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Price competitiveness and pricing to market in Taiwan

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Price Competitiveness and Pricing to Market In Taiwan

by

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Abstract

Price Competitiveness and Pricing to Market In Taiwan

by
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This paper develops models of exchange rate pass-through and pricing to market for small open economics, that allow for imperfect competition in markets for traded goods. It applied these models to Taiwan and shows that Taiwanese firms more likely act either as Bertrand competitors with capacity constraints or as price takers in their export markets. The paper also investigates exchange rate pass-through and pricing by Taiwanese firms in export and domestic markets. The paper reports equations explaining exchange rate pass-through and the margin between export price and domestic price for a wide range of commodities in Taiwan. Empirical evidence shows (1) partial exchange rate pass-through does not necessarily mean pricing to market. (2) Taiwanese firms respond to changes in real exchange rates by pricing to market, varying their export price in the NT dollar relative to their domestic prices. (3) Real wage rates and real incomes play important roles in pricing . That is indicated by increases in domestic prices relative to export prices, due to higher growth rates of real wages and real incomes in Taiwan than in its major trade partners . The results suggest that Taiwanese firm are losing their comparative advantage in many traditional products owing to rapid increases in labor costs and exchange rate appreciations in 1986-92.

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1. Introduction

One of the cornerstones of international economic theory is the notion of the law of one price, which states that the same good selling in two different countries should sell for the same price in common currency units, aside from allowances for transportation costs and tariffs. However, recent empirical studies have found substantial divergences from the law of one price across countries for many commodities. Not only are these price differentials too large to be explained solely by transportation costs and trade taxes, but they seem to persist for long period of time.

Divergent price movements for an identical commodity sold by a country in different markets have been termed "pricing to market" (PTM) by Krugman (1987). PTM shows price discrimination that violates the law of one price. In general, price discrimination can occur if (i) the industry is imperfectly competitive, so that firms can set prices rather than taking prices as given in markets; (ii) markets must be segmented, so that domestic residents can not purchase goods intended for sale in other markets. Thus a monopolistic firm is able to maximize its profit by setting different prices in a number of segmented markets in which it faces different downward-sloping demand schedules (Krugman & Obstfeld 1991). In segmental markets, if firms face different levels of competition in different markets, they may charge domestic prices different from export prices for identical goods in common currency units. Price may vary in reflection of market power in different markets, even firms act as price takers, rather than price setters, in their export or foreign markets. This phenomenon is widely observed in exports by small open economies. This paper tries to provide an empirical study of PTM behavior of Taiwan.

Most existing studies of price discrimination have emphasized exchange rate pass-through effects on the export (or US import) prices in industrial countries [1]. The relationship between changes in nominal exchange rates and changes in export (or import) prices, is known as the "pass-through" relationship. Pass-through is broadly defined as the extent to which how a change in the nominal exchange rate is reflected in the export (or import) price. It is obvious that the dramatic swings in currency values in the last two decades have meant that firms have faced large changes in exchange rates that affected their export prices of their products in domestic currency. In order to remain competitive in export market, many firms have followed pricing strategies to keep export prices competitive (relatively constant in most cases) despite fluctuations in exchange rates. In other words, the pass-through of exchange rate changes to their export prices is only partial. In response to an appreciation of the domestic currency, for example, firms have reduced the domestic currency prices of products destined for export markets to limit increases in the foreign currency prices of these products. And an exchange rate partial pass-through suggests that firms sustain shifts in the profit margins on their exports as exchange rates change. Exchange rates pass-through, however, only look at firms' pricing behavior in export markets. Firms may charge different prices in different markets only under either of the following two assumptions: (1) these firms produce only exported goods, they may charge different prices by different degree of exchange rates pass-through in their export markets; (2) the products produced by these firms are sold in both domestic and foreign markets, they may charge different prices in export markets from those in their domestic market in terms of their home currencies when their domestic prices are sticky. If firms sale their products in

[1] See, for example, Baldwin (1988), Froot and Klemperer(1989),Hooper and Mann(1989), Hong,Kim and Ohno(1993).

both domestic and foreign markets, and make corresponding changes in their domestic prices, partial pass-through need not represent pricing to market, which is defined as the price differentials for an identical commodity sold by a country in different markets. Thus, partial exchange rate pass-through or none at all is implied by pricing to market in many cases, but partial pass-through does not imply pricing to market. In order to investigate pricing to market in more general sense, we should consider firms' pricing behavior in their domestic market responding to changes in exchange rates and other real factors. Therefore, it is more reasonable to examine how changes in the exchange rate affect export prices relative to domestic prices and to compare these effects with exchange rate pass-through effects. So far little literature has studied exchange rate effects on the export-domestic price ratio [2]. In addition, existing studies focus only on examining pricing to market behavior in the industrial countries. It is worth to extend the study to LDCs such as Taiwan.

Taiwan has had a floating exchange rate system since 1979. From 1986 to 1992, the N.T. dollar appreciated by 40% in terms of the US$ ("Commodity-price Monthly in Taiwan Area of Republic of China", Republic of China, Executive Yuan). In a wide range of exported goods, domestic prices increased faster than export prices in terms of home currency in this period. Taiwan's exports apparently depend more on price competitiveness than on quality competitiveness. One possible explanation is that higher substitution elasticities of Taiwanese exported products force Taiwanese firms to keep prices constant in foreign currency when the N.T. dollar appreciates.

Although most industries in Taiwan are made up of large numbers of small plants, a

[2] An exception is a paper by Marston (1990). See discussion in section 2.

small number of the Taiwanese firms contributed a large share of total production. According to "The Report on Middle and Small Firms, 1992", which published by Economic Ministry of Republic of China, about 4% of firms accounted for 66.34% of the total domestic output and 44.08% of total exports in 1992. For this reason, the total number of plants may be a misleading indicator of the extent of competition in Taiwanese industries. It is thus appropriate to avoid the assumption of perfectly competitive behavior.

The Taiwanese government plays a very important role in creating segmented markets by export subsidies, and various visible and invisible barriers to deter imports. But the government has reduced controls on trade dramatically since 1980 (Tsiang, 1984 & Liu, 1992). Discriminatory trade policy does not seem to explain the recent facts of price discrimination in Taiwan.

This paper examines the PTM behavior of Taiwanese firms in the period of 1986-92 using an unusually detailed set of export and domestic price data published by Executive Yuan, Republic of China.. First, the paper develops empirical models to quantify the effects of exchange rates pass-through on export prices and the effects of exchange rate on export-domestic price ratios for small open economies. It then distinguishes exchange rate pass-through and pricing to market due to changes in the exchange rate by comparing both effects at the commodity group level. Second, instead of focusing only on the exchange rate influence on prices, I develop a model originated by Richard Marston (1990) and investigates how the exchange rate and real factors in both demand and supply side affect the export-domestic price ratio in Taiwan based on the following hypotheses:

(1) A firm can set different prices for its products in its domestic and export market by if it

faces different demand functions in both markets.

(2) Nominal exchange rate surprises after price setting lead to the export-domestic price ratio deviating from the law of one price. But the effects of unanticipated changes are later reversed once firms have an opportunity to change prices. Real exchange rate changes lead to permanent changes in the ratio of export to domestic price, i.e. these changes in the price ratio last for ever.

(3) The magnitude and timing of price discrimination depend upon the size of profit margin, which is determined by comparative advantages in production cost and by market structures. The bigger the profit margin, the larger is the room for firms to adjust to offset exchange rate changes. With higher economic growth rate in a developing country such as Taiwan, real wages and real incomes have been growing more rapidly than in her major export destination countries. Thus, Taiwan's comparative advantage in producing traditional export goods is declining and price differences between the domestic and foreign market for those goods are shrinking. The paper emphasizes the real factors that affect marginal costs on the supply side, such as real wages and labor productivity, rather than the sunk costs of entering markets (Baldwin 1988).

This paper also presents empirical evidence to support the above hypotheses, especially (3) , which Marston did not focus on.

The rest of the paper is organized as follows. Section 2 reviews the existing literatures relating to pricing -to-market. Section 3 develops an exchange rate pass-through model for small open economies. Section 4 develops a pricing-to-market model for imperfect competition in markets. Section 5 contains the empirical results and discussion. The final section contains summary of major results and concluding remarks.

2. Literature Review

The law of one price is an important principle in trade-theory. The law of one price is asserted in the Purchasing Power Parity (PPP) theory developed by the Swedish economist Gustav Cassel (1916). It states that in competitive markets free of transportation cost and official barriers to trade, identical goods sold in different countries must sell for the same price when their prices are expressed in terms of the same currency. Under the law of one price, if the exchange rate changes and domestic prices remain unchanged, the export price changes one for one: pass-though of the exchange rate change to export prices is 100 percent. The PPP doctrine relies on the law of one price in an integrated, competitive market. If the prices of each good, in one currency, are equalized across countries, and are combined with the same weights to form aggregate price levels, then absolute PPP prevails: $E = P/P^*$ and real exchange rate $R=(EP^*/P)=1$, where P is the domestic price level and P^* is the foreign price level.

In recent years, there has been a significant literature on microeconomic price linkage for tradable goods across different national markets under exchange rate variability. Kravis and Lipsey (1978) and Isard (1977) tested the law of one price at very high levels of disaggregation of manufacture goods. The studies established for the same good (or highly substitutable goods) quite persistent price discrepancies between domestic and export prices, between domestic and import prices, and between export prices to different markets. Krugman (1986) examined a variety of static and dynamic models illustrating aspects of the relationship between currency fluctuation and import price changes; he emphasized that the phenomenon of exchange rate pass-through was an area in which the newer models of international trade theory would find a ready application.

The relationship between changes in export (or import) prices in foreign currency (or domestic currency) and changes in exchange rates is termed exchange rate pass-through. It is widely observed that import or export prices do not reflect exchange rate fully, which means that the exchange rate pass-through is not equal to one. If changes in domestic prices do not fully match the residual between one and the extent of a partial exchange rate pass-through, then the law of one price does not hold even for tradable goods [3]. The difference in movement between domestic and export prices can be interpreted as reflecting changes in export profit margins, which cause price discrimination in domestic and export markets in a common currency. Catherine Mann (1986) pointed out that this behavior is consistent with the prediction of theoretical models in which export goods are produced and sold under conditions of imperfect competition and macroeconomic uncertainty. She reviewed both aggregate and industry-specific data on U.S import prices in period 1977-1985 by using foreign consumer prices as a proxy of foreign production cost and fond that exchange rate changes had been absorbed into profit margins of foreign suppliers (the difference between import price and foreign consumer prices) to a considerable extent and for relatively long period.

Krugman (1987) established the basic model about PTM based on Cournot competition. According to his discussion, pricing to market will be more likely to happen where there are substantial specific costs to entering a market, so that ex ante (before exchange rate changes) and ex post (after exchange rate changes) demand elasticities are different. Eric Fisher (1988) used

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[3] For example, in response to an appreciation in home currency, exchange rate only pass through to export price of good A in foreign currency by 80%, i.e., 1% appreciation of home currency only raise the price in foreign currency by 0.8%, the exporter would lose profit margin by 0.2% if the domestic price remains unchanged. In other words, the export price in terms of home currency is 0.2% lower than the domestic price for the same good. If the domestic price also declines by 0.2% , the law of one price still holds and the profit margin remains unchanged. Further discussion see section 3.

Bertrand model to explain that exchange rate pass-through depends upon market structure. "In particular, the model shows that oligopolists use their market power to set prices in anticipation of exchange rate movements; ..."

Baldwin (1988) extended Krugman's supply-side dynamics study on PTM behavior by "the beachhead model". He showed that a large enough exchange rate change, even if it is temporary, can have persistent effects on import prices and quantities. Specifically, if market-entry costs are sunk (they are already in markets and independent of the exchange rate), when an appreciation of the home currency are sufficient to reduce foreign firms' marginal cost (lower exchange rate in home currency reduces foreign costs measured in home currency) , more foreign firms enter the home market. The increasing number of firms will raise perceived elasticities and alter market structure, and thereby push prices down due to a more competitive market (from the Chamberlain assumption (1933)). As a result, large exchange rate shocks can have persistent real effects. " After the overvaluation passes, the marginal costs return to their original level. However, m (numbers of firms in the market) is still higher so the post-shock prices is permanently lower than the pre-shock price. This is hysteresis." Exchange rate pass-through is partial because of sunk market-entry cost. However, with the market being more competitive, pass-through increases.

Froot and Klemperer (1989) focused on dynamic demand-side effect in an oligopolic market. They investigated the pass-through from exchange rates to import price (in the U.S. market) when firms' future demand depended on current market shares. They stressed that the return a firm expects to earn with its current investment in market share was sensitive to the expected future exchange rate. In their model, investment in market share was different from

that in Baldwin's supply-side model. Investment was purchase of consumer allegiance, such as improve the reputation of products or consumer loyalty to the products, rather than sales infrastructures. More stable prices in domestic currency (the US dollar) would help raise foreign importers' market share in the US market. In response to a temporary appreciation in home currency (the US dollar), foreign firms (importers) would find investment in market share less attractive due to future dollar profit relatively less valuable than current dollar profit, and would prefer instead to raise current prices in the US dollar and let their current profit margin grow. When an exchange rate appreciation was thought to be permanent, foreign firms would attempt to gain more market share (or future income) by lowering their current prices in US dollar. Therefore, the exchange rate pass-through was smaller in permanent appreciations. Unfortunately, their empirical exchange rate pass-through test based on UK, west Germany, France, Japan and US export data do not lend much support to the model.

There have been empirical studies on Japanese manufacturing firms in export and domestic markets (Marston 1989), German (Krugman 1987; Kentter 1989) and other industrialized countries' manufacturing-good exporters in the United States market (Froot and Klemperer 1989). The above studies about PTM focus on the role of market structure in trade only in industrialized countries.

Hooper and Mann (1989) provided empirical estimations of the "pass-through" of fluctuations in the dollar exchange rate to U.S. import prices by using data for top nine suppliers of U.S. imports of manufactured goods , which included Taiwan and Korea. They found that some 50 to 60 percent of a change in the exchange rate was reflected in the prices of manufactured imports. Their results suggested that foreign firms on average sustain

substantial shifts in the profit margins on their exports to the United Sates as exchange rates changed. In their study, however, the import price index was a fixed-weight index that was dominated by industrial countries. The markup model in their paper might not be applicable for small open countries like Taiwan and Korea. They, entering the U.S. market, will sell at prices over which they have little control. The effect of exchange rate changes, then, will be on the quantity they choose to sell rather than on the price at which they sell.

