicates that exchange rates throughout the supply chain exert important effects on these exports.

Figure 4 presents the weighted averages of the real renminbi bilateral exchange rate relative to the 20 countries used in the empirical work and the weighted average of *wrer* relative to the same 20 countries. The weights are determined by the share of final electronic exports going to each of the 20 countries. The figure shows that, while the renminbi has appreciated logarithmically by 50 percent since 2005, weighted exchange rates in supply chain countries have actually depreciated. This occurred despite the fact that East Asian supply chain countries have run large trade and current account surpluses year after year.

Cline (2016) has reported fundamental equilibrium exchange rates for East Asian economies and other countries. He found that, as of April 2016, the Taiwanese and Singapore currencies were undervalued by, respectively, 35 percent and 40 percent relative to the U.S. dollar. He also found that China, Japan, Malaysia, the Philippines, South Korea, and Thailand were undervalued by 10 percent or more with respect to the U.S. dollar. Cline has been reporting these estimates twice a year since 2008, and Chinese and East Asian supply chain currencies have always been undervalued relative to the dollar. Thus a joint appreciation of regional currencies relative to the U.S. dollar would be appropriate.

One factor preventing East Asian currencies from appreciating together against the dollar is that the dollar remains an anchor currency in the region. Schnabl and Spantig (2016) noted that underdeveloped capital markets in China have prevented the renminbi from acting as an anchor currency in the region. High volatility of the Japanese yen against the U.S. dollar has prevented the yen from becoming an anchor currency. Thus the U.S. dollar remains the most important currency in the currency baskets of East Asian economies.

Ogawa and Ito (2002) have shown that focusing on the dollar can produce an inferior equilibrium.[6] In their model countries seek to minimize current account fluctuations. The weights they assign to each currency in their currency basket depend on the weights that neighboring countries adopt. If an important trading partner of country A adopts a dollar peg, for example, then it may be optimal for A to adopt a dollar peg also. In other words, a dollar peg may be a Nash Equilibrium. On the other hand, if A's trading partner adopts a trade-weighted

[6] This paragraph draws on unpublished work that the author did with Dr. Masaru Yoshitomi.

currency basket, then it may be optimal for A to adopt a trade-weighted currency basket also. This would also be a Nash equilibrium. Ogawa and Ito showed that pegging to a basket may be a better Nash equilibrium for East Asia than pegging to the dollar. If, because of inertia or for some other reason one country is unable to break out of a dollar peg, then a coordination failure may occur. If, on the other hand, the country is able to coordinate a managed float with its trading partner, then both countries might have smaller fluctuations in their trade balances. Thus coordination can help overcome inertia in the choice of an exchange rate regime for the region and lead to a superior Nash equilibrium. These arguments strongly suggest the importance of regionally concerted actions on exchange rate policy.

This could happen if East Asian countries adopt regime's characterized by multiple-currency, basket-based reference rates with reasonably wide bands, give greater play to market forces in exchange rate determination, and dialogue extensively about exchange rate policy. The large surpluses that they are running in their current accounts and in regional value chains would then cause their currencies to appreciate together against the U.S. dollar.

A concerted appreciation of East Asian currencies against the U.S. dollar is often hindered because countries compete extensively with each other in the U.S. and other third markets. Individual countries resist appreciation because they do not want to lose price competitiveness relative to their neighbors. If regional monetary authorities could dialogue extensively with each other about monetary policy and respond together to market forces, they might be able to achieve a joint appreciation and thus not lose price competitiveness relative to each other.

A joint appreciation would also increase consumption imports into East Asian countries. Thorbecke (2011) found that currency appreciations in East Asia would raise the purchasing power of consumers in the region and increase their consumption imports. Thus concerted appreciations in the region could help to rebalance trade in East Asia and help workers enjoy more of the fruits of their labors.

One final benefit of a concerted appreciation is that it would help to maintain intra-regional exchange rate stability. Kiyota and Urata (2004) reported that exchange rate stability promotes the flow of FDI in the region. Hayakawa and Kimura (2009) found that exchange rate volatility promotes intra-East Asian trade and especially intermediate goods trade within regional production networks. Schnabl and Spantig (2016) reported that exchange rate volatility reduces growth for ten East Asian countries.

5. Conclusion

China is the leading exporter of final electronics goods, and the value of China's exports of computers, phones, and consumer electronics now exceeds the value of these exports from the next 16 leading exporters combined. More than 80 percent of China's merchandise trade surplus has been due to FEG trade, implying that this industry is key to understanding why China's merchandise trade surplus is the largest in the world year after year.

