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THE EVOLUTION OF GLOBAL MANUFACTURES PRICES, 1988-2006: CHINA'S COMPARATIVE PERFORMANCE

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Abstract

This paper analyses the pattern of price changes between 1989 and 2006 of imports into the EU, Japan and the US and compares the price change of exports from China with the price changes of exports from other countries grouped by income level, distinguishing among goods of different technological intensity. It finds that the level and growth pattern of unit prices of China's exports are similar to those of the products from the middle income countries. Their unit prices are generally lower than those of exports from high-income economies, and grow significantly slower than those of the low and high income group countries.

Keywords: Unit prices, exports, China
JEL code: F10, F14, C22, E30

1. Introduction

Since China opened up its economy to the external world three decades ago, products "made in China" have flooded into international markets. China's share of global exports grew from 2% in 1990 to 9% in 2007[i]. Although such rapid export growth is not unprecedented, the coupling of this fast growth with China's large size is widely believed to have changed the landscape of the world economy, with any impact on global manufacturing prices being one potentially important effect. It is asserted that China's rapid expansion of manufactured exports has been a primary factor explaining the fall in the aggregate price of traded manufactures recorded by the IMF after the mid 1990s (IMF, 2003).

It is widely believed that exports from China are of lower prices than those of her competitors. Exports from a country with reservoirs of surplus unskilled (and increasingly also semi-skilled and skilled) labour, coupled with sustained productivity growth (Fu and Gong, 2008), are likely to enjoy a price competitive advantage over others. The vast domestic market, sustained fast economic growth and a differing economic system may support an alternative growth-trend in export prices from that of other economies, especially in the sectors where China enjoys a substantial market share. However, despite the widely-held belief that China's growing exports have *caused* a fall in the global prices of many manufactures, there is little empirical evidence which documents any price changes in detail. Such evidence is a necessary first step to any exploration of whether China's trade has caused changes in global prices of manufactures.

In this paper, we analyse the evolution of the prices of globally traded manufactures between 1989 and 2006 to explore 1) whether the price-trends of goods exported by China behave differently to those exported by different categories of economies; and 2) whether the price-trends of globally traded goods behave differently depending on their embodied technological content. We focus on the evolution of unit prices of manufactures between 1989 and 2006 across a range of sectors in three major importing markets – the EU, Japan and the USA. We will distinguish between the evolution of export prices in high, middle and low income economies. We will also differentiate between the prices of exports in different technological categories, using an elaboration of Lall's (2000) classification. The underlying hypothesis is that given the different factor endowment of China compared to many other exporters of manufactures as well as China's distinct competitive advantage over her close competitors, relative price behaviour will be different across product and country groups. In addition we also suggest that the nature of the final market may determine the price competitiveness of China and other exporters. For example, we would anticipate that a combination of rapid outsourcing would lead to greater price pressures on imports into the US, and a greater role for China's competitiveness in this market.

Finally, there have been a series of exogenous shocks over the last 18 years which also may have had an impact on price behaviour. These factors suggest that there may be a temporal component to changes in prices. With this in mind, we explore the co-evolution of relative prices with important contextual factors. The first is China's accession to the WTO in 2001, raising the possibility that a combination of greater competition in its domestic market and the reduction in non-tariff barriers in export markets will have affected the price of its manufactured exports. The second is that the Asian Financial Crisis of 1997 led to excess capacity in the region and hence to enhanced price competition in global market price, particularly from middle-income Asian economies in medium-technology sectors. The third is the introduction of the Euro which resulted in the pegging of relative prices in a key importing region to a single unit of account: so large is the role of the EU in global trade that this event may have been associated with ricocheting alignments in prices across the spectrum of products. The fourth factor has been the commodity boom which changed relative prices between resource-intensive and non-resource-intensive commodities after 2002 (although commodity prices only really accelerated to their peak in the first half 2008) (Kaplinsky, 2009).

Standing on the shoulders of earlier studies, this paper contributes to the literature by making several developments. First, it employs larger sample from all the triad economies at a higher disaggregate level. Second, it uses different method for sample structuring and focuses on the evolution of global manufactures prices through the China lens. Third, the auto-regressive integrated moving average (ARIMA) technique which can better reflect the dynamics in price change is employed to model the price behaviour of the exports. Moreover, to avoid spurious results, unit root tests have been carried out to test the stationarity of the time series and necessary transformation of the data are taken to ensure a reliable and unbiased result. Finally, the effect of trade-weight has been taken into account, and differences in price changes are tested for their statistical significance.

The paper is structured as follows. Section 2 discusses the literature on unit prices. Section 3 discusses data and methodology. Section 4 presents the results, and Section 5 concludes.

2. Standing on shoulders: the use of unit prices

For more than four decades, unit prices have been utilised to reflect international competitiveness. In the 1970s and 1980s, studies of UK economic performance used unit prices as a proxy for both competitiveness and technological intensity (Pavitt, 1980; Walker and Gardiner, 1980; Dosi et. al., 1988). More recently, unit prices have been utilised to examine the changing patterns of global trade specialisation (Schott, 2002) and most recently in the analysis of China's export structure (see contributions by Feenstra and Wei, Amiti and Freund, Broda and Weinstein, Brambilla, Khandelwal and Schott, and Blonigen and Ma in Feenstra and Wei, 2009).

The impact of China's rapidly growing exports on global prices will arise from a combination of both aggregate volumes of trade and changes in the quality of these traded items (Broda and Weinstein, 2009). On the demand side, evidence suggests that price movements in international trade tend to be driven by world industrial activity and the US exchange rate (Hua, 1998; Lalonde, et al., 2003). Cheung and Morin (2007) assess the impact of emerging Asia on the real prices of oil and base metals using time series analysis based on quarterly data. They find strong evidence that oil and metals prices have historically moved with the business cycle in the developed world but that this relationship has broken down since mid-1997, which suggests that industrial activity in emerging Asia appears to have become a more important driver of oil prices. By contrast, they conclude that supply side factors have been a more significant determinant of the rise in metal prices. More generally, it has also been shown that "demand-driven" structural models which ignore supply have tended to persistently over-predict real commodity prices by wide margins from the second half of the 1980s into the early 1990s (Borensztein and Reinhart, 1994). With the exception of our differentiation between the differing Triad markets in our estimations of price behaviour, our analysis in this paper draws on supply-side factors, although we are of course aware that this is only part of the explanation, and an integrated picture will necessarily also draw on demand-side factors.