Hung, Kim and Ohno (1993) found, in a cross-country study, that coefficients of pass-through in smaller, more open countries , such as Taiwan and Korea, were as small as those in industrial countries. Their study also found that smaller countries tend to base their export pricing decision on the foreign competitor's price rather than on their domestic cost. Their study on the pricing of exports was performed at a high level of aggregation using the export unit value index as a proxy for the export price index. That procedure caused a serious index problem , as they admitted. The uneven sectoral growth and the changing structure of exports had strong effects on the commodity mix and thereby on the export unit value index. Thus the export unit value could yield an index that is quite different form those using a fixed weighing scheme (Lipsey 1990). Changing commodity mix can make the export unit value a misleading measure of export prices, especially for tests on the law of one price.

This paper tries to develop models for exchange rate pass-through and PTM for smaller, more open economies. In order to avoid index number problems, the exchange rate pass-through and other effects on export domestic ratio are estimated at the most disaggregated commodity level possible.

3. A Model of Exchange Rate Pass-through

Pass-through can be broadly defined as the extent to which a change in the nominal exchange rate induces a change in the export price (in foreign currency) of a home firm. Since most existing empirical studies pointed out that the temporal shifting of profits , which reflects in partial exchange rate pass-through, is a source of pricing to market, it is plausible to begin with analyses on exchange rate pass-through. In this section, I have chosen to focus the narrower definition of pass-through as the partial derivative of the export price with respect to the nominal exchange rate in a model that relates export price to the exchange rate and other variables. Because exchange rate pass-through focuses mainly on firms' behavior in export markets, thus I consider home firms as export firms that produce exclusively for foreign markets. I assume that there are n home firms and n* foreign firms producing a homogeneous good in the *i*th industry, n and n* may be one or bigger than one. The home firms produce in the home country at marginal cost MC_i but sell in the export or foreign market at a price P^*_i expressed in home currency. The foreign firms produce in the foreign country at marginal cost MC^f_i , which may be different from MC_i/E (where E is the nominal exchange rate), but also sell in the foreign country at a price P^f_i in terms of foreign currency.

Demand for good i in the foreign market is given by $D^*(P_i)$, where P_i is the equilibrium price of good i expressed in foreign currency in the foreign market. $D^*(P_i)$ is assumed to be continuous and non-increasing. In order to simplify the following discussion, the demand function places the analysis within the framework of partial equilibrium without income effect. Because the products are identical, we can start with analysis of Bertrand competition. The firm with lowest price make all the sales. In order to study exchange rate pass-through, the

following three factors that affect exporter's price setting should be considered: marginal costs of home and foreign firms, home and foreign firms' price offers, and capacity constraints of these firms. We assume that changes in the exchange rate are exogenous. This section tries to develop a model to explain exchange rate pass-through in small open economies based on the analysis of these three factors .

We begin with a simple model of exchange rate pass-through based on the analysis of Bertrand competition with no capacity constraints, as was discussed by E. Fisher in 1988[4]. If there are one or more home (foreign) producers with no capacity constraints, then, in equilibrium, either (i) no home (foreign) firm has positive sales (ii) the best offer by a home (foreign) firm is an offer at its marginal cost that is lower than a foreign (home) firm's marginal cost. Then the equilibrium (foreign currency) price in the export or foreign market is given by:

$$P_i(E;\ P^*_i, P^f_i) = \min\left(\frac{P^*_i}{E}, P^f_i\right) = \min\left(\frac{MC_i}{E}, MC^f_i\right). \qquad (1)$$

where P^*_i and P^f_i are, respectively, the best home and foreign firms' offers; MC_i and MC^f_i are, respectively, the marginal costs of home and foreign firms [5].

The intuition behind equation (1) is simple enough. Because segmented input markets cause difference in marginal cost across countries, the best offer by a home competitor can be above domestic marginal cost and still have some chance of beating the best foreign offer when the domestic marginal cost is lower than the foreign marginal cost. In that case, the best

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[4] Fisher discussed pricing behavior of home and foreign producers in both home and foreign markets. Since my paper only discuss the pricing behavior of Taiwanese firms in export markets, I only follow his discussion on foreign or export markets.

[5] The marginal cost of home firm includes transportation cost and tariff.

response of a second home competitor will be to undercut the first. This allow only for offers at the lowest marginal cost in equilibrium. With an appreciation of home currency, the export price of home products increases if there is any exchange rate pass through. However, the magnitude of pass-through depends on the gap between marginal cost of home and foreign firms. For example, if a complete pass-through of an appreciation would cause the export price (in foreign currency) to rise above the marginal cost of foreign rival, the home firm would allow the exchange rate to pass only partially through or not at all to its export price, in order to make a sale in the foreign market. In other words, the home firm would absorb a change in the exchange rate partially or completely from its profit margin.

Since small open economies, such as Taiwan, have capacity constraints, Fisher's discussion is not a proper explanation on exchange rate pass-through for those countries. The model I develop in this section focuses on the effects of capacity constraints on exchange rate pass-through, a subject that has not been applied to empirical work in this field.

Assume that there are two or more home (foreign) firms, and home firms have capacity constraints but foreign firms have no capacity constraints, and both home and foreign firms produce identical goods. The equilibrium price with positive sales in the export or foreign market is given by the best offer of foreign firms, which is at their marginal costs. Then the equilibrium price is given by:

$$P_i(E; P^*_i, P^f_i) = \frac{P^*_i}{E} = P^f_i = MC^f_i. \qquad (2)$$

Because home firms have small capacity constraints and their foreign rivals have no capacity constraints, the market price is determined by foreign firms. If a home firm sets its

price higher than a foreign rival's, it can not make any sale in the market. If a home firm set its price lower than a foreign rival's, it would make sales under the foreign rival's price. But since the home firm's capacity is too small to determine the market price, the home firm can not profit form the lower price. Thus the home firm would prefer to follow the foreign rival's price. Equation (2) makes the positive prediction that the observed exchange rate pass-through will be lower if home firms have smaller capacity constraints and lower marginal costs than its foreign rivals. This occurs, of course, because the smaller capacity constraints of home firms, the weaker the market power they have to affect the market price. When the numbers of home export firms and foreign firms are big enough, the export or foreign market is perfect competitive. In that case, home exporters are more likely to act as price takers. In order to make sales in the export or foreign market, home firms have to absorb changes in the exchange rate by their profit margins (from the lower marginal cost than foreign firms) to make their price equal to the foreign competitors' price.

The latest empirical study provides evidence to support the discussion of the equation (2). According to Hung-Kim-Ohno's empirical findings, Taiwanese exports have a long-run relationship only with competitors' prices but not with domestic costs [6]. Because most exported products from Taiwan are low quality goods, it suggests that Taiwan's export goods are easily substituted for by those of foreign competitors, especially by those of other LDCs' competitors which have marginal costs similar to Taiwanese firms. Therefore, Taiwanese firms are more likely to act as Bertrand competitors with capacity constrains or price takers in their export

[6]Hung, Kim and Ohno (1993) estimate the long run effects of domestic costs, exchange rate and foreign competitors' price on the export prices by restricted error correction models. Their results reveal that there is no significant cost effect on the export prices in Taiwan,which implies that Taiwanese exporters' price setting rely on the foreign competitors' prices rather than their domestic costs.

market.

Perfect competitions in both foreign and home markets does not means perfect competitions across markets. Geographic barriers to the movements of inputs, such as labor and land , cause differences in wages and rents and thereby in the marginal costs of producing the identical goods in different countries. Only in the case that there are perfect competitions across the countries and thereby the marginal costs (in common currency) to produce a identical product are the same in both home and foreign countries, can a percentage change in the exchange rate produce the same percentage change in home marginal cost relative to foreign marginal cost. In that case, a change in the exchange rate will pass fully through to the export price of home firms[7]. The equilibrium price in foreign currency can be written as:

$$P_i(E; P^*_i, P^f_i) = \frac{P^*_i}{E} = MC_i = P^f_i = MC^f_i. \qquad (3)$$

The intuition behind equation (3) is that perfect competitions across markets will tie both home and foreign firm's price offers (in common currency) down to the same marginal costs. Therefore the law of one price holds.

In order to quantify the effects of exchange rate pass-through on the export price,i.e. how changes in exchange rate are reflected in changes in export prices, the exchange rate pass-through coefficient is introduced. The exchange rate pass-through coefficient can be defined as the percentage change in the export price divided by the percentage change in the exchange rate:

This equation defines pass-through coefficient in terms of changes in home currency

[7]If $dLnE = dLn(MC_i/MC^f_i)$ or $dLn(MC_i/E) = dLnMC^f_i$,i.e.the percentage changes in home marginal cost is equal to that in foreign marginal cost, with both being expressed in foreign currency, then $dLn(P^*_i/E) = dLnP^f_i$ or $dLnE = dLn(P^*_i/P^f_i)$ by definition of perfect competition, in which the price equals the marginal cost

$$\rho(E) = dLn(P^*_{it}) / dLn(E_t) \quad (4)$$

price. It could be defined equally well in terms of foreign currency price changes:

$$\rho(E^*) = dLn(P^*_{it}/E_t) / dLn\ E_t = dLnP^*_{it}/dLn\ E_t - 1 = \rho(E) - 1 \quad (5)$$

We can interpret the meaning of the pass-through coefficient by considering the following cases.

Case 1: $\rho(E)=0$ or $\rho(E^*)=-1$. There is no any exchange rate impact on export prices in terms of domestic currency. In other words, changes in exchange rates pass through fully to export prices in terms of foreign currency. The pass-through effect is 100%. For instance, a decrease in exchange rate E or an appreciation of the domestic currency by 1% will push export prices up by 1% in terms of foreign or buyer's currency. The law of one price holds in this case if the domestic price is stable. This case can be explained by equation (3).

Case 2: $0<\rho(E)<1$ or $0>\rho(E^*)>-1$. Changes in exchange rate will pass through partially to export prices in home and foreign currency, respectively. So the Pass-through effect is less than 100% and the law of one price may not hold. A decline in exchange rate or an appreciation of the domestic currency by 1% will cause export prices in terms of domestic currency to fall less than 1% and export prices in terms of foreign currency to rise less than 1%. In this case, domestic firms absorb part of exchange rate impact by their price offers in terms of home currency, if their production costs are sticky. In other words, they absorb exchange rate shocks by adjusting their profit margins.

Case 3: $\rho(E)=1$ or $\rho(E^*)=0$. Changes in exchange rate will pass through completely to export prices in terms of home currency but not at all to export prices in terms of foreign currency.

This is the reverse of case 1. In order to keep export price in terms foreign currency constant, firms absorb all exchange rate shocks by their price in terms of home currency.

Case 4: $\rho(E)>1$ or $\rho(E^*)>0$. Changes in exchange rate will pass through to export prices in home currency more than 100 % [8]. This is a case that exporters cut their price (in foreign currency) in the foreign market while the exchange of home currency appreciates. Existing studies provide dynamic explanations from aspects of market structural changes: (1) on the supply side, if market-entry costs are sunk, a huge appreciation in home currency will cause more home firms enter the foreign market (lower exchange rate reduce the exporters' market-entry cost in home currency) and thereby push prices in foreign currency down after the exchange rate shock (Baldwin 1988); (2) on the demand side, when the home firms expect an exchange rate appreciation to be permanent, the current and future costs to purchase consumer allegiance (in foreign currency) fall, then they will prefer to cut current price (in foreign currency) to win new market share (Froot and Klemperer 1989). In addition, if an exported goods has a high substitution elasticity, the export price in foreign currency depends more upon other rivals' price offers. In the case that other foreign competitors lower their prices, a home firm has to lower its price (in foreign currency) even though home currency appreciates, which is indicated by equation (2) . Since most Taiwanese products are low quality goods, it is unlikely that there is significant sunk costs and costs to purchase consumer allegiance for their products. Hence equation (2) seems to provide a most possible explanation for this case.

Case 5: $\rho(E)< 0$ or $\rho(E^*)< -1$. This is the case that export prices in home currency decline (rise) in response to the exchange rate depreciation (appreciation) . In terms of foreign currency,

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[8] $\rho(E^*)>0$ means $dLnP^*_{it}/dLnE_t > 1$ from equation 9.If $dLnE_t < 0$ (appreciations of home currency), then 1% of exchange rate drop will cause more than 1% decline in export prices expressed in home currency.

one percent depreciation (appreciation) in the exchange rate leads to more than one percent decrease (increase) in export prices. So far I have not found any empirical evidence to support this case [9].

4. A Model of Pricing to Market

Pricing to market concerns price discrimination in the two markets. The discussion on the exchange rate pass-through in section 3, however, tells one side of the story only, which focuses only on the export or foreign market. Although partial exchange rate pass-through causes pricing to market for many commodities[10] , partial pass-through need not represent pricing to market, if the home firms also make corresponding changes in their prices in the home market. In this case pricing behavior in the two markets will be identical, and there will be no pricing to market. This section tries to develop a model to discuss how changes in the exchange rate and other real variables affect changes in export prices relative to domestic prices for home firms.

Segmentation of input markets which cause different marginal costs across countries, and segmentation of final good market due to transportation costs and policy factors such as tariffs, provide possibilities that a firm may set different prices in domestic and foreign markets even though it is not able to monopolize any market. As long as product arbitrage by third parties is ineffective, the firm will in general set different prices, expressed in home currency, in two markets. We can use the following ratio of the export to the domestic prices of the same good

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[9] In the empirical results from Hooper-Mann (1989) and Hung-Kim-Ohno (1993), all pass-through coefficients (ρ(E)) were positive. I also find all the pass-through coefficients of the chosen commodities in Taiwan, which are statistically different from zero, to be positive in the following empirical study.

[10] In my empirical study for 34 commodities, 21 of 23 goods with PTM coefficients significantly different from zero (in Table 3), which means that the law of one price does not hold for those products, are of partial exchange rate pass-through (in Table 2).

to measure pricing to market behavior:

$$X_{it} = \frac{P^*_{it}}{P_{it}} \qquad (6)$$

It is also termed the export-domestic price margin.

4.1 *Pricing to Market:* Price Elasticity Differential in two Markets.

Pricing to market, which involves divergent price movements in different markets, can be seen most simply if we begin with the case of a monopolistic firm in the ith industry in the domestic country but selling in both domestic and export markets. Transport costs will be ignored, although we assume that consumers are not able to arbitrage goods across markets.

Assume at time t, the firm sells in the domestic market at price P_{it} and in the export market at price P^*_{it}, with both prices being expressed in domestic currency. The firm is assumed to produce in the domestic country subject to the cost function $C[Q_{it}+Q^*_{it}, W_{it}, r_{it}]$ and to face demand functions, $Q(P_{it}/P_t, Y_t)$ and $Q^*(P^*_{it}/(E_tP^*_t), Y^*_t)$, in the domestic and foreign market, respectively. P and P* represent general price levels in the domestic and foreign market, and Y and Y* are real income in the home and foreign countries, and E is the nominal exchange rate. The profit function of the firm can be written as:

$$\Pi_{it}=Max(P_{it}Q_{it}[P_{it}/P_t, Y_t]+P^*_{it}Q^*_{it}[E_tP^*_{it}/P^*_t, Y^*_t]-C[Q(.)+Q^*(.), W_t, r_t]) \qquad (7)$$

where Π_{it} is profits in terms of domestic currency, W_t and r_t are wage and capital price, respectively.