What drives China's soaring exports in this sector? Standard theory implies that income in importing countries and the renminbi exchange rate are likely explanatory variables. For China's exports of computers, cellphones, and other electronics goods, much of the value added comes from imported parts and components. This implies that exchange rates in supply chain countries could also explain FEG exports.

To test this hypothesis, this paper constructs a weighted exchange rate for the countries supplying electronic parts and components to China. The results indicate that exchange rates in supply chain countries are crucial for understanding China's FEG exports.

In the political arena, each Asian country's currency is considered in isolation. If China has a large surplus, China faces pressure to appreciate (see, e.g., U.S Treasury, 2016). Economically, though, when all East Asian currencies are perennially undervalued relative to the dollar it multiplies Asia's exports and breeds protectionist pressure. In the long run, Asian governments should allow their currencies to appreciate together against the U.S. dollar in response to large trade and current account surpluses. This could happen if the monetary authorities focused on basket-based reference rates rather than nominal exchange rates relative to the U.S. dollar and if they together gave greater play to market forces. If instead of a concerted appreciation some East Asian currencies appreciated against the U.S. dollar while others did not, countries whose currency appreciated would lose competitiveness relative to their Asian neighbors but Asia's burgeoning surplus would not fall and pressures for extremist policies abroad would intensify.

Table 1 Panel Dynamic OLS estimates for China's Final Electronics Goods Exports to 20 Countries

	(1)	(2)	(3)	(4)	(5)	(6)
Weighted Exchange Rates in Supply Chain	-1.45***	-2.10***		-3.38***	-1.89***	
Countries	(0.41)	(0.11)		(0.11)	(0.10)	
Renminbi Exchange	-0.76*		-2.27***	1.82***		0.28*
Rate	(0.45)		(0.11)	(0.09)		(0.15)
GDP in Importing	0.40	1.00**	1.14***	0.76**	2.85***	4.33***
Countries	(0.51)	(0.50)	(0.41)	(0.20)	(0.16)	(0.18)
Fixed Effects Included	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend Included	Yes	Yes	Yes	No	No	No
Adjusted R-squared	0.988	0.987	0.986	0.974	0.942	0.899

Notes: The table presents trade elasticities for China's final electronics goods (FEG) exports to 20 leading importers over the 2002-2014 period. FEG includes computers, telecommunications equipment, and consumer electronics goods. Weighted exchange rates in supply chain countries represent weighted bilateral real exchange rates between countries supplying inputs into China's FEG and countries importing the final goods, with weights calculated based on the share of electronic parts and components coming from each of the supply chain countries. The supply chain economies are, in order of importance in 2014, Taiwan, South Korea, Malaysia, Japan, Singapore, Philippines, U.S., Thailand, and Germany. The renminbi exchange rate represents the real bilateral exchange rates between China and each of the 20 importing countries. GDP in importing countries represents real GDP in each of these countries. Mark and Sul (1999) dynamic ordinary least squares estimates are reported. The number of lags and leads for each cross section are determined based on the Schwarz Information Criterion. Standard errors are calculated using the Bartlett Kernel and the Newey-West fixed bandwidth method.
*** (**) [*] denotes significance at the 1% (5%) [10%] level.

Table 2 Panel Dynamic OLS estimates for China's Telephone Exports [columns (1)-(3)] and Computer Exports [columns (4)-(6)] to 20 Countries

	(1)	(2)	(3)	(4)	(5)	(6)
Weighted Exchange Rates in Supply Chain	-1.95***	-2.02***		-0.83*	-2.14***	
Countries	(0.47)	(0.12)		(0.48)	(0.14)	
Renminbi Exchange	-0.18		-2.12***	-1.53***		-2.34***
Rate	(0.50)		(0.13)	(0.52)		(0.13)
GDP in Importing	0.76	1.90***	1.83***	0.51	1.21**	1.08***
Countries	(0.58)	(0.54)	(0.52)	(0.59)	(0.59)	(0.54)
Fixed Effects Included	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend Included	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.981	0.978	0.976	0.983	0.981	0.981

Notes: The table presents trade elasticities for China's telephone and computer exports to 20 leading importers over the 2002-2014 period. Weighted exchange rates in supply chain countries represent weighted bilateral real exchange rates between countries supplying inputs into China's telephones and computers and countries importing the final goods, with weights calculated based on the share of electronic parts and components coming from each of the supply chain countries. The supply chain economies are, in order of importance in 2014, Taiwan, South Korea, Malaysia, Japan, Singapore, Philippines, U.S., Thailand, and Germany. The renminbi exchange rate represents the real bilateral exchange rates between China and each of the 20 importing countries. GDP in importing countries represents real GDP in each of these countries. Mark and Sul (1999) dynamic ordinary least squares estimates are reported. The number of lags and leads for each cross section are determined based on the Schwarz Information Criterion. Standard errors are calculated using the Bartlett Kernel and the Newey-West fixed bandwidth method. *** (**) [*] denotes significance at the 1% (5%) [10%] level.

