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PACIFIC ECONOMIC PAPERS
No. 356, 2006

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2006

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Pacific Economic Papers are published under the direction of the Editorial Committee of the Australia–Japan Research Centre. Members of the Editorial Committee are:

Papers submitted for publication in this series are subject to double-blind external review by two referees.

The Australia–Japan Research Centre is part of the Crawford School of Economics and Government, The Australian National University, Canberra.

ISSN 0 728 8409
ISBN 0 86413 309 X

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RMB Exchange Rate and Local Currency Price Stability: The Case of China and ASEAN+3

This paper uses Chinese and ASEAN+3 industry panel data to measure variations in mark-up adjustment behaviour that is associated with the exchange rate changes across export destination markets. Exports that are substitutes for local products exhibit a high degree of mark-up adjustment, which has the effect of stabilising prices in export destination countries. There is evidence of this behaviour in certain export products to China where the Chinese Government provides subsidies. When mark-up adjustment behaviour exists, the short-term dynamic mark-up adjustments are consistent with the long-term pricing behaviour in source countries.

Introduction

RMB appreciation has been a focus in international economic policy discussion since 2001. In December 2001, China formally joined the World Trade Organisation (WTO) and needs to fulfil the commitments it undertook with the WTO. In February 2002 the Minister of Finance, Japan raised the RMB appreciation issue in the OECD annual ministerial conference with a view to easing the pressure on international imbalances; in June 2003, Federal Reserve Chairman Alan Greenspan stated in public that China should increase its foreign exchange flexibility to resolve the huge US–China trade deficit. Academic views, however, differ on whether the RMB should be appreciated or not depending on the perspective taken: for example economic growth, employment, wages, foreign reserve management, trade relationships with the United States and Japan, economic diplomacy and politics. This paper addresses the issue of RMB appreciation from a different angle: the importance in regional economic cooperation and integration by examining the currency and trade interaction among the member countries in the region. In particular, it investigates the impact of changes in the RMB exchange rate on the pricing behaviour of exporters within ASEAN+3 countries. The main question this paper attempts to answer is how exports in ASEAN+3 adjust their mark-ups when observing the changes of RMB exchange rate during the sample period.

This paper adds to the empirical literature on pricing behaviour when exchange rates change by examining export mark-up adjustments in both China's export to ASEAN+2 and ASEAN+2's exports to China using data directly collected from Chinese statistical sources.

The data sets provide new and interesting information on the pattern of local currency price stability since the unit value panels vary by source and destination countries as well as different industries. We can therefore make a number of interesting international comparisons of the pricing behaviour. Additionally, in late 2004 Eichengreen and others analysed the impact of China's exports on the trade of other Asian countries without considering currency rates. This paper is the first attempt to link the currency rate to trade performance directly. The answer to this question is relevant to both policy makers and practitioners.

China and ASEAN+2 trade relationship

The ASEAN+2 economies have been China's major trading partners since 1990, particularly after 1995. Taking ASEAN countries from 1995 to 2002 as an example, the bilateral trade volume has increased annually at the rate of 19.1 percent. This high growth rate has been maintained even though China's global position has moved in the opposite direction with the impact of global economic depression and the September 11 disaster. In 2002 the bilateral trade volume has set a historical record reaching US$54.8 billion with the growth rate as high as 31.8 percent. According to the statistics, ASEAN has come to be China's fifth largest trade partner, the bilateral trade volume accounts for 9.2 percent of China's entire foreign trade volume, only next to Japan, the United States, the EU and the Hong Kong Special Autonomous Region (SAR) (Table 1). Noticeably, ASEAN has been more

Table 1 China's top ten trade partners: 2003

Rank	Country/ region	Volume (exports+imports) (billions of US dollars)	Percentage of total
	Total	851.21	100
1	Japan	133.57	15.7
2	US	126.33	14.8
3	EU	125.22	14.7
4	HK, China	87.41	10.3
5	ASEAN	78.25	9.2
6	Korea	63.23	7.4
7	Taiwan Province	58.37	6.9
8	Russia	15.76	1.9
9	Australia	13.56	1.6
10	Canada	10.01	1.2

Note: Ranking by value of trade.
Source: Ministry of Commerce, People's Republic of China

important as an import source for China than as an export market. In 2003, while China's exports to ASEAN account for 7.1 percent of China's total exports, China's imports from ASEAN account for 11.5 percent of China's total imports. China's imports from ASEAN are close to its imports from the EU or America. (Table 2 and Table 3). To further examine the significance of trade relationship between China and ASEAN countries, Tables 4 and 5 present the trade values in dollars and percentage changes between China and each ASEAN+2 country during the sample period.