The first-order conditions from the profit functions of domestic firms in equation 7 can be written in terms of two price functions expressed in domestic currency:

$$P_{it} = MC_i \ [\epsilon_{it}/(\epsilon_{it}-1)] \quad (8)$$

$$P^*_{it} = MC_i \ [\epsilon^*_{it}/(\epsilon^*_{it}-1)] \quad (9)$$

Where MC is marginal cost, ϵ_{it} and ϵ^*_{it} are the price elasticities of demand for good i in the home and foreign markets, respectively. The price in the home market is generally not independent of the export price in the foreign market because each is tied to a common marginal cost. However, each price also depends on the shape of the demand curve in the market, which is indicated by the price elasticity ϵ_{it} (or ϵ^*_{it}).

The price of domestic goods relative to that of export goods in terms of the domestic currency or domestic-export price margin can be written in terms of the price elasticities of demand in the domestic and foreign markets [11]:

The influence of marginal cost and price elasticity can be tested by total differentiating the above equations:

$$dLn(P_{it}) = dLn(MC) - [1/(\epsilon_{it}-1)]\,dLn\ (\epsilon_{it}) = dLn(MC) + \beta\ dLn\ (\epsilon_{it}) \quad (10)$$

$$dLn(P^*_{it}) = dLn(MC) - [1/(\epsilon^*_{it}-1)]\ dLn(\epsilon^*_{it}) = dLn(MC) + \beta^*\ dLn(\epsilon^*_{it}) \quad (11)$$

If both domestic and foreign demand curves have constant price elasticities, changes in the export and domestic prices are tied to changes in a common marginal cost and percentage changes in both prices are the same: dLn X_{it}=dLnP^*_{it}/dLnP_{it}=1. Thus the ratio of the two prices is constant; that is, there will be no pricing to market.

[11] This equation was present in Krugman's static model (1987). The dynamic model will be discussed in the following section.

However, when price elasticities vary with the market, a monopolist is able to charge different prices in different market for the same good by his perception of the shape of the demand curve.

To make the point more clearly, let us assume that a monopolistic firm has a constant marginal cost in its domestic currency. Then, from equation (8) the relationship between domestic price and price elasticities can be written as:

$$d(P_{it})/d(\epsilon_{it}) = -MC/(\epsilon_{it}-1)^2 \qquad (12)$$

Thus, there is a negative correlation between the domestic price and domestic price elasticity. We can derive the similar result for the export price and export price elasticity.

In principle, price-discriminating monopoly can explain pricing to market by different price elasticities of demand he faces in different markets. But I would prefer to extend my study in more general case. One possibility is from considering market share in an oligopolistic market.

Total demand for ith good in the home market can be defined as a sum of the demand for the home product and the demand for import product from foreign producers:

$$q_{it} = \sum_j Q_{ijt} + \sum_j Q^d_{ijt} \qquad (13)$$

The jth firm has a profit function illustrated by equation 7. For maximum profits we will require:

and $d^2\Pi_{ijt}/dQ^2_{ijt} > 0$, for all i,j.

Rearranging (15) by using equation (14), we have:

where q_{it} is total demand for the ith good in the domestic market, and Q°it is the other firms'

$$\frac{\partial(\Pi_{ijt})}{\partial(P_{it})} = Q_{ijt} + P_{it}\frac{\partial(Q_{ijt})}{\partial(P_{it})} - \frac{\partial(C_{ijt})}{\partial(Q_{ijt})}\frac{\partial(Q_{ijt})}{\partial(P_{it})} = 0 \qquad (14)$$

$$P_{it} = \frac{\epsilon_{it}}{\epsilon_{it} - s_{ijt}(1 + \partial Q^{o}_{it}/\partial Q_{ijt})} MC_{it} \qquad (15)$$

$$P_{it} = \frac{\epsilon_{it}}{\epsilon_{it} - s_{ijt}(1 + \partial Q^{o}_{it}/\partial Q_{ijt})} MC_{it}\left[\frac{\partial q_{it}}{\partial P_{it}}\frac{P_{it}}{q_{it}} - \frac{\partial Q^{o}_{it}}{\partial P_{it}}\frac{P_{it}}{Q^{o}_{it}}\right] \qquad (16)$$

output in the domestic market. Thus, the first order condition from the profit function of domestic firm in the domestic market can be rewritten as follows [12]:

For the jth firm's export product, the similar result can be derived as:

$$P^{*}_{it} = \frac{\epsilon^{*}_{it}}{\epsilon^{*}_{it} - s^{*}_{ijt}(1 + \partial Q^{*o}_{it}/\partial Q^{*}_{ijt})} MC_{it} \qquad (17)$$

where ϵ_{it} (ϵ^{*}_{it}) is the market price elasticity of demand in the domestic market (foreign market) for the ith good and s_{ijt} (s^{*}_{ijt}) is the share of the jth firm in the domestic market (foreign market). Thus pricing to market can be explained by the differences in price elasticities, market shares and conjectural variations if the number of firms is greater than one in each market.

If firms compete in Cournot fashion, in which each firm taking the other firm's deliveries to the market as given. This means that $\partial Q^{o}_{it}/\partial Q_{ijt} = 0$ or $\partial Q^{*o}_{it}/\partial Q^{*}_{ijt} = 0$ for all j; so the conjectural variations term is zero. Then the pricing rules of the domestic firm will be:

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[12] From equation 14, the market price elasticity for the ith good can be represented as a weighted average of individual price elasticities: $\epsilon_{it} = \epsilon_{ijt} S_{ijt} + \epsilon_{iot} S_{iot}$, where ϵ_{ijt} , ϵ_{iot} is the price elasticity for firm j and others, and S_{ijt} , S_{iot} the share of the jth firm and others in the domestic market. We also consider the effect of the ith firm's output on other firms' outputs: $dq_{it}/dQ_{ijt} = dQ_{ijt}/dQ_{ijt} + dQ^{o}_{ijt}/dQ_{ijt}$, dQ^{o}_{ijt}/dQ_{ijt} is called the conjectural variation term (see Michael Waterson 1984). It reflects the jth firm's guess about how the others will react to its output changes. The conjectural variation term can be represented by shares and elasticities as following: $dQ^{o}_{ijt}/dQ_{ijt} = \epsilon_{iot} S_{iot}/\epsilon_{ijt} S_{ijt}$ or $dQ^{o}_{ijt}/dQ_{ijt} = \epsilon_{iot} S_{iot}/(\epsilon_{it} - \epsilon_{iot} S_{iot})$. Equation 17 can be obtained from equation 16 by combining the conjectural variation terms discussed above.

in the domestic market and

$$P^*_{it} = \frac{\epsilon^*_{it}}{\epsilon^*_{it} - s^*_{ijt}} MC_{it} \qquad (18)$$

in the export or foreign market.

The basic rule of Cournot competition in the constant elasticity case is that the jth firm will face perceived elasticities of demand ϵ_{it} / s_{ijt} in the domestic market and $\epsilon^*_{it} / s^*_{ijt}$ in the foreign market. The implication of (19) and (20)is that higher the market share, the lower the elasticity of demand perceived by the domestic firm and thus the higher its price for any given marginal cost (See Krugman 1987). The relative price of domestic to export goods in terms of the domestic currency or domestic-export price margin can be written in terms of the price elasticities of demand and the market shares in the domestic and foreign market:

$$X_{it} = P^*_{it}/P_{it} = [\epsilon^*_{it}/(\epsilon^*_{it}-s^*_{ijt})] / [\epsilon_{it}/(\epsilon_{it}-s_{ijt})] \qquad (19)$$

As long as there exist differences at price elasticities of demand and market shares in the domestic and foreign market, firms can set different prices for their outputs in the domestic and export market.

In the case of perfect competition in both markets, each firm's market share will tend to be zero, then P_{it} and P^*_{it} will be equal to the common marginal cost and there is no pricing to market if $MC_{it}/E_t = MC^f_{it}$.[13]

Consider the effects of an exchange rate change on pricing to market. As mentioned before, pricing to market (or PTM) concerns the relative price of same good destined for the

[13]See discussion in the section 3.

two markets, or X_{it}. The PTM elasticity a can be expressed as the percentage change in the relative price divided by the percentage change in the exchange rate [14] :

$$\alpha_1 = \frac{dLn(X_{it})}{dLn(E_t)} = \frac{dLn(P^*_{it})}{dLn(E_t)} - \frac{dLn(P_{it})}{dLn(E_t)} \qquad (20)$$

where $dlnP^*_{it}/dlnE_t$ or $\rho(E)$ is the pass-through elasticity since it measures the extent to which a change in the exchange rate is passed through to the export price; $dlnP_{it}/dlnE_t$ is the elasticity of domestic price to the exchange rate. Both prices are in terms of domestic currency.

We substituting (19) and (20) into (22) to yield:

$$\alpha_1 = \frac{dLn(X_{it})}{dLn(E_t)} = \gamma\left[\frac{dLn(s^*_{ijt})}{dLn(E_t)} - \frac{dLn(\epsilon^*_{it})}{dLn(E_{it})}\right] - \gamma^*\left[\frac{dLn(s_{ijt})}{dLn(E_t)} - \frac{dLn(\epsilon_{it})}{dLn(E_{it})}\right] \qquad (21)$$

where $\gamma^* = s^*_{ijt}/(\epsilon^*_{it} - s^*_{ijt})$, $\gamma = s_{ijt}/(\epsilon_{it} - s_{ijt})$. In this case, even though both demand curves have constant price elasticities, different shares in the domestic and foreign market still cause pricing to market.

We can interpret pricing to market behavior by the value of PTM elasticity as following:

The weak version of the law of one price is $P^f_{it}/P_{it} = KE_t$, where P^f_{it} is the price of good i in the foreign market expressed as foreign currency and K is a constant. If the law of one price holds, then $\partial Ln\,(P^f_{it}/P_{it})/\partial Ln\,(E_t) = 1$ and $\partial Ln\,(P^f_{it}/E_tP_{it})/\partial Ln\,(E_t) = 0$. The last equation can be rewritten as $\partial Ln\,(X_{it})/\partial Ln\,(E_t) = 0$, which is consistent with equation (23) when the price elasticities and the shares are constant. Hence, if $\alpha_1 = 0$, it means that the change of exchange rate does not have any effect on export-domestic price margin, i.e. the exchange rate

[14] The PTM elasticity here only considers the partial effect from the exchange rate by fixing other factors which affect the price determination.

has the same effect on the domestic and export price. Thus, there is no pricing to market behavior associated with exchange rate in this case. The law of one price holds, even though the Pass-through elasticity or $\rho(E)$ is not necessarily zero, as we discuss in section 3.

If the price elasticities of demand are not constant in a pure monopoly model or if the shares are not constant in the Cournot model, discussed before, α_1 is not equal to zero and the law of one price is violated.

When $\alpha_1 > 0$ [15], an appreciation of the home currency or $dLnE_t < 0$ will result in a bigger increase in the domestic price than the export price in the home currency, or export price in the home currency will fall if the domestic price is constant. Consider the pass-through effect. An appreciation of the domestic currency will raise the export price in foreign currency, If the export price which converts back into domestic currency increases less than the domestic price, the export price rises less than the fall in exchange rate and the pass-through is less than complete. A depreciation or $dLnE_t > 0$ will make the export price in terms of home currency fall less than the domestic price; the exchange rate pass through to the export price in terms of home currency less than 100%. Therefore, there is PTM effect when $\alpha_1 > 0$.

If $\alpha_1 < 0$, then the export price in the home currency will rise more than the domestic price while the exchange rate appreciates; the export price in the home currency will decline more than the domestic price while the exchange rate depreciates. Thus, changes in exchange rate will pass through to the export price in the foreign currency more than 100%. This is the case in which changes in the exchange rate overshoot the export price.

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[15] $\alpha_1 > 0$ means $dLn(P^*_{it})/dLn(E_t) > dLn(P_{it})/dLn(E_t)$. If $dLn(E_t) > 0$ (depreciations of home currency), then $dLn(P^*_{it}) > dLn(P_{it})$; If $dLn(E_t) < 0$ (appreciations of home currency), then $dLn(P^*_{it}) < dLn(P_{it})$. The movements of domestic and export price have opposite signs when $\alpha_1 < 0$.

4.2 Influence of other factors on export-domestic price margins

Section 4.1 discusses only exchange rate effects on export-domestic price ratios. It is obvious that other real factors on both the supply and the demand sides will affect price movements in the domestic and export markets. This subsection develops a model to discuss the influences of exchange rate and other real factors on export-domestic price margins.

Equations (19) and (20) can be written in terms of two markup functions[16]:

$$P_{it} = M(P_{it}/P_t, Y_t)\ MC_{it} \tag{22}$$

$$P^*_{it} = N(P^*_{it}/(E_tP^*_t), Y^*_{it})\ MC_{it} \tag{23}$$

where M(.) is the markup of the domestic price over marginal cost and M(.) = $\epsilon/(\epsilon-s)$; N(.) is the markup of the export price (in terms of domestic currency) over marginal cost and N(.) = $\epsilon^*/(\epsilon^*-s^*)$.