Three sets of empirical studies have explicitly concentrated on the association between traded prices in general and China's participation in these traded markets. Kaplinsky and Santos

Paulino (2005 and 2006) examined the price performance of 12,439 products imported into the EU between 1989 and 2001. The products chosen for analysis were those in which low income countries specialised. These studies concluded that in four sets of product groupings differentiated by technological intensity (using the Lall product classification), the prices of Chinese and low income country exports to Europe were more likely to fall than those exported by middle-income and high-income economies. Amiti and Freund report that "between 1997 and 2005, average prices of goods exported from China to the US fell by an average of 1.5 percent per year whereas the average prices of these products from the rest of the world to the US increased on average by 0.4 percent per year" (Amiti and Freund, 2009: 3). Finally, and seemingly in contrast to these two sets of studies, Broda and Weinstein challenge the argument that China's exports forced down the prices of competitors' exports to Japan:

"In those categories where China already had a presence in 1992, we do not find that Chinese prices fell more rapidly than those of other exporters to Japan. Moreover, the impact of Chinese competition to [sic] other exporters is also small. There is no evidence that the entry of Chinese firms into new markets has any significant impact on the pricing behavior of other exporting countries" (Broda and Weinstein, 2009: 2-3). However, crucially, the Broda and Weinstein result falls away if China and Hong Kong exports are excluded – "This result seems to be due to the treatment of Hong Kong. In our data, if we treat Hong Kong and China as two different countries, we obtain [the result of] Chinese prices falling significantly, but prices from Hong Kong rising significantly" (op cit: 14).

None of these three sets of studies attempt to model the causality of China's exports on the prices of other countries. Neither Amiti and Freund or Broda and Weinstein make any attempt to distinguish differential impact on different groupings of exporting countries, on different technology-intensities of exports, or on the interaction between technological intensity and country-type. However, despite such an analytical gap, this does not prevent the authors inferring a direction of causality – “we do not find that Chinese prices fell more rapidly than those of other exporters to Japan. [Thus] …[t]here is no evidence that the entry of Chinese firms into new markets has any significant impact on the pricing behavior of other exporting countries” (Broda and Weinstein, 2009: 2-3). In this paper we do not seek to model possible causal relationships. Instead, we seek to fill the relevant information gaps on price movements. The subsequent exploration of the issue of causality will be examined in a complementary paper.

3. Data and Method

3.1. The database

In principle, the measurement of the unit prices of traded goods is relatively simple. Almost all countries publish detailed trade data in which, for each product category, the values and volume of all traded products are recorded. In some countries, for example the USA, trade data also includes unit price indices compiled by customs authorities.

In practice, however, the calculation of these price indices is more complicated. For one thing, most countries calculate imports on a Cost, Insurance and Freight (CIF) basis, and exports on an Free on Board (FOB) basis. This immediately raises complications in the alignment of data on bilateral trade. More problematically, there are varying degrees of efficiency in the recording of trade data. In general, low income countries have relatively weak customs authorities, and either do not systematically report up-to-date trade data, or do so with significant errors. In addition, the reduction in global tariffs has in general reduced the commitment of customs authorities to the accurate measurement of trade. However, here there is an asymmetry, since even when tariff-regimes are in place, these are in themselves an inducement to mis-recording.

The problem with these tariff-induced problems in trade data is that, in general, not all countries have similar tariff structures and/or have proceeded with tariff reduction at the same pace. In the face of these difficulties, we have chosen to use three sets of data in the analysis of unit price data. Based on the widespread acceptance that the least-weak forms of trade-data are those collected by high income economies, we have used import data into the three Triad economies – the EU,[ii] Japan and the USA. However, whereas the US import data is collected on a FOB basis, the trade data for Japan and the EU is at CIF prices.

The biggest problem which arises in the measurement of unit prices is the problem of product heterogeneity. The greater the degree of aggregation the less likely that trade data will capture product-specific movements in prices. This problem is so substantial that it has led some observers to jettison the use of unit prices since "unit value indices suffer mainly from not comparing prices of like with like" (Silver, 2007: 5). Silver bases his criticism in large part on trade data collected at the 3-digit level of aggregation. In earlier work, we have shown that the higher the degree of disaggregation the more price trends are visible (Kaplinsky and Santos-Paulino, 2006: Table 2). In this analysis we have therefore used the most disaggregated trade data feasible - 8 digits for the EU and the US, and 6 digits for Japan, all for the 1989-2006 period. The EU data is sourced from the COMEXT EUROSTAT database; the US data from US International Trade Commission database; and the Japanese data from the Japanese customs official website[iii].

The time-period we have chosen for this analysis begins in 1989 with the introduction of the Harmonised System (HS) in trade data. Conveniently, China's export surge only began in the late 1980s. The HS taxonomy is available at a more detailed level than for the Standard International Trade Classification (SITC) dataset utilised in the COMTRADE database, and although this has the disadvantage of reducing the time period available for the analysis of changes in trend, it provides a finer degree of disaggregation which we believe to be essential in the analysis of unit prices.

The product categories we have employed in the unit price analysis are defined by China's trading specialisation.[iv] For each of the Triad regions, we have examined the price performance of imports from China and three comparator groups of countries for the 300 major products imported from China. In determining the direction of change in prices, we have used 2006 trade structures to identify this sample of sectors. The comparator countries are the major income groups defined by the World Bank, namely low income (excluding China), middle income and high income.

We have then elaborated these product categories to reflect technological intensity, drawing on the categories defined by Lall (2000), and subsequently utilised by UNIDO in the calculation of its world competitiveness tables (UNIDO, 2002). Since Lall's criteria were defined at the 3-digit level, we have extended these to the 6 and 8 digit level (based in large part on a similar exercise conducted previously in the analysis of the unit prices of EU imports between 1989 and 2001 (Kaplinsky and Santos Paulino, 2005 and 2006)).

One final methodological point concerns the number of sectors for which data were available.