Table 2 China's export markets (by continent and region): 2003

Continent/region	Volume (billions US dollars)	Percentage of total
China's Total Export	438.37	100
Asia	222.61	50.8
ASEAN	30.93	7.1
Middle East	16.49	3.8
6 Gulf countries	8.09	1.8
Europe	88.27	16.5
EU	72.15	16.5
America	110.02	25.1
North America	98.14	22.4
Latin America	11.88	2.7
Australia	7.29	1.7
Africa	10.18	2.3

Source: Ministry of Commerce, People's Republic of China.

Table 3 China's import sources (by continent and region): 2003

Continent/region	Volume(billions US dollars)	Percentage of total
Total	412.84	100
Asia	272.93	66.1
ASEAN	47.33	11.5
Middle East	15.14	3.7
Europe	69.74	16.9
EU	53.06	12.9
America	53.19	12.9
North America	38.26	9.3
Australia	8.60	2.1
Africa	8.36	2

Source: Ministry of Commerce, People's Republic of China.

Table 4 China's exports to ASEAN+2 and ranking from 1990 to 2002

Country/region	Volume (US dollars billions)			Percentage of China's total trade By volume		
Total	1991	1997	2002	1991	1997	2002
Brunei	1076	3331	2106	0.015%	0.018%	0.006%
Cambodia	217	57,009	25,156	0.003%	0.312%	0.077%
Laos	1115	2293	543	0.016%	0.013%	0.002%
Indonesia	48,114	184,061	342,691	0.670%	1.007%	1.053%
Japan	1,021,911	3,181,982	4,843,746	14.224%	17.417%	14.878%
Malaysia	52,789	191,993	497,456	0.735%	1.051%	1.528%
Myanmar	28,617	57,009	72,482	0.398%	0.312%	0.223%
Philippines	25,349	133,911	204,232	0.353%	0.733%	0.627%
Singapore	201,419	431,905	696,567	2.804%	2.364%	2.140%
South Korea	N/A	911,627	1,549,700	N/A	4.990%	4.760%
Thailand	84,781	150,030	295,841	1.180%	0.821%	0.909%
Vietnam	2140	107,854	214,866	0.030%	0.590%	0.660%

Note: 'N/A' denotes not available.
Source: China Foreign Economic and Trade Statistic Yearbook from 1991 to 2003.

Table 5 China's imports from ASEAN+2 and the ranks from 1990 to 2002

Country/region	Volume (billions of US dollars)			Percentage of China's total trade Volume		
Total	1991	1997	2002	1991	1997	2002
Brunei	234	N/A	2418	0.004%	N/A	0.082%
Cambodia	48	4501	2455	0.001%	0.032%	0.008%
Laos	222	582	965	0.003%	0.004%	0.003%
Indonesia	130,334	267,358	450,141	2.043%	1.878%	1.525%
Japan	1,003,155	2,899,298	5,346,793	15.726%	20.366%	18.112%
Malaysia	80,400	249,538	929,599	1.260%	1.753%	3.149%
Myanmar	10,592	7341	13,689	0.166%	0.052%	0.046%
Philippines	13,048	32,707	32,1719	0.296%	0.230%	1.090%
Singapore	201,419	431,905	696,567	2.804%	2.364%	2.140%
South Korea	N/A	1,492,920	2,857,417	N/A	10.487%	9.679%
Thailand	42,166	201,446	560,226	0.661%	1.415%	1.898%
Vietnam	23	35,710	111,528	0.0004%	0.251%	0.378%

Note: 'N/A ' denotes not available.
Sources: China Foreign Economic and Trade Statistics Yearbook from 1991 to 2003.