In order to determine marginal costs, I assume the domestic production function for the ith good to be a Cobb-Douglas function, which is linear homogenous:

$$Q_{it}+Q^*_{it} = \frac{1}{A}K_{it}^{\alpha}L_{it}^{1-\alpha} \tag{24}$$

The cost function of a home firm can be represented as:

$$C(W_{it}, r_{it}, Q_{it}+Q^*_{it}) = Min_{L_{it},K_{it}} W_{it}L_{it}+r_{it}K_{it} \tag{25}$$

$$\text{s.t. } Q_{it}+Q^*_{it}=1/A(K_{it}^{\alpha}L_{it}^{1-\alpha})$$

The first order condition from minimizing cost on (27) yields the marginal cost function as

[16] see Marston's discussion (1990).

following[17] :

$$MC_{it} = \frac{1}{A}\left(\frac{L_{it}}{K_{it}}\right)^{\alpha} \frac{W_{it}}{1-\alpha} \qquad (26)$$

Where W_{it} is the domestic nominal wage rate to produce good i , and L_{it}/K_{it} is the domestic labor-capital ratio for producing the ith good. Since the labor productivity for producing good i , H_{it} ,can be written as a function of labor-capital ratio

$$H_{it} = (Q_{it}+Q^{*}{}_{it}) / L_{it} = A\frac{K_{it}{}^{\alpha}}{L_{it}{}^{\alpha}}, \qquad (27)$$

the marginal cost function can be rewritten as:

$$MC_{it} = \frac{W_{it}}{H_{it}\ (1-\alpha)} \qquad (28)$$

Substituting the marginal cost function (30) into (24) and (25) yields:

$$P_{it} = M\left(\frac{P_{it}}{P_t}, Y_t\right) \frac{1}{1-\alpha}\frac{W_{it}}{H_{it}} \qquad (29)$$

A reduced-form expression is obtained by totally differentiating (31),(32) and solving for

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[17]The equation (27) is equivalent to:
$\min_k\ r_{it}K_{it}+w_{it}A^{-1/(1-\alpha)}(Q_{it}+Q^{*}_{it})^{1/(1-\alpha)}\ K_{it}^{-\alpha/(1-\alpha)}$.
The first order condition is:
$r_{it}-[\alpha/(1-\alpha)]w_{it}A^{-1/(1-\alpha)}(Q_{it}+Q^{*}_{it})^{1/(1-\alpha)}\ K_{it}^{-1/(1-\alpha)}=0$,
which gives the conditional demand function for capital K:
$K(r_{it},w_{it},Q_{it}+Q^{*}_{it})=A^{-1}[\alpha w_{it}/(1-\alpha)r_{it}]^{1-\alpha}(Q_{it}+Q^{*}_{it})$.
The other conditional demand function for labor L is:
$L(r_{it},w_{it},Q_{it}+Q^{*}_{it})=A^{-1}[\alpha w_{it}/(1-\alpha)r_{it}]^{-\alpha}(Q_{it}+Q^{*}_{it})$.
And $K_{it}/L_{it}=\alpha w_{it}/[(1-\alpha)r_{it}]$ or $r_{it}/w_{it}=\alpha L_{it}/[(1-\alpha)K_{it}]$.
Thus the cost function for producing good i at time t is:
$C(r_{it},w_{it},Q_{it}+Q^{*}_{it})=r_{it}K_{it}+w_{it}L_{it}=A^{-1}(L_{it}/K_{it})]^{-\alpha}\ [1/(1-\alpha)]w_{it}(Q_{it}+Q^{*}_{it})$.
And Marginal cost is:
$MC_{it}=A^{-1}(L_{it}/K_{it})]^{-\alpha}\ [1/(1-\alpha)]w_{it}$.
If numbers of firms are large enough, then input prices, such as labor and capital prices, are exogenous, and thereby the factors in the equation (30), such as labor productivity and wage rate are exogenous.

$$P^{*it} = N\left(\frac{P^{*it}}{E_t P_t}, Y^{*t}\right) \quad \frac{1}{1-\alpha}\frac{W_{it}}{H_{it}} \tag{30}$$

$$dLn(x_{it}) = \alpha_1 dLn(R_t) + \alpha_2 dLn\left(\frac{W_{it}}{P_t}\right) + \alpha_3 dln(H_{it}) + \alpha_4 dLn(Y_t) + \alpha_5 dLn(Y^*_t) \tag{31}$$

dX_{it}/X_{it} [18]:

where $R_t = (E_t P^*_t/P_t)$ is the ratio of general price levels expressed in domestic currency or the real exchange rate.

Thus the percentage change of export-domestic price margin are determined by the percentage changes of real variables such as real income ,real wages, real exchange rates and labor productivity [19].

Several observations can be made about export-domestic price behavior on the basis of (33). First, even though the PTM elasticity with respect to real exchange rate α_1 is zero, there still exist pricing to market due to impacts from other real variables. Second, real factors in

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[18] Domestic production costs and their components, such as wage rate and labor productivity, are treated as exogenous to exchange rate changes in my empirical analysis. The most recent study reveals that there are significant effects of exchange rates on production cost through imported inputs and indirect cost competition in the world market (Hung,Kim & Ohno, 1993). I leave development of a more general empirical model of export-domestic price margin to future research.

[19] In order to distinguish permanent and temporary exchange rate effects on the price ratio, we need to test the impacts from nominal exchange rate shocks and from changes in the real exchange rate. In Marston's reduced-form expression for the export-domestic price margin determination (1990), the real exchange rate is obtained by converting the nominal wage and the price of raw materials in the domestic and export markup functions into real terms (dividing by the domestic general price level) . In other words, all the anticipated changes in nominal variables can be caught by the changes in the real exchange rate and their corresponding real terms. Thus the export-domestic price ratio, a ratio of nominal variables, is a function of real variables: $dLn\ X_{it} = \alpha_1\, dLnR_t + \alpha_2\, dLn(W_t/P_t) + \alpha_3\, dLn(P^m{}_t/P_t) + \alpha_4\, dLnY_t + \alpha_5\, dLnY^*{}_t$,where P^m is the price of raw materials. From Cobb-Douglas production function, the marginal cost can be represented as a function of nominal wage and labor productivity rather than the price of raw materials that was assumed by Marston. Therefore, the export-domestic price ratio can be expressed by equation (33).

supply side, such as real wage rate and labor-capital ratio in (33), will have significant impacts on the export-domestic price margin if the demand curves for the same commodity in both markets are significantly different. The parameters of real wage α_2 and labor productivity α_3 depend on markup elasticities respect with relative price in both markets, which reflect concavity of demand curve in the market. Third, the real factor in demand side, the domestic and foreign real income, will also affect the export-domestic price margin, since changes in real incomes in both countries and in consumers' preference associated with income level will alter the demand for the same good in the domestic and foreign market.

In section 3, based on Bertrand competition, in order to maintain a competitive price, a domestic firm can not offer a price higher than that of its foreign competitors. When the exchange rate of the domestic currency appreciates, the firm would like to absorb the exchange rate shock by its profit margin in the short run for the following reasons:

First, because the foreign competitor's price is fixed in the short run, the exchange rate passing through to the export price of the domestic firm in foreign currency will made the foreign demand for its product drop to zero if the substitution elasticity of its product is very high.

Second, the firm will prefer to hold its price relatively stable against volatility in the exchange rate. Demand depends not only on the actual price but on the price that customers expect to when they decide whether or not to put themselves into market for the products. In practice, this means that firms cultivate a reputation over time for being in a certain price range. Therefore, when the firm expects that a change in the exchange rate is a temporary shock, i.e. a appreciation today will be offset by depreciations in the near future, it will ignore this

appreciation in order to retain its market reputation.

However, if the exchange rate keeps appreciating, the cost of maintaining an export price in foreign currency stable will keep increasing. The firm will be forced to raise the export price in foreign currency when the cost of exchange rate absorption is bigger than its profit margin. Price competitiveness consideration therefore provide an important explanation for the time lag in the exchange rate pass-through, especially in the case that an exported good that has a very high substitution elasticity.

The magnitude and timing of absorption of exchange rate changes depend on the size of the profit margin, which is determined by the comparative advantage in production cost. As discussed in (30), the marginal cost can be described as a function of the wage rate and the labor productivity. The wage rate is positive correlated with the marginal cost and the labor productivity is negative correlated with it. In the case of developing countries, both their wage rates and labor productivities are lower than those of the developed countries in producing the same good. For labor-intensive goods, which require more labor inputs, developing or low income countries have comparative advantages, since the wage rate dominates the cost determination. In addition, the higher income countries have a higher national price level than the lower income countries. The higher national price level in rich countries is not caused only by higher prices in nontradables, but also by higher prices of tradables [20]. Thus, a lower income

[20] Kravis and Lipsey (1983) defined the price level as the ratio of the purchasing power parity of a currency to its exchange rate, both taken relative to the U.S. dollar as the numeraire currency. The price level can be represented as the reciprocal of the real exchange rate: $PL = 1/R = P/(EP^*)$. They tested the structural relationship between the price level and basic national economic characteristics,such as per capita real income and propensity to trade, by 25 countries data in the period 1960-83. They pointed out that real income per capita was the major source of variation among countries in the price levels of both tradables and nontradables and in the total price level. They also found that there is a significant positive correlation between the price level and per capita income and positive correlation between the price level and level of openness for rich countries and negative correlation for poor countries.

country not only has cost comparative advantages in labor intensive goods, but also can charge higher prices for those goods exported to richer countries (the export price that converts into domestic currency by the nominal exchange rate is higher than the domestic price) if inputs to produce those goods contain large enough nontradable elements, such as rent of land and prices of other related services, which are generally higher in rich countries [21].

With faster economic growth rate in a developing country such as Taiwan, the real factors (real wage rate, labor productivity and domestic real income) in (33) have been growing more rapidly than in the U.S.A., which is a major export destination country of Taiwan, Taiwan's advantage in producing traditional export goods is declining. More precisely, prices in Taiwan are going up faster than prices in U.S.A. for those products. The difference in the percentage change in the export-domestic price margin in terms of the same currency would last until the differentials in real factors in supply side and in demand side for ith good between two countries disappear.

To summarize the above discussion, we can say that there are two kinds of effects on a change in the export-domestic price margin: one is the permanent effect caused by changes in real or structural factors, another is the temporary effect due to the nominal exchange rate shock. The former has a permanent impact on domestic firms' profit margins since changes in real factors can not be reversed in a short period of time. For instance, an increasing real cost (the real wage increases faster the labor productivity) to produce the ith good will force firms to raise the price. They will stop producing this product or switch production to other countries

[21] It is not necessarily true that all lower income countries can have bigger profit margins to produce and export the labor-intensive goods to the rich countries. Only those products that can meet the consumers' requirements are able to find demand in the markets of rich countries.

with lower costs if their prices lose competitiveness. The latter only has a temporary impact on their profit margins. To hold their prices stable, firms can offset today's loss due to a appreciation by tomorrow's gain from a depreciation. The profit margins play a role as a buffer to absorb the exchange rate shocks

4.3 Price-setting and Nominal Exchange Rate Shocks

The models described in the above sections are static in the sense that neither the actual not the expected duration of the exchange rate change affect the extent of pricing to market. That is, the extent to which export prices change is independent of whether the exchange rate of the N.T. dollar has just appreciated or has been low for a number of quarters, and is also insensitive to whether the current strength of the home currency is regarded as permanent or soon to be reversed. Intuitively this is implausible. The effect of a given exchange rate change on the export-domestic price ratio may well change over time. In particular, firms may be willing to squeeze their profit margins initially in response to an appreciation in the exchange rate, but not indefinitely. As discussed before, the magnitude and timing of absorption of changes in the exchange rate depend upon the size of profit margin. If profit margins returned gradually to desired levels, other things equal, pass-through would tend to build up gradually over time. The extent of pricing to market is due to the actual and expected duration of changes in the exchange rate and in the real factors in the supply and demand side. This section presents a dynamic model that offers a possible rationalization for the idea that changes in the export-domestic price margin reflect current and past changes in the exchange rate and the real factors, that firms take into account in their price setting.

First, let us assume a firm setting export an price in foreign currency $P^{**}_{it}=P^{*}_{it}/E_t$(and

a domestic price in domestic currency) for period t based on information available at t-1. Then at t, the firm will change its export and domestic prices on the basis of changes of its expected changes in the nominal exchange rate and other real factors:

$$dLnP^{**}_{it}-dLnP_{it}=-E[dLnE_t/\Omega_{t-1}]+\alpha_1 E[dLnR_t/\Omega_{t1}]+\alpha_2 E[dLn(W_{it}/P_t)/\Omega_{t-1}]$$

$$+\alpha_3 E[dLnH_{it}/\Omega_{t-1}]+\alpha_4 E[dLnY_t/\Omega_{t-1}]+\alpha_5 E[dLnY^*_t/\Omega_{t-1}] \quad (34)$$

If a firm presets its export price in foreign currency, and the actual spot rate may differ from its expected value, observed changes in the export-domestic price ratio may reflect the effects of unanticipated changes in the exchange rate rather than pricing to market[22]. As a result, the actual changes in the export-domestic price ratio is affected by unanticipated shocks in the nominal exchange rate as well as real factors:

$$dLnX_{it} = dLn\,E_t + dLnP^{**}_{it} - dLnP_{it}$$

$$= dLn\,E_t - E[dLnE_t/\Omega_{t-1}]+\alpha_1 E[dLnR_t/\Omega_{t1}]+\alpha_2 E[dLn(W_{it}/P_t)/\Omega_{t-1}]$$

$$+\alpha_3 E[dLnH_{it}/\Omega_{t-1}]+\alpha_4 E[dLnY_t/\Omega_{t-1}]+\alpha_5 E[dLnY^*_t/\Omega_{t-1}] \quad (35)$$

Because price-setting patterns can differ across goods, the observed movements in X_{it} may reflect prices set contemporaneously as well as prices preset on the basis of past expectations. In order to investigate the lagged effect of exchange rate surprises and other real factors, we specify the export-domestic price margin with distributed lags on the independent variable coefficients as following:

$$dLnX_{it} = dLn\,E_{it} + dLnP^{**}_{it} - dLnP_{it}$$

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[22] Pricing to market concern divergent price movements in different markets over a relatively long period. That only occurs when real factors have effects on the export-domestic price ratio. If that there are no real factor effects on the export-domestic price ratio. Then changes in the price ratio are only affected by the exchange rate surprise term. If no further surprise occurs the following period, then the price ratio falls back to its original level since exchange rate surprises have no effect on the desired change in the export-domestic price ratio. Exchange rate surprises, in effect, have only a transitory effect (Marston 1990).

$$=\Sigma_{j=1}\alpha_{0j}(dLnE_t\text{-}dLnE_{t-j})+\Sigma_{j=0}\alpha 1_j dLnR_{t-j}+\Sigma_{j=0}\alpha_{2j}dLn(W_{it-j}/P_{t-j})+\Sigma_{j=0}\alpha_{3j}dLnH_{it-1}$$

$$+\Sigma_{j=0}\alpha_{4j}dLnY_{t-j}+\Sigma_{j=0}\alpha_{5j}dLnY^{*}_{t-j}+\mu_t \qquad (36)$$

There are two distinct ways in which changes in exchange rates influence observed changes in X_{it} :

(a) Permanent real exchange rate effects: changes in real exchange rates lead to permanent changes in the ratio of export to domestic price since changes in the real exchange rate have effects on price setting, that will cause the price ratio to diverge from the original level in the long run;

(b) nominal exchange rate surprise: unanticipated changes in nominal exchange rate lead to temporary changes in the ratio of export to domestic prices because of their temporary impacts on the profit margin. The effects of unanticipated changes are later reverse once firms have a opportunity to change prices.

Changes in nominal and real exchange rate are usually highly correlated, so it is normally difficult to separate their effects. But the nominal exchange rate enters (36) as the difference between the change in the previous periods and that in this period, while the real exchange rate enters the equation as the change previous periods. The two terms are unlikely to be highly correlated, so it is possible to distinguish empirically between the temporary effects of exchange rate shocks and the permanent effects of changes in real exchange rates.