Trade structures have changed over the 18 year time-period of data analysis, and some sectors represented in China's trade with Triad economies in 2006 were not represented in 1989. These dynamics in trade composition are particularly evident in the US data. In addition, and this is no surprise, data sets are not complete, so there are some years with missing values (for either value or volume). Where there is a gap in an 18 year-time series, we have interpolated trends. However, where there are observations for only two years in the whole series, or the maximum year with trade data after interpolation is less than five years, or the gap is too large for interpolation, or the full 18-year time series does not exist, we have excluded these sectors. This leads to a smaller sample for each market than the 300 sector samples with which we began the analysis in each Triad region. We have also dropped a limited number of outlier sectors which report a non-credible growth of unit price (+/-3).[v] Finally, some of the products that appeared in the top 300 Chinese exports did not appear in other country groups, for one or several years, or even for the whole sample period. To ensure we are comparing like with like, we have kept only those products that have price values in *all* four country groups in a given year. Thus the final sample of sectors utilised in the analysis was 213 sectors for Japan, 94 for the US, and 177 for the EU, resulting in a total of 1,936 sectors from four country groups in three destination markets.

3.2. How would we know if unit prices changed?

Four major approaches to modelling economic time series can be identified (Gujarati, 2003). They are single-equation regression models, simultaneous-equation regression models, autoregressive integrated moving average (ARIMA) models and vector autoregression (VAR) models. Although the simultaneous-equation regressions models were widely-used during the 1960s and 1970s, they suffer from the well-known Lucas critique that the estimated parameters are not invariant in the presence of policy changes (Lucas, 1976). In the time-period governing our analysis, these shocks include changes in world trade and financial systems and changes in production policy, environmental and regulatory requirements during the sample period.

The most recent tool for modelling time-series is the probabilistic, or stochastic, model designed to "let the data speak for themselves". For example, in the Box-Jenkins (BJ) ARIMA method, Y is modelled as being explained by past, or lagged, values of Y itself and a stochastic error term, as the basis of a univariate analysis.

The most frequently used autoregressive (AR) model is as follows in a general *p*th-order form

$$y_y = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \ldots + \gamma_p y_{t-p} + \varepsilon_t \qquad (1)$$

A first order AR process is written as

$$y_y = \mu + \gamma_1 y_{t-1} + \varepsilon_t \qquad (2)$$

Y can also be modelled as equal to a constant plus a moving average (MA) of the current and past error terms;

$$y_t = \mu + \varepsilon_t - \theta \varepsilon_{t-1} \qquad (3)$$

A general model that encompasses AR and MA is the autoregressive moving average, ARMA (*p,q*), model:

$$y_y = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \ldots + \gamma_p y_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \ldots - \theta_q \varepsilon_{t-q} \qquad (4)$$

which means an ARMA process with *p* autoregressive terms and *q* lagged moving average terms. Models of this sort with relatively small values of *p* and *q* are found to be very effective and sometimes even superior to much more elaborate specifications (Greene, 2003).

A pre-condition for using all these modelling approaches is the stationarity of the time series. If a time series has a unit root, it is non-stationary. This can be tested using the Augmented

Dickey-Fuller test, assessing whether a variable follows a unit root process. The null hypothesis is that the variable contains a unit root, and the alternative is that the variable was generated by a stationary process. If a variable is stationary at the *d*th order, an ARMA process can be modified with variable, Y, integrated at order *d*. This is the autoregressive integrated moving average (ARIMA) time series model. An important aspect in the model-building process is to determine the lag structures which can be accomplished by using the Box-Jenkins test. Hence, for the empirical test, we first test for the stationarity of each time series using the unit-root test. If a time series is stationary at order zero, ARMA is preferred to ARIMA. If a time series is stationary at order *d*, ARIMA is preferred.

We model the price behaviour of each product in each market. This approach allows for different behaviour across different products in different markets. It is important to note, however, that this approach has the limitation that the number of observations for each product is small. Since the results of the unit root test show that most of the variables are stationary at the first order, we have to transform the data to its first difference to obtain a stationary time series that enables reliable estimation results. Therefore, the price behaviour we model using ARIMA is the growth of unit price. Due to the short time series in the data, for modelling we use ARIMA (1,1,1) - one lag in the price and one lag in the error tem and integrated at the first order.

We then compare the proportion of products that experienced positive price growth over the sample period from different countries and the magnitude of the average price change. We also carry out the same exercise for products of different technology intensities exported from different countries. Following our elaboration of Lall (2000), we group the products into four categories by technology intensities: resource based products; low technology products;

medium technology products; and high technology products. Details of the HS code of the products included in the study are listed in Appendix 1.

We regress the estimated growth coefficients (γ) on a vector of country-group dummies to examine whether the differences in the price growth rates between China and other countries are statistically significant. China is set as the base in the regression. A vector of technology category dummies and market dummies are also included in the regression as control variables. The regression is carried out with and without trade weights as a robustness check.

The innovative methodological component of our work is as follows. First, we take into account the dynamics in time series and consequently employ ARIMA estimation. Second, we test the stationarity of each of the 1,936 time series, transforming the data into the stationary first difference, and therefore ensuring that the estimated results are not spurious. Third, we test the statistical significance in the difference in the behaviour of unit price between Chinese imports and imports from other country groups and between different technology categories. Finally, we have taken trade weights into account and have examined the unit price change pattern with and without trade weights. We are not aware of any previous studies which have adopted this approach towards the analysis of unit price behaviour.

4. Results: have unit prices changed?

We report our results in four stages. We begin with a visual inspection of overall trends by plotting the number of sectors experiencing price rises in each of the Triad economies with respect to products imported from China, low-, middle- and high-income economies, respectively (Section 4.1). We then proceed to examine the slope of price change in the Triad economies from these different exporting economic groupings, comparing them with imports sourced from China (Section 4.2). This is followed by an analysis of price levels (Section 4.3) and finally (Section 4.4) by an examination of the extent to which price changes were associated with the four exogenous shocks mentioned in Section 3, notably the 1997 Asian Financial Crisis, China's accession to the WTO, the introduction of the Euro and the onset of the commodity boom

4.1. The incidence of price change across sectors

Figures 1a and 1b display the overall results of price performance of exports into the Triad economies from China and the three different sets of economies. They report the number of sectors experiencing rising prices over the 18 year time period. Overall, approximately the same number of products experienced falling prices as rising prices over the 18 year period. Considering price performance by exporting economy (Figure 1a), in aggregate it is the middle income economies whose export prices are least likely to have risen, and this is particularly evident in relation to imports into Japan and the EU. As a general observation, China is next in line as a continuing low price source of imports (except in the US) whilst it is the low income and the high income economies who are least likely to have experienced falling prices. Considering the picture in relation to the importing economy (Figure 1b), in Japan, it is the middle income economies which primarily seem to have experienced pricing pressures, followed by China. However, in the US, it is the low income economies which most seem to have experienced pricing pressures, while China and the middle- and the high-income countries enjoy widespread price growth. In EU, the middle income economies and China seem to have experienced pricing pressures over the sample period.