Trade relations between ASEAN+3 countries is a crucial factor that China has to consider when formulating its trade policy. According to Professor Ba Shusong from the Department of Finance of the State Council of the People's Republic of China, the Chinese Government decides on the exchange rate adjustment according to the trade imbalances among its major trade partners. For those industries that may be exposed to negative impacts from the adjustments, the government will treat it in one of two different ways: if the industry falls into the category the government intends not to develop in the future, it will allow the industry to fade away through market processes; if the opposite is the case, the government will subsidise the industry in various ways to maintain and help it grow in the future. Before the adjustment is implemented, the government will organise a nation-wide conference to explain to the firms that will be affected most directly, the reasons, consequences and responses to such an adjustment. In most cases the domestic firms will follow the advice from the government, even though a small number of joint ventures and wholly foreign-owned firms may not fully follow the recommended measures. The latter situation leads to a policy adjustment that is less than fully implemented or effective. Thus, whether and how Chinese exporters actually respond to changes in the RMB exchange rate is an interesting and important question to explore.

Analytic Framework

Deciding on the optimal response in a firm's export price to changes in currency values depends on a variety of factors. These factors operate through two channels: through the impact that exchange rates have on marginal cost and through the impact exchange rates have on mark-ups of price over marginal cost. Export destination-specific adjustment of mark-ups in response to exchange rate changes has been referred to in the literature as 'pricing to market' (Krugman 1987). Local currency price stability is defined by Knetter (1993) in the following terms: 'sellers reduce mark-ups to buyers whose currencies have depreciated against the seller, thereby stabilising prices in the buyer's currency relative to a constant mark-up strategy'.[1]

Using panel data, this paper examines firms' pricing behaviour in relation to the variation of the currency value. Both China's imports from and exports to ASEAN+2 countries are examined. The rest of the paper is arranged as follows: first, the model specification, data description and analysis are explained; second, model estimation and analysis is set out; third, where 'pricing to market' exists, the dynamic pattern of adjustment is further investigated using an error correction model; and fourth, the asymmetry of 'pricing to market' behaviour is addressed. Finally a conclusion and suggestions for further research end the paper.

Model Specification and Data Description

Model specification

The prototype model (equation 1) in this paper follows mainly what Knetter (1989, 1991 and 1993) has introduced in his paper.

$$\Delta P_{it} = \alpha_t + \beta \Delta E_{it} + \varepsilon_{it} \quad (1)$$

where $i=1,\ldots,N$ and $t,\ldots,T$ indicate the individual destination countries of exports and time – 'year' in this case – respectively, and p is the log of export price, E is the log of the destination-specific exchange rate expressed in terms of units of the buyer's currency per unit of the seller's currency, divided by the destination market price level, the error term ε_{it} is assumed to be independently and identically distributed with mean zero and variance σ^2.

$$\Delta X_{it} = \alpha + \beta \Delta E_{it} + \delta i + \nu_t + \varepsilon_{it} \quad (2)$$

$$\Delta M_{it} = \alpha + \beta \Delta E_{it} + \delta i + \nu_t + \varepsilon_{it} \quad (3)$$

The adjusted model is specified in equations (2) and (3) where ΔX_{it}, ΔM_{it} are the mark-ups of export firms in China and ASEAN+2 countries respectively; ΔE_{it} is the real exchange rate, δi is fixed effects (FE) when country-specific effects are considered, ν_t is the random effects (RE) when both country and time variations are taken into account, ε_{it} follows the usual statistic regularities.

In equations (2) and (3) the exchange rate channels of 'pricing to market' are explicitly modelled. Following Gagnon and Knetter (1992) and Knetter (1989, 1991, 1993), marginal costs are considered common to all destination countries but with variations over time. All the common factors that may vary over time but remain constant to all destinations, such as marginal cost, can be accounted for by including a full set of time dummies in the estimation, and they are actually captured by ν_t in the model specification in equations (2) and (3).