In the following empirical test, the real wage rate of the sectors that contain each commodity is chosen. The use of the sectoral real wage rate will reduce the correlation with real national income. The effects of the real wage rate on the supply side and the effects of real income on the demand side are tested by their parameters in (36). An error term μ_t represents

disturbances that are not caught by the estimators in equation (36) and random factors affecting pricing, which are unobserved .

5. Empirical Analysis

In an open economy such as Taiwan, the foreign exchange market is a vital link in the financial market. Nevertheless, prior to 1979, there was no foreign exchange market outside the central bank. The central bank alone was authorized under exchange control laws to hold foreign exchange and conduct foreign exchange transactions. Until the exchange rate was set to float in 1978, the NT dollar had been officially pegged to the U.S. dollar. A rate of NT$40 per U.S. dollar was maintained from 1963 to 1973. The central bank revalued the NT dollar to NT$38 in 1973 and NT$36 in 1978 because huge current account surpluses, stimulated huge supplies of domestic currency and thereby caused double-digit inflation. However, by coincidence, each revaluation was followed by a major international oil-price shock that sharply increased Taiwan's import bill. The import increase turned large current account surpluses into large deficits and drastically reduced the money growth rate, and hence the domestic economic growth rate and inflation rate. Since such coincidences are not predictable, the pegged exchange rate policy could not function as well as the central bank expected.

In July 1978, at the same time as the exchange rate revaluation, the NT dollar was officially set free from its pegging to the U.S. dollar. In December, the Foreign Exchange Regulation was amended to permit residents to hold foreign exchange deposits in designated banks and to buy and sell foreign exchanges freely through these banks. The operating rule of this nascent foreign exchange market was not promulgated until February 1979. Under the new rule, exchange rates were to be limited to a very small margin on either side of a "central rate",

which was set daily by a group of five banks together with the central bank. The day-to-day fluctuation around the central rate was initially limited to 0.5 percent. Subsequently, the central bank withdrew from participation in the rate setting, and the limit on the day-to-day fluctuation was widened to 2.25 percent. In September 1982, instead of being set by five banks, the central rate depended upon the weighted average of exchange rates from transactions among domestic banks in the previous day.

Since 1987, controls on foreign exchange have been further relaxed. First, on July 15 1987, the central rate and the limitation of day-to-day fluctuation around the central rate in spot and future exchange markets were abandoned. Exchange rates were determined by supply and demand in the foreign exchange market. Second, direct capital movements across countries were officially permitted for the general public from July 1987. Any firm or resident can buy or sell foreign exchange through designated banks; Exporters are eligible to manage their earned foreign exchange freely, even to make deposit in foreign banks; The upper limits on capital inflows and outflows were US$ 50,000 and US$ 500,000 respectively per person per year in 1987. The capital outflow limit was raised to US$ 3,000,000 in 1990.

Even though the exchange rate system in Taiwan was officially changed to a floating rate regime in February 1979, the exchange rate has often been affected by the central bank intervention and hence could not fluctuate to respond to market forces fully or immediately, especially before 1987 when the central rate system was abandoned. There were increasing surpluses in both current and capital accounts in the balance of payment of Taiwan in the period of 1979-85. Taiwan's foreign assets rose from NT$ 72 billion (US$ 2 billion) at the end of 1979 to NT$ 936 billion (US$ 23.4 billion) at the end of 1985, while its current account balance

swung from a deficit of US$ 0.9 billion in 1980 to US$ 9.2 surplus in 1985 (the surplus in the current account kept growing from 1981 to 1985). If the foreign exchange market had been efficient, the excessive supply of foreign exchange, especially the US dollar, from the huge surplus in the trade balance would have caused appreciating in the NT dollar. But its exchange rate to U.S. dollar depreciated in the period of 1978-83 and remained very stable in the period of 1984-85. Clearly, the exchange rate policy of the central bank was a heavily managed float, designed to prevent appreciation of the NT dollar.

In order to avoid the distortion from manipulation of exchange rates before 1986, commodities are selected to test Pricing to Market behavior from the quarterly data on domestic and export prices in the period 1986-92. The Executive Yuan, Republic of China, reports monthly domestic and export prices for a large number of disaggregated products in "Commodity-Price Monthly in Taiwan Area of Republic of China"[23]. This paper focuses on 34 products for which both export and domestic prices are available in the price publication, at the finest level of commodity category in Taiwan today. The domestic prices are those reported at the wholesale level for sale in Taiwan, while the export prices are FOB export whosale prices expressed in NT dollars. The range of commodities covers 15 commodity groups (see tables 1 and 2). Since the purpose of this paper is to test relatively long run PTM behavior in Taiwan, the monthly price data are converted into quarterly data by averaging

These products are exported to a wide range of countries. However, the United States,

[23] "Commodity-Price Monthly in Taiwan Area of Republic of China" reports both prices and price relatives for more than 1,000 commodities. It also provides price and price relative for domestic and export goods at both whosale and retail levels. Monthly whole sale prices represent the average of prices on the 4th, 14th, and 24th day of the month at a pricing locality. Price relatives, are obtained by dividing the current monthly prices of each locality by their corresponding base period prices and are then averaged to obtain the monthly values. This paper uses price relatives as a measure of prices in the following empirical study.

Japan and Hong Kong are the biggest trade partners of Taiwan. Exports have been overwhelmingly dominated by these three areas in the last fourteen years. From table 1 we can see that exports destined for the U.S. and Japan accounted about 60% of total exports of Taiwan. In spite of a down trend of exports to the U.S. after 1987, the United States has remained the single largest market for Taiwan's exports(about 25% in September of 1992) and Hong Kong has replaced Japan as the second biggest export market since 1990 [24]. In the 34 commodities I select, except bananas, meat of swine (mainly exported to Japan) and Tankan (mainly exported to Singapore), all goods are exported mainly to the U.S. From 1986 to 1992, the US dollar fell sharply against the NT dollar, while the Japanese Yen remained relatively stable against the NT dollar and the HK dollar was pegged to the US dollar. Not surprisingly, in that period the exchange rate of the US dollar against the NT dollar dominated the effective exchange rate for exports, which is the trade-weighted geometric mean of the bilateral exchange rates with a country's trading partners and competitors. To simplify the analysis, the exchange rate against the currency of the main export destination is chosen as the exchange rate for exports in this paper. The effective real exchange rate and the demand for Taiwan's export goods are proxied by the real exchange rate against the currency of the main export destination and a measure of demand for imports in the main importing country. For example, for all commodities except bananas, meat of swine and tankan, the real exchange rate is equal to the bilateral exchange rate between the US dollar and NT dollar, deflated by both American and Taiwanese export price indices. The demand for Taiwan's exports is then a function of real

[24] It is obvious that a large part of exports to Hong Kong go to mainland China eventually. However, all exports to mainland China through Hong Kong are paid for in HK dollars, because the Chinese Yuan is not a currency that can be exchanged in Taiwan's banks. Therefore, only changes in the exchange rate of the NT dollar against the HK dollar affect Taiwan's exports to Hong Kong.

national income of the U.S.A..

5.1 Disaggregated Microeconomic Evidence on Profit Margins and Pass-Through

The empirical evidence shows that the nominal exchange rate is exogenous, especially at the commodity level[25]. We can choose the exchange rate as an independent variable to estimate the pass-through effects on the export price. In order to test the lag effects of the exchange rate pass-through, I employ ordinary least squares estimation with distributed lags to estimate coefficients of the exchange rate pass-through. Disaggregated regression equations for testing the exchange rate pass-through to the price of Taiwan's exported commodities take the form of a transformation of equation (4) as following:

$$dLn(P^*_{it}) = \sum_{j=0}^{j=6} \alpha_j \, dLn(E_{t-j}) + \varepsilon_{it} \qquad (37)$$

where $\Sigma\alpha_j$ is the estimated $\rho(E)$, the exchange rate pass-through coefficient for exports, in equation (4).

Table 1 reports the distributed lag estimated results on export pass-through coefficients based on the exchange rate against the foreign currency of the main export country from the second quarter of 1986 to the third quarter of 1992 [26]. With lags ranging from zero to six

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[25] In Hung-Kim-Ohno's empirical study on aggregate export prices (1993), they test the causality relationship between the export price and the exchange rate. Their results indicate there is no feedback into the exchange rate from other variables in Taiwan, even though most countries in their study have significant feedback from prices or costs to exchange rates. According to their estimations, the exchange rate in Taiwan only receives feedback from its previous value: $\Delta E_t = 0.382\ \Delta E_{t-1}$. Therefore, the exchange rate of the NT dollar against the US dollar is strongly exogenous.

[26] Because Japan is a major export market for banana and meat of swine, I use the exchange rate of the NT against Japanese Yuan to test the exchange rate pass-through for banana and meat of swine. For tankan, since over 90% of the export go to Singapore, the exchange rate of the NT against Singapore dollar is selected. Other commodities use the exchange rate of NT against the US dollar. The same exchange rate selections are implied for the pricing to market elasticities.

quarters. 23 of 34 products have coefficients different from zero at a 95% confidence level, which means that changes in exchange rate affect the currency price and therefore do not pass through 100% to the export prices of those products. All the cumulative coefficients of pass-through significant from zero are greater than zero and 18 of them have significant cumulative lagged exchange rate effects in three quarters or longer, which can be seen from the significant level or t-statistics of the cumulative coefficients of exchange rate pass-through. It means that the response of Taiwan export prices for those goods to changes in exchange rate appear between the current quarter and sixth quarters latter. The lags I found here, in average, are close to the three quarter lags that reported by Hung, Kim and Ohno in their empirical study the using average unit value of Taiwan's total exports.

There are eight commodities with pass-through coefficients insignificant from zero at 10% confident level, which means that changes in the exchange rate pass through 100 percent to their export price in terms of the foreign currency. It is interesting to know that two of the three agriculture goods (bananas and sugar) and two raw material products (iron or steel plates and bagasse pulp) in the data belong to this category. One possible answer may come from the smaller profit margins of these products.

As for the commodities with pass through coefficients significant from zero, 18 of them have pass-through coefficients between zero and one, which indicates that changes in exchange rates only pass through partially to export prices in terms of domestic currency. With radio cassettes, for example, a 1 percent appreciation in the exchange rate in the current and past five quarters causes a 0.77 percent decline in the export price in terms of NT dollars at the current quarter. In other words, only 23 percent of the exchange rate appreciations in the current and

past six quarters pass through to the export price in terms of the US dollar in the current quarter. Eight products (tankan, false cypress, upper cattle leather, wool tops, men's shirt, polypropylene, plastic raincoats and telephone sets), however, have pass-through coefficients bigger than one, which means that changes in exchange rate pass through more than 100% to the export prices in terms of domestic currency (recalling the discussion in section 3). Since the exchange rate against the US dollar kept appreciating in this period, it seems that exporters of those products absorb exchange rate effects by cutting their profit margins[27]. Firms producing products with pass-through coefficients bigger than one apparently cut their export price in foreign currency in a period of exchange rate appreciation. Thus an appreciation in home currency by 1% make their export price in domestic currency drop by more than 1%. As a result, in order to keep their prices competitive in export markets, these firms apparently lose part of their profit margins in response to exchange rate appreciations. The results on the exchange rate pass-through provide the empirical evidence that the export prices of Taiwanese firms in the US market depend more on foreign competitors' prices than on production costs in a wide range of commodities, coinciding with Hung's findings.

5.2 Disaggregated Microeconomic Evidence on Pricing to Market Elasticity.

The test on the exchange rate pass-through , however, only tell one side of the story about pricing to market. The fact that exchange rate changes are not fully passing through to export prices does not necessarily mean that the law of one price [28] is violated or there is a

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[27] The only exception is tankan, which is mainly exported to Singapore and measured by the exchange rate against the Singapore dollar..

[28] In this paper, I use a narrow definition of the law of one price. The law of one price, as defined here, implies that the Taiwan domestic price for a good is equal to the Taiwan export price of the identical good in terms of the NT dollar.

pricing to market behavior, since pricing to market concerns the divergent price movements for an identical good in different markets. For example, in spite of the export price of a good in foreign currency increasing less than the exchange rate appreciation and even declining, this goods may still obey the law of one price if the rise in its domestic price fully matches the changes in export price (in home currency) and the exchange rate. The exchange rate fully passing through to the export price also does not necessarily means that law of one price holds. For instance, although appreciations in the exchange rate fully pass through to the export price of a commodity, this commodity still violates the law of one price if its domestic price rises more than its export price (in home currency). We will see those differences by comparing the exchange rate pass-through coefficients (in table 1) with the pricing to market elasticities (in table 2).

In order to study pricing to market behavior, we should investigate how changes in exchange rates affect changes in export prices relative to domestic prices for the same commodities. I use the domestic whosale price relative and the export whosale price relative in terms of the NT dollar for identical commodities. There are obtained from the Commodity-Price Monthly in Taiwan Area of Republic of China, as measures of domestic price P_{it} and export price P^*_{it}.

From the pricing to market elasticity in equation (22), a regression of percentage changes in export-domestic price margins (P^*_{it}/P_{it}) on percentage changes in exchange rate E_t can be written as follows:

$$dLnX_{it} = \sum_{j=0}^{j=6} \beta_j dLn(E_{t-j}) + \varepsilon_{it} \qquad (38)$$

where $\Sigma\beta_j$ is the estimated α_1 in (22) , the PTM elasticity. β_j is the coefficient that reflects the effect of lagged exchange rate at time t-j on the export-domestic price margin at time t.

The estimators of PTM elasticity with cumulative distributed lag are reported in table three. There are several interesting points to note:

1. Twenty six of thirty four commodities have PTM elasticities bigger than zero at the 90% significant level . This suggests that the domestic price rises relative to the export price in terms of the NT dollar for the same commodity when the NT dollar appreciates against foreign currencies (see footnote 9 in section 4.1). It is obvious that the law of one price dose not hold for those twenty six products (recalling the discussion in section 4.1). The evidence strongly suggests that Taiwanese firms vary their export prices relative to their domestic prices in response to changes in exchange rates in a wide range of products. The exchange rate effects on the export-domestic price ratio take place between the current quarter and six-quarter lag for the products with significant PTM elasticities. 18 products have significant cumulative coefficients in three quarters or longer, and 14 of them coincide with the length of lagged effect I found in the exchange rate pass-through.