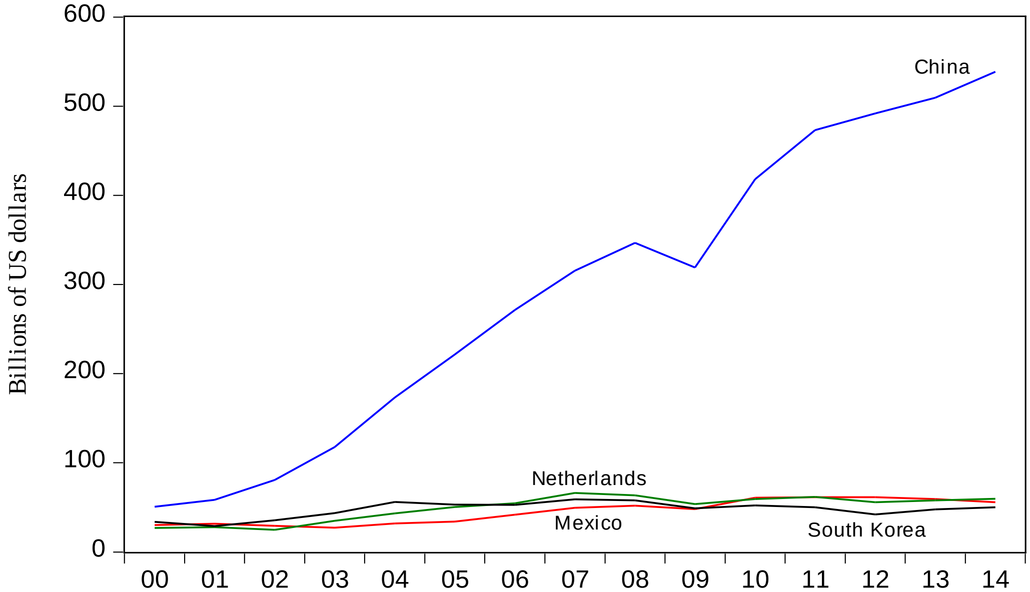

Fig. 1. Final electronics goods exports from the world's four leading exporters in 2014.
Note: Final electronics goods include computers, telephones, and consumer electronics.
Source: CEPII-CHELEM database.

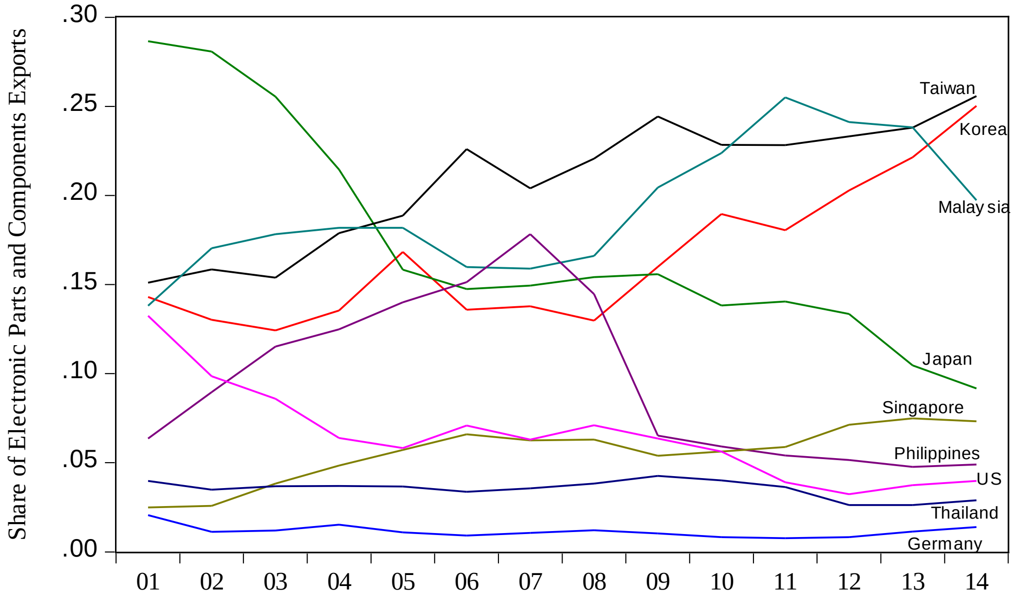

Fig. 2. Share of electronic parts and components exports to China from the nine leading suppliers.
Source: CEPII-CHELEM database.