The statistical interpretation of β is as follows: a value of zero or near zero implies that the mark-up to a particular destination is unresponsive to fluctuations in the value of the exporter's currency against the buyer's currency. Thus the cost of exchange rate changes will be borne fully by buyers in destination countries. In other words, there will be a full pass-through effect. A negative value of β implies that the mark-up adjustment is related to the stable local pricing, or local currency price stability, and a positive value of β implies the

amplification of the effect of destination-specific exchange rate changes on local pricing in units of the buyer's currency.

The data

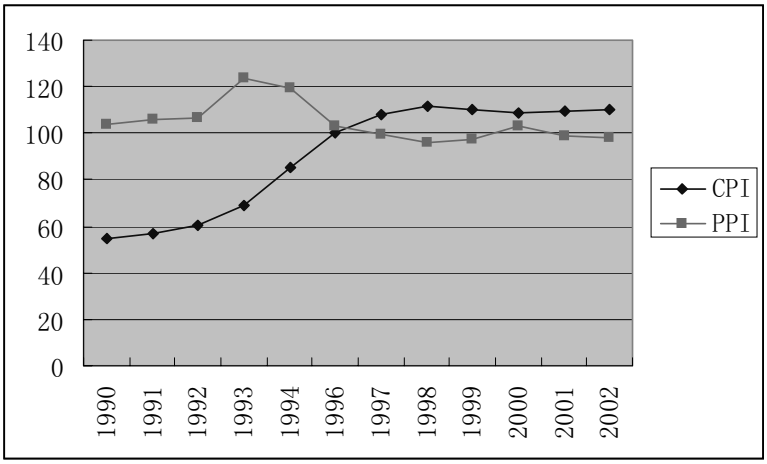
As a measure of export and import prices, we use unit values for selected 4-digit SITC categories within different industries (see the Appendix for product categories of exports and imports). The data sources are China Foreign Economic and Trade Statistic Yearbooks from 1991 to 2003. There are nine source countries: Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, Japan and South Korea. The data are taken from the Almanac of China's Foreign Economic Relations and Trade from 1990–2002.

While the prices used are FOB prices, the products and industries are selected with several factors in mind. We start with all recorded products so that data are randomly chosen. For the purpose of comparison, we choose those products that are shared by all the nine destination countries covering the entire sample period over which China's exports are considered. The same criteria are applied in the case of other ASEAN +2 member countries' exports to China. Eventually, we are left with only five Chinese export products and four Chinese import products that satisfy the conditions. Implementing sample selection in this way implies that sampling over destinations and countries is not random. As a result, caution should be taken in drawing inferences from the results.

The nominal exchange rate is adjusted by dividing by the wholesale price index (WPI) in the destination markets. According to Knetter (1991, 1993), the rationale for this adjustment is that optimal output pricing should be neutral with respect to changes in the nominal exchange rate that corresponds to inflation in the destination market. However, the consumer price index (CPI) has been used in this study because half of the countries do not publish a wholesale price index (according to International Financial Statistics). Only one other study uses the same treatment, that by Marston, (1989)[2] but no justification is provided, so some explanation is necessary here.

In China the components of the CPI are different from those of the WPI, and the WPI usually leads CPI by about one and half years. Figure 1 shows the relationship between the WPI and CPI during the sample period. These data show that the WPI is less volatile than the CPI, with 1996 as a turning point (Zhou and Feng 2005). In 1996 the central government launched 'a soft-landing, anti-inflation' program in order to ease economic overheating at the provincial level by reducing credit for purchasing real estate. This was achieved by issuing administrative orders from the central authorities to the provincial levels. There was a similar episode – 'a soft-landing program' on a smaller scale in 1999. The nature of these soft-landing programs is that the central government sets anti-inflation

Figure 1 China CPI and WPI from 1990 to 2002



Source: China Foreign Economic and Trade Statistics Yearbook , 1991 to 2003.

goals as the major target during the ninth Five-Year Plan Scheme (1996–2000) because of the high price levels prevailing in 1995. The high inflation rate was mainly the result of fast-growing investment in real estate at the provincial level. A side effect of the 'soft-landing program' was that it reduced the variance of WPI as was intended by the central government. Consequently, we see a smaller variance in WPI in this period.