2. The degree to which the export-domestic price ratio departs from the law of one price can be seen from the size of the PTM elasticity. The range of cumulative PTM elasticities significantly different from zero is from 0.475 in electric irons to 3.465 in false cypress. In the case of electric irons, for example, the cumulative PTM elasticity of 0.475 indicates that an appreciation in the exchange rate by 1 percent leads to a decrease in the export-domestic price

margins for ball point pens as a whole by over 0.47 percent (or equivalently, an appreciation in the exchange rate by 1 percent decreases the export price relative to the domestic price by over 0.47 percent). When there is an appreciation (depreciation) of the NT dollar, Taiwanese firms lower (raise) their export prices relative to their domestic prices in order to limit changes in the foreign currency price in their product. The bigger the size of PTM elasticities, the more the firms reduce their export price relative to their domestic price when the NT dollar appreciates, and therefore the larger the deviation from the law of one price. Taking false cypress as an example, that PTM elasticity is 3.465, indicating that an appreciation in the exchange rate by 1 percent lead to the export price decline relative to the domestic price by 3.465 percent, which is much bigger than that for ball point pens.

3. Comparing the results in table 2 with those in table 1, we can find the relationship between PTM elasticities and exchange rate pass-through coefficients: the PTM elasticity significantly different from zero does not necessarily mean the exchange rate pass-through coefficient significant indifferent from zero, and vice versa, even though there is a corresponding relationship for most commodities. For instance, men's jacket, bagasse pulp, motorcycle tyres and air compressors have PTM elasticities but not pass-through coefficients significantly different from zero. The domestic prices for those goods rise relative to the export prices although appreciations pass fully through to the export prices. The examples on the other side are tankan, lauan plywood, wool tops and drilling machines. They have pass-through coefficients but not PTM elasticities significantly from zero. Although changes in the exchange rate pass through partially (in lauan plywood and drilling machines) or more than 100 percent (in tankan and wool tops) to their export prices in the NT dollar, the exchange rate changes have no effect on the

export-domestic price margin since both export price (in the NT dollar) and domestic price move at the same pace. In other words, in spite of declines in the export prices (in NT dollars) for those goods, due to the appreciation in the exchange rate, decreases in the domestic prices of the same magnitude keep the export-domestic price ratio unchanged.

4. Most raw materials products, such as lauan plywood, wool tops and iron or steel plates, and all agriculture products in table 2 follow the law of one price. Profit margins may have been too small to absorb changes in exchange rates. Most machinery, plastic, rubber products and all electrical and misc. manufacturing goods in table 2 violate the law of one price. The profit margins of those goods are shrinking because of the firms' pricing to market behaviors. Therefore, It seems that Taiwanese firms are losing their competitive advantages in producing those goods, because exchange rates keep appreciation and real costs are rising faster than in the U.S.A.[29].

The results in table 3 coincide with the findings about the strength of comparative advantage in Taiwanese export goods given by James Riedel (1990), who used Balassa's "revealed comparative advantage " (RAC) index as a test. By convention, if the RAC for the ith commodity is greater than one, in which case the share of commodity i in country j's exports is greater than the share of that commodity in world trade, country j is revealed to have a comparative advantage in commodity i. Riedel showed period average values and rank orders (out of 129 three-digit SITC categories) of RCA indexes for the 40 categories for which the RCA index for 1986-87 was greater than unity (the highest RCA rank order was 40 and the higher the RCA rank index the stronger the comparative advantage). In his result, electrical

[29] The only exception is meat of swine, which exported mainly to Japan.

goods declined in RCA rank from 40 to 36 between 1983-85 and 1986-87, Plastic and rubber products dropped from 14 to 12 and from 39 to 38 respectively in the same period . Although the period Riedel used for the test is shorter than the period I choose in this paper, both results do indicate declining trends in Taiwan's comparative advantage in those products.

The estimation on the PTM elasticity in this section focus only on effects of the nominal exchange rate. But a large part of changes in the export-domestic price margin are not explained by changes in the nominal exchange rate for most goods. In five regressions is the R square higher than 60% and none of them is over 79%. Additional factors may be playing an important role in generating pricing to market. Even for effects of the exchange rate on the export-domestic price margin, we would like to distinguish temporary effects and permanent effects, which can be identified with nominal exchange rate surprises and changes in real exchange rates respectively. Recalling the discussion in section 4, the departures from the law of one price reflected in the export-domestic price margin can be explained as follows: First, As long as there are price elasticity and market share differences between domestic and foreign markets, firms can set export prices for their products different from domestic prices. Those differentials may be considered as demand side impacts on price setting, that reflect the coefficients of real incomes and real exchange rate in (36). Second, the magnitude and timing of price discrimination depend on the size of profit margins, which is determined by comparative advantage in production costs. Impacts on the supply side can be reflected in the coefficients of real wages and labor productivity in (36). Third, nominal exchange rate surprises or unanticipated shocks after price setting led the export-domestic price ratio to deviate from the law of one price.

5.3 Evidence of Influence of Real Factors and Nominal Exchange Rate Shocks on Export-domestic Price Margin.

This section reports PDLs (polynomial distributed lag) estimators in equation (36) explaining export-domestic price margins for the chosen Taiwanese products. The equations are estimated over the period from the second quarter of 1986 to the third quarter of 1992, a total of 25 quarterly observations. The dependent variable in each equation is defined as the first difference of the log value of the export price in NT dollars relative to the domestic price of that the identical product. The independent variables are first differences of the log value of the nominal exchange surprise, the real exchange rate ,the real incomes (Taiwan and its main export markets), real wages and labor productivity.

The data for Taiwan are various publications of the Executive Yuan, Republic of China. The series for wholesale prices and export price indexes of Taiwan and the bilateral exchange rate are reported in Monthly Statistics of the Republic of China, Taiwan Area. The real national income series of Taiwan are derived from the national income reported in Quarterly National Economic Trends, deflated by the wholesale price index of Taiwan. The labor productivity and wage series are based on sectoral labor productivity and sectoral wage series in manufacturing drawn from Monthly Bulletin of Manpower Statistics in Taiwan Area, Republic of China [30]. The real wage is obtained by deflating the sectoral wage by the Taiwan' s Wholesale price index. The real national incomes of the US, Japan and Singapore are calculated by deflating the national income by the same countries' wholesale price indexes, which published by the

[30] Since there are no available sectoral wage and labor productivity data for the agricultural sector, I use the sectoral wage and labor productivity in food processing, which is the closest sector to agriculture, as a proxy of that for the agricultural sector. Bananas and tankan belonging in this category.

International Monetary Fund International Financial Statistics. The real exchange rates are calculated by the American, Japanese and Singapore export price index converted into NT dollars and deflated by the Taiwanese export price index.

Table 3 presents the estimates explaining pricing to market for twenty four Taiwanese products, which have coefficients statistically different from zero at a 10 percent or a more stringent level. The table reports the statistically significant PDLs coefficients of each variable with lags ranging from zero to six quarters. The t-statistic is in parentheses below. The table also reports the adjusted R square, and the Durbin-Watson statistic. The polynomial degree of the PDLs estimators is one, since there are not enough observations for higher polynomial degrees.

Let us discuss the effects of each factor on the export-domestic price ratio. The nominal exchange rate against the US dollar kept appreciating over the 1986-92 period. It appreciated by 36% from January 1985 to September 1992 (see chart 1). Since the exchange rate had been appreciating for such a long period, there is not doubt that Taiwanese exporters always expected that the exchange rate would appreciate during the next period and often faced unanticipated spot rate shocks . Assuming a firm setting export prices in foreign currency for period t on the basis of past changes in the exchange rate - more precisely the percentage change of the exchange rate in the past periods - the nominal exchange rate surprise from the exchange rate change in t - j can be represented by the difference between the current rate of change and the rate of change at t -j, i.e. $dLnE_t - dLnE_{t-j}$. Consequently, the total effect of the nominal exchange rate shocks on the export-domestic price margin can be measured by a cumulative effects of exchange rate surprises during the past periods. In 11 of 22 equations in table 3, there are positive coefficients for nominal exchange rate surprises at the 5% significance level. This result suggests that

unexpected appreciations in the exchange rate lead domestic prices rise relative to export prices in the NT dollar for those goods.

Two other interesting points can be seen from the results in table 3. First, exchange rate surprises dominate changes in the export-domestic price margin for all three raw material products (bagasse pulp, polypropylene and iron or steel plates) , plastic raincoats, ball point pens and bench grinders. With a price setting lag of one period, an appreciation of the NT dollar in the period t decreases the export-domestic price ratio not because of pricing to market, but simply because the nominal exchange rate is free to vary while the export price (in foreign currency) and domestic price are preset. Unanticipated changes in the exchange rate thus lead to unintended changes in the export-domestic price ratio [31]. This empirical finding supports the hypothesis that profit margins in raw material products are too small to permit pricing to market even though those products violate the law of one price temporarily. Second, nominal exchange rates have strong current and lagged effects on the export-domestic price ratio. The size of cumulative coefficients of the exchange rate surprises are much bigger than those for Japanese final products, which were presented by Marston (1990) [32]. It seems that expected exchange changes from the Taiwanese firms which produce those goods can not catch up to the actual changes in the exchange rate, especially for products with relative stable prices (in the US dollar) in the US market, such as false cypress, bench grinders, electric irons, drilling machines

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[31] According to Marston's argument(1990), "if no further surprise occurs the following period, then X_{it} (export-domestic price margin) falls back to its original level since, in the absence of pricing to market, exchange rate surprises have no effect on the desired change in X_{it} . Exchange rate surprises, in effect, have only a transitory effects on X_{it} ."

[32] In Marston's estimations for seventeen Japanese products, there was no any cumulative coefficients of exchange rate surprises over 0.6.

and telephone sets.

The second factor is the real exchange rate. As we discuss before , the real exchange rate can be defined as $E_t P^*_t / P_t$, where P^*_t is the US, Japan or Singapore export price index at time t, and P_t is the export price index of Taiwan . Since America had a much higher inflation rate than Taiwan in 1986-92 when the US export price index increased by 13.4 percent while Taiwan's declined by 19.1 percent (in the NT dollar), appreciations in the nominal exchange rate were offset by the divergent movement between the US and Taiwan's export price indexes. Hence, the real exchange rate appreciated from 1985 to 1992 much less than the nominal exchange rate.

The response of export price to changes in the exchange rate arise from two effects: an exchange rate expectation effect, and a price discrimination effect (Giovannini 1988). Marston (1990) defined an exchange rate expectation effect as a nominal an exchange rate surprise, which we just discussed. He defined the discrimination effect as the permanent real exchange rate effect. Because changes in the real exchange rate are more predicable than the nominal rate shocks, firms can change their export-domestic price margins intentionally in response to changes in real exchange rate. And these changes in the export-domestic price margin are not latter reversed.

In 10 of 24 equations in table 3, there are coefficients for the real exchange rate that are statistically significant at 10% or a more stringent level. For the products with statistically significant coefficients for both nominal exchange rate surprises and real exchange rate, the real exchange rate does have stronger influences and longer lengths of lags. Changes in the real exchange rate have longer lag impacts on the price ratio than that of nominal exchange rate

surprises.

Two main inferences can be drawn form the estimated coefficients for the real exchange rate. The first inference from the sign of coefficients concerns pricing to market behavior for those products. The real exchange rate coefficients significantly different from zero are greater than zero in all equations. The coefficients range in size from 0.51 in telephone sets to 4.5 in false cypress. So pricing to market behavior takes the standard form described in the section 3.2: When there is an appreciation (depreciation) of the NT dollar, Taiwanese firms lower (raise) their export prices (in the NT dollar) relative to their domestic prices in order to limit changes in the US dollar prices of their products.

The second inference concerns pricing to market in different sectors. Except false cypress and polypropylene, none of these products belong to the agricultural and raw material sectors, which generally have lower added values and profit margins. 9 of 11 products belong to plastic products, textiles, fabricated metals, machinery and electrical equipment and rubber products. According to the report on 1986 industrial and commercial Census Taiwan-Fukien Area, the average numbers of employees per establishment in these sectors are twice or three times as high as those in other sectors. This result coincides with Wang and Tsi's empirical finding (1992) . They found that there was a positive relationship between establishment size and profit margin in Taiwanese firms. Bigger firms not only can have bigger profit margin to absorb fluctuations in the exchange rate, but also can make extra profits by operating in the foreign exchanges futures market.

The third factor is the real wage rate. From table 4, we can see the average nominal wage rose much faster then labor productivity in each sector from the third quarter of 1985 to

the third quarter of 1992 . The only exception is the textile mill sector, in which the average wage increased by 19.33 percent while the labor productivity increased by 70.49 percent in the same period. Recalling the discussion of equation 31 of section 3.3, and assuming the capital coefficient α to be stable, the higher growth rate of the nominal wage than productivity pushes marginal cost up. Because of the downtrend of the wholesale price index, the gap between the real wage and the productivity is even bigger. There is no doubt during this period that Taiwanese firms suffered strong upward real cost pressure that had significant influences on their price determinations.

13 of 24 equations in table 3 have real wage coefficients significantly different from zero, 11 of the significant coefficients are positive while others are negative. The positive coefficients for the real wage suggests that a rise in the real wage increases the export-domestic price margin or the product loses price competitiveness in the export market because of a rise in the cost. It is interesting to note that the real wage plays a dominant role in determining the export-domestic price margin for all three agricultural products (bananas, tankan and sugar). The agricultural products thus are losing price competitiveness in foreign markets[33].

This result provides empirical evidence to explain the fact that the share of agricultural products in the value of exports declined from 1.68% in 1986 to 0.93% in 1992. For the plastic products, the market share declined by 2.89 % from 1989 to 1991 in the US market[34]. This decline is consistent with the positive real wage parameters I found for plastic products, such

[33] Since most agricultural goods export to Japan, it is more reasonable to use the exchange rate against Japanese Yuan rather than against the US dollar in the estimations for agricultural products. However, the real wage rate still dominate the export-domestic price ratio by using the real and nominal exchange rate against Japanese yuan as independent variables to estimate the equations for banana and tankan.

[34] From Li's empirical results about the export market share analysis of Taiwan (1993).

as plastic raincoats and plastic slippers in my equations. In contrast to the positive coefficients, the negative coefficients for the real wage suggests that a rise in the real wage decreases the export-domestic price margin or a firm loses profit margin in order to export its product. There are 2 products in table 3 belong to this class. This kind of real wage effects can be explained as follows: It is obvious that there is a positive correlation between the real wage and the domestic price. In order to retain market share, Taiwanese firms may limit changes in their export prices in the US dollar thereby their export prices in the NT dollar fall in response to an appreciation in the NT dollar. The ratio of the export price to the domestic price, therefore, declines while the real wage rises. So real wages play an important role in pricing to market behavior.

For labor productivity, equations in table 3 show coefficients significantly different form zero, all positive. The positive coefficients for labor productivity in those equations suggest that a rise in labor productivity increases the export-domestic price ratio. In other words, a rise in the labor productivity lower the domestic price relative to the export price, especially when the export price in home currency is stable.