(Fig. 1a and Fig. 1b here)

4.2. Rates of change in unit prices

Figure 1a and Fig 1b reported the proportion of prices rising across a spectrum of products in all three importing markets. Table 1 reports the average rate of change of product prices: that is, the slope of the ARIMA estimates, across all sectors. It reports both the unweighted and trade-weighted averages. The results suggest that it is not just that in the US a greater proportion of sectors enjoyed price growth than in the EU and Japan over the sample period but also that the average rate of price change was much higher in the US than in the other two markets. This cross market price difference pattern was accentuated when trade-weightings were incorporated. Interestingly, the price change pattern across different exporting countries changed when trade-weightings were taken into account. When trade-weightings were incorporated, the weighted average price change rate of China's exports was higher than that of low-income countries, on a par with that of the middle income countries.

(Table 1 here)

Table 2 reports the estimation results of the tests assessing the statistical significance of the difference in price change rates between China and the other country groups and between different technology groups. It considers the statistical significance of patterns of price change in relation to three sets of questions. The first is the average rate of price changes of exports from low-, middle- and high-income economies in comparison to those of China's exports (rows 1-3). The result is that, on average, the average change in the prices of China's exports was significantly lower than either those of the low-income or high-income group (both significant at the 1% level), but similar to that of middle-income exporters.

(Table 2 here)

Rows 4-6 address the technological intensity of traded products and consider the statistical significance of price trends of resource-based, medium-tech and high-tech products and the extent to which they have changed compared to those of low-tech products.[vi] No significant difference in average price change rates was found between products of different technological groups.[vii] Finally, rows 7-8 address the significance in difference of average price changes into the EU and Japan in comparison with the US and find that in both cases, prices into the US were rising at a significantly higher rate (both significant at the 1% level).

4.3. Price levels in different markets

Even though the analysis is focused on the highest feasible level of product disaggregation (8 digit into the US and the EU and 6 digit into Japan), there is of course considerable heterogeneity in each of these product categories. In some cases this is because the product sub-groupings represent items which are close, but different (for example, cherry tomatoes are classified separately from other tomatoes in US trade data – Amiti and Freund, 2009); in other cases products are similar, but quality is different (for example, in automobiles). In general, higher unit prices reflect a combination of complexity and quality rather than higher production costs.

(Table 3 here)

Table 3 compares absolute unit price levels (in logarithm[viii]), in 2006, into each of the Triad markets from different points of origin. (We do not compare absolute prices across the Triad for two reasons. First, the US data records FOB prices, and Japan and the EU record CIF prices; second, the Japanese data is at the 6-digit level, and the US and EU data is at the 8-digit level.) It suggests that in each of the three major importing regions, products originating from high-income economies have a significantly higher unit price than those from China (significant in the US and the EU at the 1 percent level, and in Japan at the 5 percent level). In the US market, middle income economy products have a significantly higher unit price than those exported by China (significant at the 5 percent level), and in the EU unit prices of low income economy products were significantly lower (significant at the 5 percent level).

(Table 4 here)

Table 4 extends this analysis of absolute unit prices in 2006 to the 18 year period (1989-2006) using a random effects model for panel data, controlling for the destination market, technology and product specific effects. The persistent story which emerges from this data is that, over time, unit prices within product groups are significantly higher for exports from high-income economies compared to those from China, in all three destination markets. This result is unaffected by technology-intensity. On the other hand, there is no statistically significant difference in unit prices between China's exports and those from middle income countries at the 5% significance level. This evidence suggests that China's exports exist in the same price level in the international markets as those of products from the middle income countries, which may be due to similar technology and skills levels and hence similar product sophistication levels of these products.

4.4. Unit prices and exogenous shocks

Tables 5, 6 and 7 analyse price trends for China and the major exporting blocs in each of the three Triad markets in relating to four exogenous shocks – the 1997 Asian Financial Crisis, China's accession to the WTO in 2001, the introduction of the Euro in 2000 and the onset of the commodities boom (2002). Table 5 examines the association between these events and price performance in the EU market; Table 6 considers the US market; and Table 7 the Japanese market in relation to the four shocks. Table 8 summarises the price behaviour in the three Triad markets following each of these four shocks, showing the direction of change and the level of confidence in the significance of these changes. (Blank cells reflect no statistically significant change in price trend.)

(Table 5, 6, 7, 8 here)

There is a remarkable consistency in these results, particularly within Triad economies, but also between the Triad economies. They suggest that in general, prices fell after each of these events. There are some exceptions, notably that the prices of low income economy products displayed a tendency to rise in the EU market and in Japan after the Asian Financial Crisis and after the introduction of the Euro. Thus perhaps the main conclusion is not the significance of any one of these exogenous shocks but that the period between 1997 and 2002 may have represented a period of divergence in price behaviour, with China, medium- and high-income economies experiencing price decline and low income economies price rises.

5. CONCLUSIONS

In this paper we have analysed the pattern of price behaviour of different sets of products imported into the Triad markets from China and other categories of economies (grouped by per capita income levels). We have also taken account of differing levels of technological intensity and have explored the extent to which price patterns changed in relation to four sets of events –

the Asian Financial Crisis in 1997, the introduction of the Euro in 2000, China's accession to the WTO in 2001 and the onset of the commodities price boom in 2002.