To determine the effect of using CPI instead of WPI, we calculate the standard deviations of the CPI and WPI. They are 22.65 and 8.38 respectively. The nominal exchange rate is the real rate with the addition of the WPI factor. So if we derive the real exchange rate by CPI instead of WPI, and if WPI is more volatile than CPI as is the case for most market-oriented economies where there is less government intervention, the volatility of the exchange rate could partially be the result of the volatility in price levels rather than the exchange rate as such. However, from the calculations we can see the variance of WPI is smaller than that of CPI, so we could safely draw the conclusion that the volatility of the real exchange rate is not likely to be exaggerated by replacing WPI with CPI over the sample period (1990–2002).

However, this is not true when equation (2) is considered. As for China's exports to other ASEAN+2 countries (equation 2), it might be possible that the volatility of exchange rate has been exaggerated by using the local CPI instead of WPI for various export

destination countries. This is because governments in partner countries manage their economies differently, allowing more market-oriented activities compared with Chinese authorities. The WPI data may consequently be more volatile than the CPI data as would be the normal movement pattern of the two variables in the market economies. However, at this stage we are unable to measure the exaggeration accurately with the available data, since countries with both CPI and WPI data in this region are not complete.

The exchange rate data used in this paper are cross rates based on data collected from International Financial Statistics by International Monetary Fund from 1991 to 2003. Most of the currencies in this region are pegged to the US dollar, so the cross rates are derived by comparing two dollar-pegged exchange rates directly. To be more accurate, the exchange rate systems in this region have been described as 'soft pegging', which means that the exchange rate is pegged to the US dollar, but when a economic or political event jeopardises the system, it will be allowed to float for a while. Zhang (2002) describes the soft-pegging system as an essentially 'periodical floating' regime.

One prime example is Singapore's soft-peg exchange rate system. The Singapore dollar exchange rate is managed and set against a trade-weighted basket of currencies of its major trading partners. The trade-weighted Singapore dollar is allowed to float within a target band as the economic environment changes. The Monetary Authority of Singapore keeps the trade-weighted dollar within the band through foreign exchange interventions (Kapur 2005). The policy is in part also designed to help Singapore maintain the 'soft peg' that has been crucial for its export-led strategy of economic development. Singapore's successful maintenance of its soft peg defies the conventional wisdom that soft-pegs are not viable.

China's current exchange rate policy is partially following the path of Singapore's. From Table 1, the variations can be observed on cross rates between China and rest of the ASEAN+3 countries. The other summary statistics for mark-ups and real local currency rates are also presented in Table 1.

Further analysis of data before parametric regression is carried out by plotting the mark-up and real exchange rate pairs for each industry over time and this suggests that the two series are not stationary. Having applied the unit root testing methodology of Phillips and Phillips–Perron[3], we cannot reject the null hypothesis of a unit root in the logarithm of the series. In the light of this analysis, we subsequently consider the first differences for the series in examining the short-run pricing to market effect, while the level regression enables examination of a long-run co-integrating relationship among the relevant time series. The results are presented in Tables 2 and 3 using the fixed effects regression method.

Analysis of the Estimation Results

Tables 2 and 3 present the estimated values of β for each industry.[4] Fixed effects and random effects approaches have both been attempted to estimate equation (2) and (3). The HAUSMAN test is used to decide which one is preferable. The HAUSMAN test statistic is only significant in one out of nine cases, so the fixed effect approach is selected.

Examining the estimated values of β, the evidence suggests that there are important differences in the pricing behaviour both across different industries as well as across different source countries. As for the exports, the coefficient for clothing is negative, and statistically significant at the five percent level, which implies local currency price stability. The coefficients for soybeans, electronic fan, metal grinding; machine, refined petroleum are insignificant at the five percent level. Among them the T-statistics for soybean is –1.61, which is close to 2. If we choose the 10 percent significance level, the coefficient is of significance.

One explanation for these results relates to the substitution and complementarity features of these industries. For China's exports, clothing and soybean are primary goods that are substitutes for local goods in ASEAN destination countries. China therefore tends to stabilise the prices of clothing and soybean by applying a mark-up adjustment when exchange rates change. Electric fans, metal grinding machines, and refined petroleum are complementary, and for these commodities there is no evidence of local currency price stability. These results are consistent with what those of You, Ouyan and Feng (2004) have discovered.