Real national income plays a role on the demand side in determining prices. The effects of changes in the real national income in Taiwan on the export-domestic price margin is measured by the parameters in table 3. There are statistically significant coefficients in six equations. All estimators are of the expected negative signs. The negative income coefficients suggest that a rise in domestic income stimulates domestic demand and thereby increases the domestic price relative to the export price. Taking men's shirts as an example, a rise in Taiwan's income by 1 percent leads to a decline in the export-domestic price margin for this product by

1.03 percent. An interesting feature of the domestic (Taiwan) income coefficient estimators is that with only one exception (Women's shirts) real income has only lagged effects on the relative price ratio. Changes in the export-domestic price margin react to changes in income at least two quarters latter.

In six equations, those for banana, sugar, men's jackets, plastic slippers, screw drivers and telephone sets, the real foreign (American or Japan) income has significant effects on ratios of export to the domestic prices. Three of the foreign income coefficients statistically different from zero are positive. These findings suggest that a rise in the foreign real income increases export-domestic price margins. In other words, the foreign income has bigger positive effects on the export price than on the domestic price. The size and lag length of coefficients for the foreign income is bigger and longer for these products. However, the foreign income coefficients are negative for other three goods (plastic slippers, screw driver and telephone sets).

To summarize: (1) For agricultural and most raw material products, there are no real exchange rate effects on export-domestic price margins. The differential movements between export and domestic prices are caused only by real wage effects and nominal exchange rate surprises. All the real wage coefficients are positive for these products, suggesting that a rise in the real wage increases the export price relative to the domestic price. These products, therefore, are losing their price competitiveness in the export market because the profit margin is too small to absorb changes in the real exchange rate. As we mentioned before, effects of nominal exchange rate shocks on the export-domestic price ratio are temporary. This empirical finding thus suggests that there is no pricing to market behavior or the law of one price holds in the long run for agricultural and most raw material products.

(2) For one third (10 of 34) of the commodities, real exchange rate coefficients significantly different from zero are all positive. The evidence strongly suggests that Taiwanese firms vary their export prices relative to their domestic prices in response to changes in the real exchange rate. It may be the case, however, that Taiwanese firms follow different pricing behavior depending on whether the NT dollar appreciates or depreciates. More specifically, in periods when the NT dollar appreciates, these firms may vary the relative price of their exports more than when the NT dollar depreciates. This asymmetric pattern would hold if firms try to maintain market share by reducing the export price in the NT dollar (or keeping the export price in the foreign currency constant) when the NT dollar appreciates, but try to increase market share by holding export prices in the NT dollar constant (or reducing export price in the foreign currency) when the NT dollar depreciates. For the commodities with significant real exchange effects, two of real wage coefficients are negative, suggesting that Taiwanese firms limit increases in their export prices relative to their domestic prices when real wages rise. In order to maintain market share, therefore, Taiwanese firms reduce their profit margins on export goods not only in response to real exchange rate changes but also in response to increases in real wages.

(3) All the significant coefficients of real domestic incomes are negative in my empirical study , that suggests that increases in real incomes in Taiwan raise the domestic prices relative to the export prices for those goods. However, the empirical results show that in three of six equations with significant coefficients for real foreign incomes, there are negative foreign income effects on the export-domestic price ratio. Thus, in general, domestic incomes have more directly positive impacts on domestic prices rather than foreign incomes on export prices,

especially for lower quality products.

(4) All the significant coefficients of labor productivity in the equations have positive effects on export-domestic price ratios. Since increases in labor productivity will reduce marginal costs and thereby prices. That result suggests that changes in marginal costs affect domestic prices more than export prices.

6. Conclusion

This paper has investigated exchange rate pass-through and pricing to market by Taiwanese firms over the period 1986-1992. The sample period includes a sharp appreciation of the NT dollar in nominal terms in 1986-1992. The empirical result provides strong evidence that appreciations in nominal exchange rate do not fully pass through to export prices and lead to domestic prices increasing relative to export prices (in the NT dollar) in a wide range of commodities in Taiwan. It suggests that Taiwanese firms limit changes in their export prices in terms of the US dollar by absorbing appreciations in the Taiwanese exchange rate by their profit margins. Therefore, Taiwanese firms may charge different prices in common currency in their domestic and export markets.

Second, this paper has developed a demand and supply model that relaxes the assumption of competitive pricing, in both domestic and foreign markets for a small open country such as Taiwan. Unlike most existing pricing to market studies on industrial countries, Taiwanese firms act more as Bertrand competitors with capacity constraints or price takers than as Cournot competitors. The reason is that small firms account for about half of production in Taiwan and there are very high substitution elasticities for most Taiwanese exported goods. Price competitiveness thus is very crucial for Taiwanese firms. It explains why Taiwanese firms have

to suffer profit losses in their exports when the exchange rate appreciates.

Third, the paper studies the temporary effects on the export-domestic ratio from nominal exchange surprises and the permanent effects on the export-domestic price ratio form the real exchange rate and other real factors, such as real incomes, real wage and labor productivity, by using demand and supply models in the domestic and foreign markets. If exchange rate surprises have only temporary effects on export-domestic price ratios, pricing to market behavior is measured only by real factor effects. The evidence strongly suggests that Taiwanese firms lower (raise) their export prices in the TN dollar relative to their domestic prices in response to an appreciation (depreciation) in the real exchange rate. The empirical results also indicate that real wages and domestic real income play important roles in determining prices. The empirical finding suggests that with faster growth rate in real wages and domestic real income , Taiwanese firms either suffer lose in profit margins in the export market (indicated by negative real wage coefficients and negative domestic income coefficients) or lose the price competitiveness (indicated by positive real wage coefficients) to export most traditional goods. Since most Taiwanese firms act as price takers in their export markets, changes in marginal costs, which are represented by wages and labor productivities in my study, have significant effects on domestic prices rather than on export prices. For textile products, such as men's and women's shirts in my equations, the quotas on the US market restrain the substitution from other foreign competitors. That allows Taiwanese firms to pass increases in wage rates through to the export prices, which shows in the positive coefficients of the real wage rate in table 3.

There is overwhelming evidence that export-domestic price margins are systematically varied to help Taiwanese firms protect their competition position. The evidence also suggests

that Taiwanese firms are losing their comparative advantage in traditional products due to rapid increases in labor costs. Taiwanese firms are forced to upgrade their exported products in the US market or to transfer the production of traditional goods to other lower labor cost countries.

There are two limitations of this paper due to unavailable data: First, U.S. domestic price effects on export price determination for these commodities are not considered. Second, the substitution effects from other foreign rivals, such as Korea and Hong Kong, are not taken into account. These effects play an important role in determining Taiwanese export prices in the US market, especially when Taiwanese exporters act as Bertrand competitors or price takers.

TABLE 1

EXCHANGE RATE PASS-THROUGH COEFFICIENT IN TAIWAN (1986,Q2-92, Q3)

$$[dLn(P^*)t = a0 + a1^*dLn(E)t + a2^*dLn(E)t-1 + a3^*dLn(E)t-2 + a4^*dLn(E)t-3 + a5^*dLn(E)t-4 + a6^*dLn(E)t-5 + a7^*dLn(E)t-6]$$

COSDI GROUP	COMMODITIES CONTENT	Constant	E_t	E_t-1	E_t-2	E_t-3	E_t-4	E_t-5	E_t-6	Cumulative E value	R sqare	D/W	* - Coeff at 95% Sig level
0	BANANA	-0.006 (-0.295)	-0.243 (-0.754)								0.027	2.166	
0	TANEAN	0.006 (0.464)	0.260 (0.547)	0.766 (1.458)	-0.199 (-0.383)	0.286 (0.583)	0.481 (1.086)			1.595 (2.474)	0.284	2.216	*
2	CRYSTAL SUGAR	-0.001 (-0.041)	1.566 (1.430)								0.108	1.652	
2	INSTANT NOODLE	0.004 (0.500)	0.410 (1.618)	0.500 (1.672)	-0.585 (-1.948)	0.365 (1.472)				0.690 (2.441)	0.401	2.165	*
2	MEAT OF SWINE	-0.008 (-1.214)	0.463 (4.146)	0.256 (2.383)	0.089 (0.858)	-0.063 (-0.640)	0.047 (0.502)	-0.045 (-0.501)	-0.054 (-0.566)	0.694 (2.263)	0.655	1.922	*
3	FALSE CYPRESS	0.001 (0.575)	0.718 (8.498)	0.306 (2.960)	-0.063 (-0.623)	0.044 (0.468)	-0.063 (-0.630)	0.052 (0.506)	0.019 (0.228)	1.015 (8.965)	0.934	1.864	*
3	LAUAN PLYWOOD	-0.012 (-1.044)	0.851 (1.843)							0.851 (1.843)	0.146	1.951	**
4	UPPER LEATHER, CATTLE OR COWHIDE	0.023 (1.076)	2.011 (2.603)	-0.388 (-0.425)	0.638 (0.695)	-0.496 (-0.634)	-0.403 (-1.760)			1.765 (2.046)	0.354	2.060	*
5	WOOL TOPS	-0.017 (-0.862)	1.684 (2.179)							1.684 (2.179)	0.229	1.849	*
6	JACKET, MEN'S	-0.016 (-1.399)	0.717 (1.599)								0.212	2.691	
6	SHIRT, MEN'S	0.020 (2.572)	0.865 (3.229)	0.306 (0.932)	0.245 (0.770)	0.065 (0.221)	-0.163 (-0.518)	-0.027 (-0.082)	0.057 (0.213)	1.348 (3.759)	0.716	1.538	*
6	SHIRT, WOMEN'S	0.008 (0.832)	0.713 (1.824)							0.713 (1.824)	0.164	1.462	**
7	PULP, BAGASSE	0.005 (0.318)	0.643 (1.154)								0.060	1.325	
8	POLYPROPYLENE	0.001 (0.061)	0.824 (1.188)	0.319 (0.386)	0.395 (0.562)					1.537 (2.199)	0.202	1.299	*
9	TUBES, RUBBER, BICYCLE	0.004 (0.671)	1.272 (6.224)	-0.714 (-2.950)	0.022 (0.097)	0.366 (1.629)	0.168 (0.702)	-0.408 (-2.009)		0.706 (2.750)	0.736	2.642	*
9	TUBES, RUBBER, MOTORCYCLE	0.007 (0.528)	0.261 (0.540)								0.114	2.230	
9	TYRES, RUBBER, BICYCLE	0.002 (0.236)	1.390 (3.762)	-0.498 (-1.139)	0.374 (0.852)	-0.272 (-0.728)				0.994 (2.409)	0.485	1.584	*
9	TYRES, RUBBER, MOTORCYCLE	0.002 (0.493)	0.558 (4.389)	0.230 (1.476)	-0.176 (-1.166)	0.096 (0.683)	0.010 (0.069)	-0.109 (-0.700)	0.058 (0.464)	0.668 (3.924)	0.779	2.234	*
10	PLASTIC RAINCOATS	-0.002 (-0.125)	1.263 (2.045)							1.263 (2.045)	0.173	1.657	*
10	PLASTIC SLIPPERS	0.005 (0.666)	0.961 (3.629)	-0.359 (-1.145)	0.095 (0.326)	0.230 (0.789)	0.267 (0.861)	-0.501 (-1.904)		0.693 (2.083)	0.554	2.280	*
10	PLATES, POLYMETHYL METHACRYLATE, RIGID	-0.033 (-1.500)	0.592 (7.901)	0.181 (1.977)	-0.056 (-0.630)	-0.120 (-1.448)	0.112 (1.269)	-0.053 (-0.578)	-0.020 (-0.266)	0.637 (6.349)	0.909	1.704	*

TABLE 1 (Continue)

EXCHANGE RATE PASS-THROUGH COEFFICIENT IN TAIWAN (1986,Q2-92, Q3)

$$dLn(P^*)it = a0 + a1^*dLn(E)t + a2^*dLn(E)t-1 + a3^*dLn(E)t-2 + a4^*dLn(E)t-3 + a5^*dLn(E)t-4 + a6^*dLn(E)t-5 + a7^*dLn(E)t-6$$

COMM GROUP	COMMODITIES CONTENT	Constant	E_t	E_t-1	E_t-2	E_t-3	E_t-4	E_t-5	E_t-6	Cumulative E value	R square	D/W	* - Coeff at 95% Sig level
11	PLATES, OF IRON OR STEEL	0.021	1.168								0.117	1.428	
		(1.035)	(1.497)										
12	CHAIRS, FOLDING, METAL	0.013	0.945								0.036	2.877	
		(0.413)	(0.765)										
12	SCREW DRIVER, IRON OR STEEL	0.008	0.552	0.273	-0.014	0.106	-0.285	0.052	0.169	0.853	0.488	1.228	*
		(0.909)	(1.922)	(0.777)	(-0.041)	(0.333)	(-0.843)	(0.145)	(0.593)	(2.218)			
13	AIR COMPRESSORS	0.011	1.674								0.151	2.886	
		(0.430)	(1.691)										
13	BENCH GRINDER	0.001	0.842	-0.117						0.725	0.243	1.385	*
		(0.107)	(2.266)	(-0.315)						(2.151)			
13	DRILLING MACHINES	0.003	0.777							0.777	0.162	1.855	**
		(0.280)	(1.971)							(1.971)			
14	ELECTRIC FANS, DOMESTIC USE	-0.003	0.290	0.459	-0.333	0.347	-1.389			0.626	0.428	2.230	*
		(-0.534)	(1.281)	(1.775)	(-1.283)	(1.334)	(-0.614)			(2.237)			
14	ELECTRIC IRONS	0.013	0.406	0.482						0.888	0.386	2.086	*
		(1.851)	1.506	1.787						(3.630)			
14	RADIO CASSETTE	-0.001	0.832	-0.304	0.521	-0.114	-0.023	-0.256	0.093	0.770	0.714	2.675	*
		(-0.221)	(4.231)	(-1.260)	(2.227)	(-0.524)	(-0.097)	(-0.983)	(0.476)	(2.923)			
14	TELEPHONE SETS	-0.002	0.555	0.387	-0.146	0.050	-0.110	0.743	-0.282	1.195	0.601	2.512	*
		(-0.330)	(2.177)	(1.239)	(-0.483)	(0.178)	(-0.369)	(2.389)	(-1.117)	(3.504)			
15	FISHING RODS	0.002	0.502	-0.045	-0.147	0.233				0.544	0.253	1.506	*
		(0.314)	(2.095)	(-0.158)	(-0.515)	(0.960)				(2.030)			
15	PANS, BALL POINT	0.010	0.594	0.150						0.744	0.195	1.598	*
		(1.005)	(1.563)	(0.394)						(2.157)			
15	UMBRELLAS	0.006	0.632	0.022						0.654	0.336	1.929	*
		(0.960)	(2.584)	(0.090)						(2.945)			

Coefficients different from zero at 5% significance level -* 23
Coefficients different from zero at 10% significance level -** 3

P*it - Export Price in terms of home currency for commodity i at time t.
E_t-j - Nominal exchange rate at time t-j.
** - Coefficient is estimated by second-degree Almon polynomial lag model. Others by three-degree Almon polynomial lag model.