From this analysis we can draw four main conclusions. First, in general, the unit prices of middle income economy exports are least likely to have risen over the period, followed by those exported by China. In the US market distinctively, low income economies were least likely to have experienced declining unit prices. Second, the average growth rate of unit prices of China's exports, controlled for sector, was significantly lower than those of the low and high income group countries. No differences of significance were found when distinguishing the rate of change of prices of traded products by technological intensity. Unit prices of imports into the US grew significantly more rapidly than those into Japan and the EU. Third, considering unit price levels (as opposed to unit price changes), the unit prices within product groups are generally significantly higher for exports from high-income economies compared to those from China, in all three destination markets. This result is unaffected by technology-intensity. On the other hand, there is no statistically significant difference in unit price levels between China's exports and those from middle income countries. And, fourth, in general, prices fell after each of the four exogenous events. There are some exceptions to this general picture, notably that the prices of low income economy products displayed a tendency to rise in the EU market and in Japan after the Asian Financial Crisis and after the Introduction of the Euro. Thus perhaps the main conclusion is not the significance of any one of these four exogenous shocks but that the period between 1997 and 2002 may have represented a turning point in price behaviour, with China, medium- and high-income economies experiencing price decline and low income economies price rises.

None of the above conclusions on price behaviour imputes causality. There are, however, a number of causal explanations which are suggested by this data and which can be considered as future research hypotheses. For example, it could be hypothesised that China's exports have grown so rapidly and have been so large (bearing in mind that our sample is determined by sectors of significance to China's exports) that they have *caused* the prices of competitor countries' exports to change. After the mid-1980s, China's penetration of global markets began with low-technology products. This primarily affected low income producers, a phenomenon captured in the results of empirical research undertaken by Kaplinsky and Santos-Paulino (2005) and suggested by Lall and Albaladejo (2004). However, by the turn of the millennium, the changing structure of Chinese exports (the move into higher technological intensity exports) removed some of the pricing pressure on these low income competitors. At the same time the changing structure of China's manufacturing exports (Fu, 2004) meant that it was the middle-income economies which were increasingly affected by China's rising competitiveness. This development was predicted, inter alia, by Lall and Albaladejo who observed trade complementarity between China and its regional middle income regional trading in the 1990s, but warned that as China moved up the technological capability spectrum, so it would be more likely that its exports would begin to compete with its middle income neighbours (Lall and Albaladejo, 2004). The causal relationship between China's exports and the price behaviour of global manufacturing products will be considered in a complementary paper.

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Figure 1a: % Sectors with rising prices by exporting economy

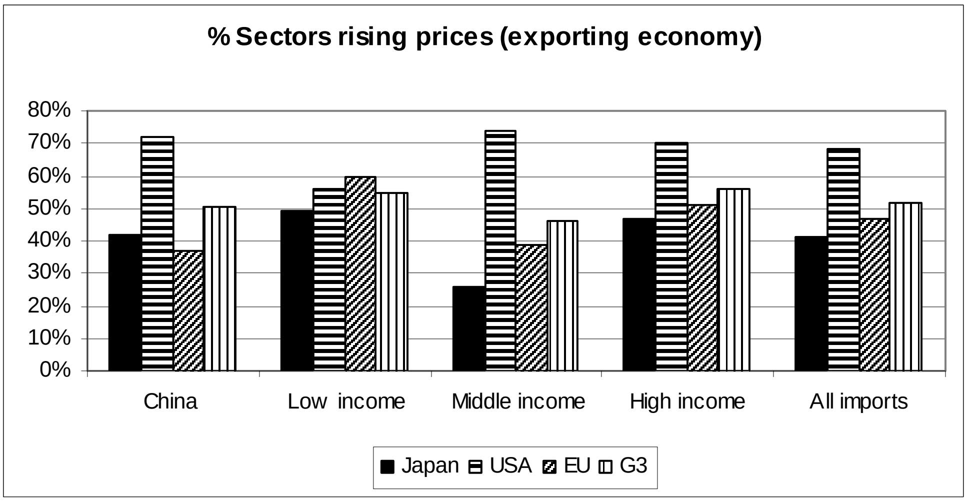
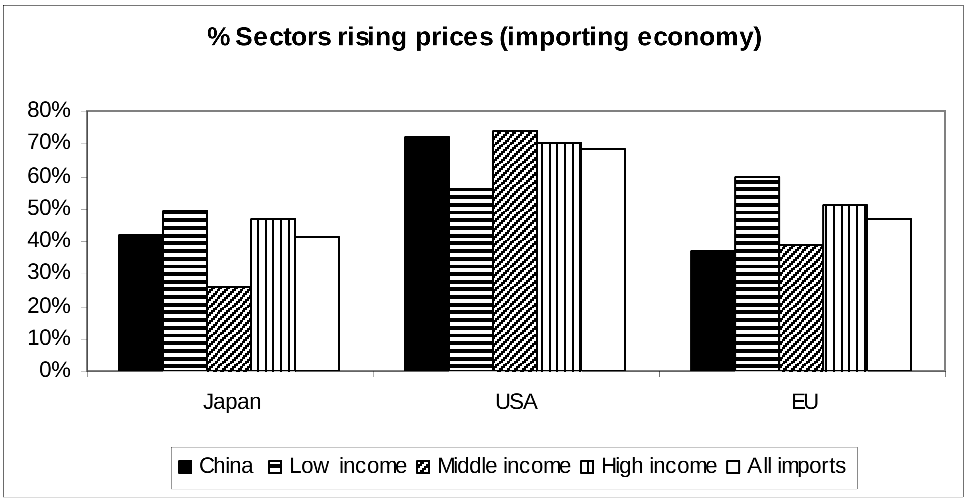


Figure 1b: % Sectors with rising prices by importing economy



Note: G3 in Figure 1a refers to all three markets.
Source: authors' estimations.

Table 1. Average price changes of imports from China and other countries

		Unweighted average			Trade share weighted average		
	N	US	EU	Japan	US	EU	Japan
China	8,712	0.133	-0.127	-0.022	0.209	0.126	-0.003
Low income	8,712	0.348	0.058	-0.010	0.109	0.142	-0.005
Middle income	8,712	0.192	-0.069	-0.093	0.277	0.108	-0.148
High income	8,712	0.054	0.095	-0.006	0.325	0.127	-0.024
TOTAL	34,848	0.182	-0.011	-0.033	0.230	0.126	-0.045

Source: authors' estimation.