In terms of imports, the β values are significantly negative for natural rubber and edible vegetable oil, suggesting local currency price stability, and significantly positive for copper, but not significant for paper. The cases of nature rubber and copper are of particular interest. In order to protect domestic markets, the central government in China imposed import quotas until 2001 to protect its domestic market. Import quotas have been replaced by low tariffs and tariffs will fall to zero in 2006, in accordance with China's commitments to the WTO. In the case of copper, there is a *de facto* zero tariff, which allows freer market competition. In order to maintain market share, exporters adjust price accordingly and hence there is evidence of local currency price stability in natural rubber but not in copper.[5]

To further investigate the role of the central government on 'pricing to market' behaviour, an additional equation is estimated by including a dummy variable. The dummy variable is set to be one before 2001, when there was an import tariff for nature rubber, and zero for the rest of the years when there was not. The results are reported in Table 3 for the case of nature rubber. It shows the coefficient of β is negative and significant. However the magnitude of the coefficient is larger, which indicates that with tariff operating, the

Table 6 Descriptive statistics of mark-ups and exchange rates

Industry	Mean	Standard deviation
China exports		
Clothing	8.8126	0.4439
Electronic fans	1.9696	1.2048
Metal grinding machines	6.9979	1.4929
Refined petroleum	5.4906	0.4821
Soy beans	5.7924	0.4449
Real local currency rate (cross rate)	–4.7640	0.3223
China imports		
Edible vegetable oil	6.2966	0.5180
Copper	6.9646	0.7133
Paper	6.7184	0.2958
Natural rubber	6.3316	0.3559
Real local currency rate (cross rate)	2.6740	3.001

Source: Ministry of Commerce, People's Republic of China.

exporters of nature rubber demonstrate more local currency price stability in order to maintain their competitiveness.

While level data can be used to examine the long-term relationship among the variables, the short-term dynamic adjustment process can be shown by taking first differences between data at the current period to data at the previous period. Such treatment can initially be found in Gagnon and Knetter, 1992. The fixed effects method is again used. The coefficients for clothing exports and for natural rubber and copper imports are significant at the conventional level (see Tables 2 and 3). The results suggest the existence of short-term price adjustment indicated by the coefficients of –0.1631, –0.0432 and 0.1164 respectively. However the magnitudes of the coefficients are smaller than those of the long-term case, which indicates that the adjustment is milder. The coefficients for the rest of the products are not significant suggesting that the same type of adjustment may not occur.

While we examine the short-term effect by taking first difference, it is known that such treatment was also considered in response to the finding of non-stationarity. For instance, when two series are co-integrated in degree one, co-integration analysis can also reflect a long-term relationship between the two variables. In order to examine both the long-term and short-term effect, we further apply the error correction model to reflect the short-term dynamics of the mark-ups in the system influenced by the deviation from the equilibrium.

Table 7 China's exports to ASEAN+2 (industry effects) estimation of β from equation (2) with fixed effects and random effects

Industry	β (FE)	Standard error	T statistics
Clothing (level)			
Clothing (1st difference)	–0.3096*–0.1631*	0.00620.0279	–4.68 –2.01
Electronic fans (level)			
Electronic fans (difference)	0.23140.09213	0.17710.1245	1.310.25
Metal grinding machines (level)			
Metal grinding machines (1st difference)	0.6520*0.1265	0.26720.2359	2.440.76
Refined petroleum (level)			
Refined petroleum (1st difference)	0.08450.0296	0.20370.1245	0.99 1.02
Soy beans (level)			
Soy beans (1st difference)	–0.7182*–0.0989*	0.4472 0.054	–1.61–1.58

Industry	β (RE)	Standard Error	Z Statistics	HausmanTest
Clothing	–0.0168	0.0272	–0.62	23.5*
Electronic fans	0.0773	0.0958	0.81	1.07
Metal grinding machines	–0.0224	0.0833	–0.27	7.06
Refined petroleum	–0.0044	0.02995	–0.15	1.24
Soy beans	–0.0135	0.1010	–1.34	1.79

Note: * denotes significant at 5 percent.