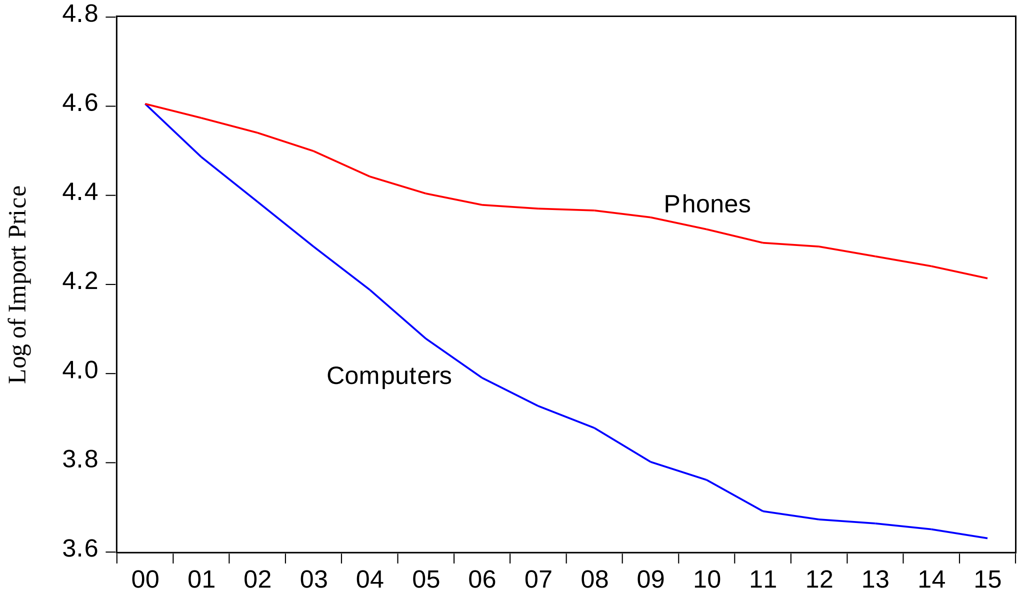

Fig. 3. Price indices for computer equipment and telephone equipment.
Note: The price index for computer equipment is for the HS classification number 8471 and the price index for telephone equipment is for the HS classification number 8517.
Source: Bureau of Labor Statistics.

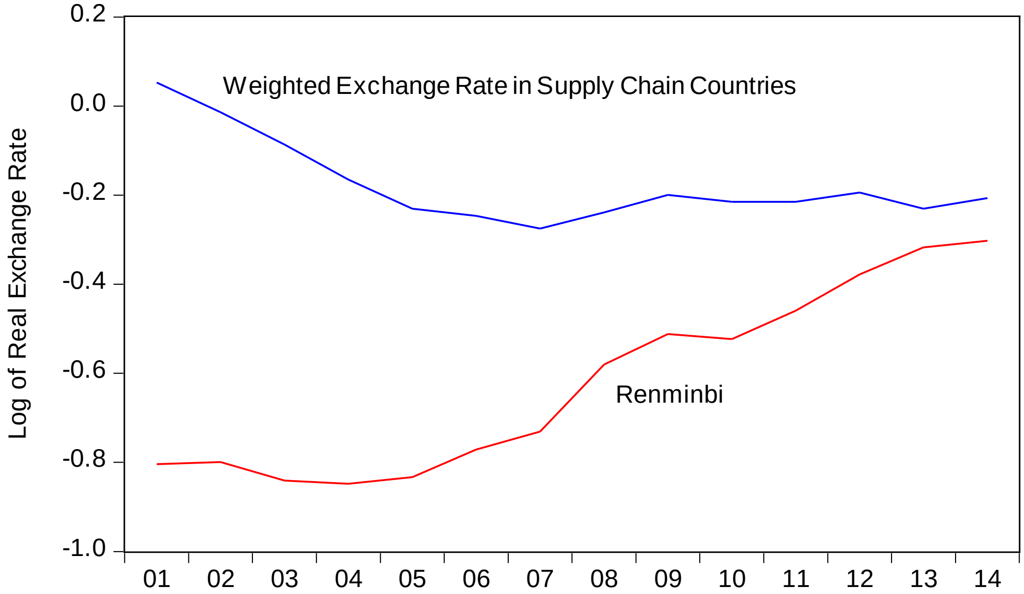

Fig. 4. Weighted Averages of the Bilateral RMB Exchange Rate and The Exchange Rate in Supply Chain Countries with 20 Importing Countries.

Note: These represent weighted average values across the 20 countries used in the empirical work of the real renminbi bilateral exchange rate and the real exchange rate in supply chain countries. The weights are determined by the share of final electronics exports going to each of the 20 countries.

Source: CEPII-CHELEM database and calculations by the author.

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