Table 2. Unit price changes of exported products: full sample, 1989-2006

		Growth rate of Δp (γ)	
		Coefficient	Stan. Errors
Compared with China exports	Low-income	0.0818***	-0.0311
	Middle-income	0.0102	0.0311
	High-income	0.124***	0.0311
Compared with low-tech exports	Resource-based	0.0225	0.0336
	Medium-tech	0.0305	0.0356
	High-tech	-0.0095	0.031
Compared with imports into the US	EU	-0.184***	0.0312
	Japan	-0.211***	0.0315
	Constant	0.115***	0.0317
	N	1936	
	Adj. R^2	0.036	

Notes: *** significant at the 1% level

Table 3. Comparison of price level: China vs other countries, 2006

	EU	US	Japan
Low-income	-0.540***	0.281	0.298
Middle-income	0.037	0.392**	0.0364
High-income	0.628***	0.861***	0.429**
Constant	2.030***	2.501***	-4.587***
Observations	872	712	576

Notes: Figures reported in the table are estimated coefficients of the country dummies. China is the base country for comparison.
*** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 4: Comparison of price level, panel results (2000 constant price)

	Unweighted				Weighted			
	All	Japan	EU	US	All	Japan	EU	US
	1	2	3	4	5	6	7	8
	ln_riprice	ln_riprice	ln_riprice	ln_riprice	ln_riprice	ln_riprice	ln_riprice	ln_riprice
Low-income	-0.108	0.740***	-1.372***	0.175	0.0767	1.086***	-1.234***	0.221
	0.116	0.145	0.155	0.187	0.116	0.146	0.154	0.188
Middle-income	-0.00121	-0.156	-0.00252	0.288	0.0762	0.266*	-0.124	0.306*
	0.113	0.136	0.154	0.185	0.113	0.137	0.154	0.186
High-income	0.566***	0.541***	0.506***	0.730***	0.612***	0.746***	0.506***	0.730***
	0.113	0.136	0.155	0.186	0.113	0.135	0.154	0.186
Market	3.713***				3.711***			
	0.0506				0.0505			
Technology intensity	0.451***	0.617***	0.319***	0.000909	0.447***	0.607***	0.317***	0.000599
	0.043	0.0495	0.0582	0.0779	0.0428	0.0492	0.0578	0.0779
Trade share					0.648***	1.132***	0.639***	0.149***
					0.0311	0.0623	0.0515	0.0363
Constant	-8.432***	-5.973***	1.349***	2.525***	-8.662***	-6.478***	1.187***	2.472***
	0.157	0.149	0.181	0.232	0.157	0.151	0.181	0.233
Observations	43675	17424	15010	11241	43475	17282	15007	11186
Number of code	2865	1130	982	753	2865	1130	982	753
R-squared	0.6641	0.1602	0.165	0.022	0.6666	0.1695	0.1743	0.0217

Notes: Standard errors in parentheses; Model: random effects.
Dependent variable: log(real unit price).
*** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 5. The impact of external shocks on unit price change: by country group in EU market

	Low-income				Middle-income				High-income				China			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
crisis	0.476***				-0.221***				-0.150***				-0.225***			
	(0.035)				(0.009)				(0.011)				(0.016)			
WTO		0.330***				-0.297***				-0.179***				-0.308***		
		(0.039)				(0.009)				(0.012)				(0.017)		
Euro			0.450***				-0.225***				-0.144***				-0.227***	
			(0.035)				(0.009)				(0.011)				(0.016)	
boom				0.369***				-0.266***				-0.160***				-0.266***
				(0.037)				(0.009)				(0.012)				(0.017)
Constant	-3.936***	-3.779***	-3.895***	-3.812***	-2.366***	-2.396***	-2.377***	-2.389***	-1.891***	-1.917***	-1.903***	-1.914***	-2.354***	-2.383***	-2.367***	-2.380***
	(0.025)	(0.021)	(0.024)	(0.022)	(0.007)	(0.005)	(0.006)	(0.005)	(0.008)	(0.006)	(0.007)	(0.007)	(0.012)	(0.009)	(0.011)	(0.010)
N	3737	3737	3737	3737	3856	3856	3856	3856	3856	3856	3856	3856	3730	3730	3730	3730
Adj. R^2	0.05	0.02	0.045	0.028	0.139	0.211	0.145	0.187	0.049	0.059	0.045	0.051	0.053	0.083	0.054	0.068

Notes: dependent variable: ln(real price)
Standard errors in parentheses
*** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 6. The impact of external shocks on unit price change: by country group in US market

	Low-income				Middle-income				High-income				China			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
crisis	-0.178***				-0.002				-0.058***				-0.042**			
	(0.036)				(0.018)				(0.016)				(0.019)			
WTO		-0.089**				-0.028				-0.022				-0.099***		
		(0.037)				(0.019)				(0.017)				(0.019)		
Euro			-0.179***				-0.012				-0.062***				-0.054***	
			(0.035)				(0.018)				(0.016)				(0.018)	
boom				-0.099***				-0.021				-0.036**				-0.088***
				(0.036)				(0.019)				(0.017)				(0.019)
Constant	-1.799***	-1.875***	-1.810***	-1.865***	-1.852***	-1.844***	-1.847***	-1.845***	-1.381***	-1.407***	-1.383***	-1.400***	-2.112***	-2.103***	-2.108***	-2.101***
	(0.027)	(0.021)	(0.025)	(0.022)	(0.014)	(0.011)	(0.013)	(0.011)	(0.012)	(0.010)	(0.011)	(0.010)	(0.014)	(0.011)	(0.013)	(0.011)
N	2706	2706	2706	2706	2842	2842	2842	2842	2842	2842	2842	2842	2822	2822	2822	2822
Adj R^2	0.01	0.002	0.01	0.003	0	0.001	0	0	0.005	0.001	0.006	0.002	0.002	0.01	0.003	0.008

Notes: dependent variable: ln(real price)
Standard errors in parentheses
*** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 7. The impact of external shocks on unit price change: by country group in Japan market