Table 8 China's imports from ASEAN+2 (industry effects) estimation of β from equation (3) with fixed effects and random effects

Industry	β	Standard error	T Statistics
Edible vegetable oil (level)			
Edible vegetable oil (1st difference)	–0.6247*0.0256	0.11720.9692	–2.52 0.65
Copper (level)			
Copper (1st difference)	0.2633*0.1164*	0.19100.0820	2.094.38
Paper (level)			
Paper (1st difference)	0.33370.0280	0.28950.3249	0.73 0.88
Natural rubber (level)	–0.1648*	0.0826	–2.00
Nature rubber (1st difference)	–0.0432*	0.0073	–3.58
The effect of import tariff	–0.3000*	0.0629	–4.41

Industry	β	Standard error	Z Statistics	Hausman test
Edible vegetable oil	0.0029	0.0384	0.08	0.07
Copper	–0.0336	0.0445	–0.76	7.65
Paper	0.0279	0.0219	1.27	0.12
Natural rubber	0.0202	0.01558	1.30	10.42

Note: * denotes significant at 5 percent.

$$\Delta P_{it} = \alpha_t + \lambda (P_{it-1} + \beta E_{it-1}) + \Delta E_{it} + \varepsilon_{it} \quad (4)$$

Equation (4) is the model to be estimated for clothing, natural rubber and copper which are significant for the short-term effects estimated previously. The coefficient μ captures any immediate effect that E has on P, described as a contemporaneous effect or short-term effect. The coefficient β reflects the equilibrium effect of E on P. It is the causal effect that occurs over future time periods, often referred to as the long-term effect that E has on P. Finally, the long-term effect occurs at an adjustment rate dictated by the value of λ. Table 4 reports the estimation results for natural rubber, copper and clothing. The coefficients of adjustment speed λ are 0.5 313 for natural rubber, significant at the five percent level, but the coefficients of λ are not significant for the rest of the products. The coefficients of β are not significant either for the three products. However, the short-term effects for three products denoted by μ demonstrate the signs that are consistent with the long-term pricing behaviour, which indicates on average firms' responses in the short term follow the long-term pricing behaviour.

Finally, we address the issue of whether the local currency price stability is asymmetric with currency appreciation compared to depreciation. We treat 1997 as a turning point because the actual exchange rate behaviour changed after the financial crisis. Before 1997 the devaluation of the RMB is a fact of history; after 1997 a period of real RMB appreciation occurred as other nations depreciated their currencies while China did not. The results in Tables 5 and 6 suggest that there are not symmetric responses in pricing behaviour when the currency rate depreciates compared with when it appreciates. But the local currency price stability effect is apparently not larger when the currency depreciates compared with when it appreciates.

There are three general conclusions in the asymmetric study. Some studies reveal larger degrees of local currency price stability when exporter's currency appreciates than when it depreciates. However, some opposite findings indicate more local currency price stability in the period when the currency depreciates than when it is in the period of currency appreciates. On the other hand, a number of studies did not find statistical or even suggestive evidence in support of asymmetry. Our finding falls into the third category, and concludes that the asymmetry is non-existent. The explanation could be that there is no neat pattern in firms' pricing behaviour in aggregation: some firms adjust more than others during a period of currency appreciation compared with a period of depreciation; however, other firms adjust much less, thereby offsetting each other, and the overall effects are therefore not significant.

Table 9 Estimation of ECM for equation 4

Industry	λ	β	μ
Nature rubber	0.5313*	–0.1440	–0.0227*
Copper	0.2980	0.0865	0.0762*
Clothing	0.3211	–0.0912	–0.0013*

Note: * denotes significant at 5 percent.

Table 10 The asymmetry response to changes in RMB – exports

Industry	β (Standard error) (1990–1996)	β (Standard error) (1997–2002)
Clothing	–0.2884 (0.1150)*	0.1348 (0.1126)
Electronic fans	0.5620 (0.2141)*	–1.017 (0.5791)
Metal grinding machines	0.7735 (0.3168)*	1.1977 (0.8589)
Refined petroleum	0.1626 (0.0752)*	0.1306 (0.4406)
Soy bean	–0.3534 (0.1454)*	–1.4412 (2.4637)

Note: * denotes significant at 5 percent.