	Low				Middle				High				China			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
crisis	0.109**				-0.260***				-0.190***				-0.264***			
	(0.048)				(0.009)				(0.011)				(0.016)			
wto		-0.003				-0.328***				-0.210***				-0.338***		
		(0.048)				(0.010)				(0.012)				(0.017)		
euro			0.0822*				-0.264***				-0.182***				-0.265***	
			(0.047)				(0.009)				(0.011)				(0.016)	
boom				0.0373				-0.301***				-0.194***				-0.300***
				(0.047)				(0.009)				(0.012)				(0.017)
Constant	-8.687***	-8.618***	-8.665***	-8.635***	-2.303***	-2.344***	-2.316***	-2.334***	-1.827***	-1.866***	-1.842***	-1.859***	-2.291***	-2.332***	-2.306***	-2.326***
	(0.037)	(0.028)	(0.034)	(0.030)	(0.007)	(0.005)	(0.006)	(0.005)	(0.008)	(0.006)	(0.008)	(0.007)	(0.012)	(0.009)	(0.011)	(0.010)
N	2123	2123	2123	2123	3856	3856	3856	3856	3856	3856	3856	3856	3730	3730	3730	3730
R(squared	0.02	0.025	0.034	0.029	0.181	0.241	0.186	0.223	0.075	0.077	0.07	0.072	0.07	0.098	0.072	0.085

Notes: dependent variable: ln(real price) .
Standard errors in parentheses
*** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 8. Summary of the effects of external shocks

	EU	US	Japan
Asia Financial Crisis (1997)			
China	Falling (1%)	Falling (5%)	Falling (1%)
Low-income	Rising (1%)	Falling (1%)	Rising (5%)
Middle-income	Falling (1%)		Falling (1%)
High-income	Falling (1%)	Falling (1%)	Falling (1%)
China WTO Accession (2001)			
China	Falling (1%)	Falling (1%)	Falling (1%)
Low-income	Rising (1%)	Falling (5%)	
Middle-income	Falling (1%)		Falling (1%)
High-income	Falling (1%)		Falling (1%)
Introduction of Euro (2000)			
China	Falling (1%)	Falling (1%)	Falling (1%)
Low-income	Rising (1%)	Falling (1%)	Rising (10%)
Middle-income	Falling (1%)		Falling (1%)
High-income	Falling (1%)	Falling (1%)	Falling (1%)
Onset of commodity boom (2002)			
China		Falling (1%)	Falling (1%)
Low-income	Rising (1%)	Falling (1%)	
Middle-income			Falling (1%)
High-income		Falling (5%)	Falling (1%)

Note: Significance levels are shown in parentheses.

Appendix 1. HS code of the leading Chinese imports into the Triad markets included in this study

EU 2006						
Resource based (N=21)	**Low-tech (N=150)**			**Medium-tech (N=25)**	**High-tech (N=69)**	
29349099	95034930	95035000	63026000	85164010	85043180	42023100
20056000	64052091	94049010	42029291	84263000	85199918	95059000
05040000	71171910	61103099	42022210	84158200	85281294	85239010
51021100	66019911	42029211	61143000	91051100	84733010	62034231
03042085	64029991	73239390	65061010	85273210	85044030	85272120
44183091	61083100	61101091	83024100	84672199	84733090	62043390
03042029	61051000	39249090	49090090	85091010	85299060	83062990
44121400	42029219	62019300	84145100	85167980	85438990	95021010
32041700	73269097	63039290	72083900	85163190	85422183	91021100
50020000	95069990	94018000	95021090	36041000	85229080	85044090
44092091	94055000	62052000	62044900	90041091	85281291	85044093
27040019	85167200	61101190	62104000	87089998	85182990	85422117
68010000	74122000	46021091	61112090	94052091	85365080	90091100
29309012	63079099	42021291	64039991	84818099	84716090	
02071410	42032910	62031100	42023100	38061010	85182100	
85444190	64021900	62045990	95059000	84821090	85442000	
04090000	71131900	65059090	85239010	87087050	85369085	
68029310	62064000	42031000	62034231	85444110	88024010	
80011000	39262000	39269091	85272120	87149110	85312095	
12022000	95067030	61121200	62043390	87032210	29362700	
51021050	34060019	62021210	83062990	87111000	85299089	
	39264000	61046200	95021010	85131000	85078030	
	64029996	62061000	63025190	85094000	85340090	
	94032020	64029939	95069100	84145190	85098000	
	67029000	39269099	61102091	72022100	91021900	
	64029993	50072051	44219099		85013100	
	39234010	71131100	64069960		85253090	
	70139900	61109090	63062200		85281220	
	83024900	73084090	61082100		84119190	
	62105000	61124190	61159200		85273191	
	69131000	65059030	64034000		84119100	
	62112000	61091000	61046300		85271399	
	42022100	61102099	95034100		85366900	
	62021310	94051091	95010090		90091200	
	95037000	66011000	72193310		85044055	
	73239999	94035000	64041910		84716040	
	94019080	39241000	42021299		85011099	
	95039034	62160000	39231000		85043190	
	62034235	62046390	62046231		85202000	
	84314980	76169990	41132000		90065390	
	95051090	94053000			85081010	
	64041100	95041000			84716060	
	62121000	95049090			84717053	
	44201019	39232100			85219000	
	94051098	95039032			84729080	
	39261000	94049090			85271900	
	62063000	95038010			85369010	
	61071100	42022290			85166090	
	94054099	64041990			84715090	
	82152010	42029298			85411000	
	94017100	67021000			85088051	
	73089099	62114390			85182995	
	62029300	61171000			90259010	
	82051000	62092000			85013190	
	94054039	64031900			85171990	

Japan 2006							
Resource based (N=64)		**Low-tech (N=136)**			**Medium-tech (N=45)**	**High-tech (N=55)**	
200590	441820	621143	420221	381800	853890	850440	854160
690210	160420	610910	284690	610443	843149	852731	847193
401693	811100	630231	620212	630392	901910	841810	847191
160419	030613	761010	420291	392310	870829	851999	850780
160249	121220	420329	392690	420310	392321	841861	847010
190590	030349	611430	940161	620311	851679	900990	851790
401699	200899	691110	620193	640399	847790	851829	850131
284390	854430	940171	420212	640419	381512	900190	
441212	284920	940320	610510	940390	910211	847290	
800110	200819	620343	611593	950639	854449	853400	
282590	760110	721331	650590	392490	845011	852190	
441890	270112	950691	611010	610343	900211	852110	
030379	270710	630260	620443	610821	853690	850300	
071230	441229	420292	620341	620452	720110	852990	
401110	854441	621040	620432	620640	720221	852810	
270400	160239	230910	640610	620439	870899	847120	
760120		610462	640299	620342	840734	854380	
271000		611030	611693	950210	853650	851660	
030192		420222	230400	620113	841510	850152	
070310		611020	620211	950341	871110	850431	
160590		620530	940350	630790	841590	850110	
720230		610520	691200	852390	871200	852090	
071290		620520	510710	392620	850910	853224	
120100		620433	620821	620462	848071	851710	
270900		621210	630140	940360	850980	852910	
030420		660199	610610	611120	841459	850450	
210690		950699	950349	610620	900219	851740	
251990		420232	620293	611420	870870	852721	
440920		460191	950631	950410	851629	901819	
071190		620431	620213	610463	840991	901380	
701400		620332	420330	731815	841583	847340	
854451		620453	030791	730890	841581	852290	
280469		640192	610711	392610	940540	851650	
270111		610831	950490	732690	848210	847330	
160520		610822	950380	430310	853669	851830	
160510		570330	940190	640411	382390	853340	
050510		621133	611592	848180	853710	852520	
280530		640291	030799	621142	940510	854211	
442190		392640	630539	392410	846693	847192	
680293		940490	950390	761690	871680	901839	
071080		620711	640219		848310	850490	
070951		620463	460210		847990	847989	
280461		610990	620442		720270	903290	
270119		732510	611090		903289	854140	
160100		481940	620630		910511	851782	
200490		841451	761510			842139	
441900		620192	848190			847199	
811291		732393	420231			854219	

US 2006

Resource based (N= 16)	Low-tech (N= 156)			Medium-tech (N= 43)	High-tech (N= 78)	
85444290	42033000	39249010	39232100	69101000	85258050	85171800
40112010	94054080	94049080	63023190	85444220	85287272	85014040
03042960	39232900	49090040	94039080	84304980	84716010	85312000
29310090	61022000	42022190	61101210	84182100	85072080	85163200
44123205	61101100	62046990	61102020	84433960	85414060	85041000
44140000	42029100	61112060	95069960	84432100	84714900	85235100
40111010	62045220	42029230	95051040	87163900	84715001	85256020
68109900	72104900	94052060	62101050	85167100	85287120	85198130
44189046	61044320	67042000	82152000	84439925	85287264	85044095
44123231	62029220	39269099	62063030	85363080	84717040	85171200
44219097	61089200	39264000	83025000	87169050	84701000	85256010
27040000	64052030	95041000	95030000	84145190	85437096	84733011
31021000	62034240	94016960	48201020	84145130	84718090	85366940
03042930	73262000	63014000	64041990	85443000	85183020	85198140
25232900	64039160	94013080	63062290	87089981	85131040	85285925
68029300	94049020	64052090	42022215	85162900	85269100	85285100
	83014060	96081000	94053000	90031900	85255030	85286945
	83024160	42029215	64039190	84672900	84433210	84716090
	62061000	94059940	62064030	85365090	85285930	84733091
	95051050	49019900	61083100	87120015	85182100	85184020
	94017900	61159690	97060000	90041000	85340000	
	71179075	39249056	39253010	85165000	85176100	
	95049040	94034090	62034340	84314380	84733051	
	69120048	95063900	95049060	87083050	84718010	
	64039130	39269075	84145960	85442000	85078080	
	84818010	94035090	94039070	84439950	90138070	
	64029990	73170055	49030000	87087045	85044085	
	48194000	62046335	64029931	84672100	85081100	
	84818030	83024230	71131950	84186901	85393100	
	42021280	64039990	65059020	84159080	84713001	
	73042910	95051025	42029290	84439920	85198930	
	63079089	39239000	94051060	84139190	84433100	
	63079098	62044910	94052080	87082950	85285915	
	94012000	64039960	83063000	85167900	85271360	
	61109090	74111010	61012000	84148016	85177000	
	62044340	61103030	62029345	73063050	85182200	
	42031040	42023160	62121090	87032100	84716020	
	64029140	72139130	62104050	84672200	85272140	
	42022245	94017100	94033080	84433990	85423100	
	42022280	66011000	83062900	87120035	84717050	
	94019050	95059060		85094000	85423200	
	39261000	94032000		84151030	85258040	
	94016160	76169950		85098050	85258030	
	94037080	94036080			85423900	
	94038960	73239930			85286100	
	73181520	95063100			85219000	
	94054060	39241040			85166040	
	62044230	39231000			84729090	
	73211160	63039220			84717060	
	73239990	96039080			90191020	
	67029035	61051000			85176900	
	94016140	84819090			85171100	
	95069955	62019330			85182980	
	64042040	76151930			85279160	
	71171990	95069100			85044070	
	62046240	94055040			85176200	
	61109010	63026000			84714101	
	73269085	94049085			85299099	

Notes

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[i] Source: International Financial Statistics Database, 2009.

[ii] Given the continuing enlargement of the EU, which has in recent years incorporated economies with relatively low per capita incomes, the sample of EU economies is confined to the 15 countries which were members at the introduction of the Euro in 2000.

[iii] The US data is collected from from http://dataweb.usitc.gov/; and the Japanese data from http://www.customs.go.jp/toukei/info/index_e.htm.

[iv] This China-lens for the identification of sectors differs from the earlier Kaplinsky-Santos-Paulino study (Kaplinsky and Santos-Paulino, 2005 and 2006) which examined price trends for a set of products defined by the trade-specialisation of low income economies.

[v] Outlier sectors are also excluded by Broda and Weinstein (2009).

[vi] By number of sectors, low tech products comprise 56.4 percent of the total sample of the analyses products, as defined by China's export structure; this was followed by resource-based products (16.7 percent), high-tech products (14.9 percent) and medium-tech (12 percent).

[vii] Experiments using other technology group as the base group are also carried out. All the results suggests no significant difference in average prices change rates across different technology groups.

[viii] Unit roots tests suggest that most of the unit prices are also stationary in logarithm at zero order.