Table 11 The asymmetry response to changes in RMB – imports

Industry	b (1990–1996)	b (1997–2002)
Edible vegetable oil	–0.5852	0.7115
Copper	–1.4533*	–0.3181
Paper	0.1374	–0.0403
Natural rubber	–0.4839	0.7197*

Note: * denotes significant at 5 percent.

Table 12 Industry categories of exports and imports

Code (SITC rev3)	Industry
China export data	
8469	Knitted or crocheted clothing
7434	Electronic fans, miscellaneous manufactured articles
7317	Metal grinding machines
4211	Refined petroleum
4542	Shelled, dried soybeans
China import data	
4220	Soybean edible oil
2831	Copper
6412	Paper
6211	Nature rubber

Conclusions, Policy Implications and Future Research

Both the methodology and newly collected data used in this paper allow for new insights into pricing behaviour by firms in ASEAN+3 countries. This was achieved by expanding the dimensions across which variations in local currency price stability are examined by including source countries, destination countries, industries, and government policy effects. At a minimum, this paper has documented the existence of mark-up adjustment and that this adjustment is sensitive to exchange rate changes in certain industries within the ASEAN+3 region.

It appears that industry is a critical dimension upon which many studies, including this one, have focused in explaining the local currency price stability behaviour. In this paper we found pervasive evidence of local currency price stability consistent with the nature of the industry. When exports are substitutes for products in the destination country, local currency price stability can be observed. When certain industries in destination countries enjoy government protection under import quotas, local currency price stability also appears in the price behaviour of exporters. Further, when local currency price stability exists, the short-term dynamic adjustments are consistent with the long-term pricing behaviour in source countries; the speed of adjustment, however, is moderate. Finally we have not found that prices are adjusted more when the currency depreciates compared with when the currency appreciates.

The first policy implication of this study for countries in this region (other than China) might be to classify their exports to China into those that show local currency pricing stability and those do not show such a characteristic, then devise certain assistance measures in either financial or non-financial forms in order to facilitate their exports to China. Second, for those exports with less international competitiveness and showing local currency price stability, such as natural rubber, the Chinese Government in some situations might be prepared to give up the industry entirely and allow imports from ASEAN+2 countries, such as Indonesia, instead of imposing import tariff which violates WTO rules. From China's perspective, it has neither rich nature endowment nor advanced production technology. Therefore such a strategy might be beneficial for both sides of trade parties. Third, the moderate speed of pricing adjustment indicates that firms are not inclined to take immediate action and all ASEAN+3 governments therefore need to allow sufficient time for them to adapt to such macroeconomic shocks.

The current research can be extended in the future with different availability of data. Trade data released by United Nations may contain information on ASEAN+3 nations allowing researchers to examine local currency price stability among ASEAN+3 countries. Network analysis methodology may be applied to analyse such a complex multi-dimensional space matrix too.

Notes

* I am grateful to seminar participants at the Shanghai Academy of Social Science 2004 and 2nd Beijing Conference of Harvard–Yenching Alumni China 2005 for comments on earlier drafts of this paper. Suggestions from anonymous reviewers were also appreciated. In addition, I would like to thank Danhua Fong, Jin Zhang and Zhong Xu for their research assistance. Finally, I am very grateful for financial support from the Social Science Fund of the Shanghai Municipal Government via SASS, (No. 20040506). Any remaining errors are my responsibility.

1 See Knetter, M. (1993) 'International comparisons of pricing to market behaviour', *American Economic Review*, June 473–483.

2 See Marston, R. (1989) 'Pricing to market in Japanese manufacturing', *NBER Working Paper* No. 2905.

3 See Perron, P. (1988) 'Trends and random walks in macroeconomic time series', *Journal of Economic Dynamics and Control 12*, 297–332

4 Separate regressions are carried out for each industry in each country, yielding in all 77 regression results. βs reveal differences for each country. Results for country effects are available upon request.

5 In order to see the structure change, a policy time dummy is created treating year 2001 as the cut-off point. The coefficient is not significant, most likely because the numbers of observations are limited after 2001.

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