Comm Group

1	Agriculture	9	Rubber Products
2	Food	10	Plastic Products
3	Wood & Bamboo Products	11	Primary Metal Products
4	Leather	12	Fabricated Metal Products
5	Textile mill products	13	Machinery
6	Apparel & other Textile Products	14	Electrical & Electronic Equipments
7	Paper products	15	Misc. Manufacturing
8	Industrial Chemical		

TABLE 2

ESTIMATED VALUE OF PTM ELASTICITY IN TAIWAN (1986 Q2-92,Q3)

$$dLnQ2 = a0 + a1*dLn(E)t + a2*dLn(E)t-1 + a3*dLn(E)t-2 + a4*dLn(E)t-3 + a5*dLn(E)t-4 + a6*dLn(E)t-5 + a7*dLn(E)t-6$$

COMM GROUP	COMMODITIES CONTENT	Constant	E_t	E_t-1	E_t-2	E_t-3	E_t-4	E_t-5	E_t-6	Cumulative E value	Centered R square	D/W	* - Coeff at less than 90% Sig level
0	BANANA	-0.052 (-0.971)	-0.072 (-0.086)								0.000	2.157	
0	TANKAN	-0.039 (-0.525)	4.167 (1.823)								0.131	2.558	
2	CRYSTAL SUGAR	0.013 (0.481)	0.735 (0.803)								0.028	1.652	
2	INSTANT NOODLE	-0.001 (-0.165)	0.120 (0.467)	0.674 (2.213)	-0.318 (-1.040)	0.178 (0.682)				0.654 (2.273)	0.345	1.755	*
2	MEAT OF SWINE	-0.008 (-0.251)	1.123 (1.996)	1.355 (2.504)	1.027 (1.962)	-1.201 (0.140)	-2.406 (-0.210)	-0.260 (-0.577)	0.821 (1.714)	3.444 (2.230)	0.538	2.417	*
3	FALSE CYPRESS	0.007 (0.483)	0.544 (1.134)	0.587 (0.999)	0.848 (1.488)	0.447 (0.844)	0.205 (0.363)	0.756 (1.293)	0.079 (0.166)	3.465 (5.398)	0.706	0.606	*
3	LAUAN PLYWOOD	-0.007 (-0.630)	0.455 (1.182)								0.060	1.842	
4	UPPER LEATHER, CATTLE OR COWHIDE	0.028 (1.332)	1.877 (2.403)	-0.309 (-0.333)	0.452 (0.572)					2.020 (2.568)	0.305	2.068	*
5	WOOL TOPS	-0.001 (-0.032)	0.792 (1.411)								0.083	2.495	
6	JACKET, MEN'S	0.026 (-1.747)	1.066 (1.881)							1.066 (1.881)	0.174	1.864	**
6	SHIRT, MEN'S	0.018 (2.077)	0.927 (3.076)	0.282 (0.790)	0.254 (0.765)	0.076 (0.230)	-0.148 (-0.421)	0.034 (0.113)		1.425 (3.759)	0.654	1.302	*
6	SHIRT, WOMEN'S	0.019 (1.774)	0.813 (1.961)	0.101 (0.242)						0.914 (2.428)	0.245	1.322	*
7	PULP, BAGASSE	0.019 (2.332)	1.364 (4.599)	-0.333 (-0.950)	-0.458 (-1.300)	0.225 (0.751)				0.799 (2.412)	0.563	2.288	*
8	POLYPROPYLENE	0.016 (1.196)	1.684 (3.649)	-0.360 (-0.626)	-0.377 (-0.687)	0.303 (0.594)	0.538 (0.991)	-0.065 (-0.116)	0.228 (0.498)	1.957 (3.168)	0.563	2.100	*
9	TUBES, RUBBER, BICYCLE	0.007 (1.234)	1.236 (6.524)	-0.751 (-3.238)	0.232 (1.032)	0.233 (1.114)	0.272 (1.218)	-0.761 (-3.293)	0.239 (1.274)	0.701 (2.762)	0.789	2.852	*
9	TUBES, RUBBER, MOTORCYCLE	0.002 (1.097)	0.261 (0.491)	0.194 (0.309)	0.138 (0.218)	0.643 (1.197)				1.235 (2.083)	0.197	2.617	*
9	TYRES, RUBBER, BICYCLE	-0.002 (-0.197)	1.401 (3.241)	-0.784 (-1.535)	0.955 (1.860)	-0.457 (-1.045)				1.114 (2.309)	0.456	1.805	*
9	TYRES, RUBBER, MOTORCYCLE	0.003 (0.321)	0.688 (2.482)	0.010 (0.030)	-0.285 (-0.896)	0.113 (0.354)	0.239 (0.875)			0.764 (2.231)	0.335	1.992	*
10	PLASTIC RAINCOATS	0.000 (0.021)	1.351 (2.067)							1.351 (2.067)	0.188	1.771	*
10	PLASTIC SLIPPERS	0.007 (0.817)	0.777 (2.721)	-0.143 (-0.439)	0.097 (0.296)	0.284 (0.867)	-0.156 (-0.555)			0.859 (2.433)	0.430	2.053	*
10	PLATES, POLYMETHYL METHACRYLATE, RIGID	0.003 (0.460)	0.563 (2.119)	0.162 (0.516)	0.311 (0.984)	-0.194 (-0.720)				0.842 (2.831)	0.425	1.246	*

TABLE 2 (Continue)

ESTIMATED VALUE OF PTM ELASTICITY IN TAIWAN (1986 Q2-92, Q3)

$$dLn(X)t = a0 + a1*dLn(E)t + a2*dLn(E)t-1 + a3*dLn(E)t-2 + a4*dLn(E)t-3 + a5*dLn(E)t-4 + a6*dLn(E)t-5 + a7*dLn(E)t-6$$

COMM GROUP	COMMODITIES CONTENT	Constant	E_t	E_t-1	E_t-2	E_t-3	E_t-4	E_t-5	E_t-6	Cumulative E value	Centered R square	D/W	* - Coeff at 95% Sig level
11	PLATES, OF IRON OR STEEL	0.031	0.880								0.086	1.327	
		(1.657)	(1.442)										
12	CHAIRS, FOLDING, METAL	0.009	0.875								0.033	2.813	
		(0.283)	(0.874)										
12	SCREW DRIVER, IRON OR STEEL	0.009	0.560	0.208	0.265	0.033	-0.284	0.018	0.253	1.053	0.549	0.986	*
		(1.120)	(2.012)	(0.609)	(0.802)	(0.107)	(-0.867)	(0.054)	(0.915)	(2.824)			
13	AIR COMPRESSORS	0.007	1.800							1.800	0.156	2.905	**
		(0.296)	(1.842)							(1.842)			
13	BENCH GRINDER	-0.001	0.628							0.628	0.130	1.281	**
		(-0.077)	(1.815)							(1.815)			
13	DRILLING MACHINES	0.002	0.541								0.111	2.033	
		(0.167)	(1.655)										
14	ELECTRIC FANS, DOMESTIC USE	-0.005	0.275	0.450	-0.337	0.345	-0.160			0.574	0.415	2.214	*
		(-0.747)	(1.217)	(1.745)	(-1.301)	(1.334)	(-0.718)			(2.058)			
14	ELECTRIC IRONS	0.006	0.304	0.508	0.516	-0.853				0.475	0.681	2.368	*
		(0.996)	(1.480)	(2.096)	(2.118)	(-4.110)				(2.074)			
14	RADIO CASSETTE	0.013	0.892	-0.404	0.830	-0.519	0.090			0.889	0.536	1.947	*
		(1.585)	(3.084)	(-1.221)	(2.501)	(-1.563)	(0.316)			(2.489)			
14	TELEPHONE SETS	0.002	0.575	0.427	-0.106	0.033	0.015	0.590	-0.175	1.359	0.607	2.893	*
		(0.303)	(2.214)	(1.342)	(-0.344)	(0.115)	(0.050)	(1.861)	(-0.680)	3.906			
15	FISHING RODS	0.002	0.530							0.530	0.211	1.641	*
		(0.295)	(2.147)							(2.147)			
15	PANS, BALL POINT	0.016	0.004	1.743	-1.341	0.835				1.242	0.449	1.852	*
		(1.205)	(0.009)	(3.065)	(-2.347)	(1.716)				(2.311)			
15	UMBRELLAS	0.008	0.659	-0.006						0.654	0.297	1.599	*
		(1.112)	(2.422)	(-0.021)						(2.645)			

Coefficients different from zero at 5% significance level -* 23
Coefficients different from zero at 10% significance level -** 3

X*t - the ratio of Export Price in terms of home currency to Domestic Price for commodity i at time t.
E_t-j - Nominal exchange rate at time t-j.

Comm Group

1	Agriculture	9	Rubber Products
2	Food	10	Plastic Products
3	Wood & Bamboo Products	11	Primary Metal Products
4	Leather	12	Fabricated Metal Products
5	Textile mill products	13	Machinery
6	Apparel & other Textile Products	14	Electrical & Electronic Equipments
7	Paper products	15	Misc. Manufacturing
8	Industrial Chemical		

TABLE 3
RESPONSES OF EXPORT-DOMESTIC PRICE RATIO IN TAIWANESE PRODUCTS

Commodity		BANANA		TANKAN		CRYSTAL SUGAR		INSTANT NOODLE		FALSE CYPRESS		JACKET, MEN'S		SHIRT, MEN'S		SHIRT, WOMEN'S		PULP, BAGASSE		POLYPROPYLENE		TUBES, RUBBER, BICYCLE		TYRES, RUBBER, BICYCLE	
Commodity Group		1		1		2		2		3		6		6		6		7		8		9		9	
		(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		(12)	
Constant																0.54	(2.97)								
% Change in Nominal Exchange Rate Shock																									
	t											1.02	(2.76)	0.45	(2.36)	0.80	(2.91)	1.27	(2.77)	1.31	(2.39)	1.20	(2.91)	1.24	(2.22)
	t-1											0.77	(2.43)					0.66	(1.93)			0.84	(2.75)	1.13	(2.17)
	t-2									0.80	(3.37)														
	t-3									1.40	(4.18)														
	t-4																								
% Change in Real Exchange Rate																									
	t													0.83	(2.04)										
	t-1													0.76	(2.17)					0.63*	(2.09)				
	t-2													0.70	(0.48)					0.51*	(1.89)				
	t-3									0.73	(2.11)			0.63	(2.30)							0.67	(2.01)		
	t-4									1.00	(2.71)			0.56	(2.14)							0.85	(2.22)		
	t-5									1.27	(3.15)														
	t-6									1.54	(3.44)														
% Change in Real Wage Rate of Taiwan																									
	t					0.73	(2.20)	0.73	(2.20)			-0.97	(-3.43)			0.67	(2.87)								
	t-1			1.83	(1.83)	0.52	(2.03)	0.52	(2.03)			-0.78	(-3.45)			0.52	(2.85)								
	t-2			1.77	(2.29)							-0.58	(-3.47)	0.16*	(1.84)	0.38	(2.79)								
	t-3	0.76	(2.40)	1.71	(2.32)							-0.38	(-3.38)	0.11*	(1.84)	0.23	(2.56)								
	t-4	0.82	(2.45)									-0.18	(-2.55)												
	t-5	0.87	(1.97)																						
	t-6																								
% Change in Labor Productivity of Taiwan																									
	t																								
	t-1																								
	t-2											0.51	(2.27)												
	t-3											0.56	(2.63)	0.23	(2.08)										
	t-4											0.61	(2.95)	0.25	(2.34)										
	t-5											0.66	(3.20)	0.27	(2.55)									0.40	(2.24)
	t-6											0.71	(3.36)	0.30	(2.68)									0.48	(2.40)
% Change in Real Income of Taiwan																									
	t																								
	t-1															-0.87	(-2.03)								
	t-2	-4.61	(-2.08)			-1.17	(-2.02)	-0.56	(-2.48)							-0.93	(-2.59)								
	t-3	-3.80	(-2.19)			-2.21	(-2.63)	-0.50	(-3.47)							-0.98	(-3.16)								
	t-4	-2.99	(-2.02)			-2.72	(-2.88)	-0.44	(-2.33)							-1.04	(-3.43)								
	t-5					-3.24	(-2.87)							-0.43*	(-1.97)	-1.09	(-3.26)								
	t-6					-3.76	(-2.77)							-0.58*	(-2.01)	-1.15	(-2.88)								
% Change in Real Income Income of Foreign Country																									
	t					8.04	(2.87)																		
	t-1					6.78	(3.00)																		
	t-2					5.52	(3.27)																		
	t-3	8.95	(2.26)			4.26	(3.50)					1.48	(3.07)												
	t-4	9.47	(2.86)			2.99	(3.01)					2.45	(5.38)												
	t-5	10.00	(3.17)									3.42	(5.12)												
	t-6	10.52	(3.57)									4.38	(4.50)												
Regression R Square		0.82		0.72		0.74		0.72		0.95		0.84		0.90		0.84		0.69		0.75		0.71		0.67	
Durbin-Watson		1.70		2.84		2.54		2.52		2.84		2.38		2.71		2.51		2.17		2.84		2.85		2.97	

The figures in parentheses are t-statistics.
* - Reject the hypothesis that the coefficient equals zero at 0.10 significance level. Others reject the hypothesis at 0.05 significance level using the two-tail test.

Commodity Group:

1 Agriculture
2 Food
3 Wood & Bamboo Products
4 Leather
5 Textile mill products
6 Apparel & other Textile Products
7 Paper products
8 Industrial Chemical
9 Rubber Products
10 Plastic Products
11 Primary Metal Products
12 Fabricated Metal Products
13 Machinery
14 Electrical & Electronic Equipments
15 Misc. Manufacturing

TABLE 3 (Continue)
RESPONSES OF EXPORT-DOMESTIC PRICE RATIO IN TAIWANESE PRODUCTS

Commodity	TYRES, RUBBER, MOTORCYCLE		PLASTIC RAINCOATS		PLASTIC SLIPPERS		PLATES, OF IRON OR STEEL		SCREW DRIVER, IRON OR STEEL		BENCH GRINDER		DRILLING MACHINES		ELECTRIC IRONS		TELEPHONE SETS		FISHING RODS		PAINT, BALL POINT		UMBRELLAS	
Commodity Group	9		10		10		11		12		13		13		14		14		15		15		15	
	(13)		(14)		(15)		(16)		(17)		(18)		(19)		(20)		(21)		(22)		(23)		(24)	
Constant					0.27	(2.76)			0.39	(2.43)														
% Change in Nominal Exchange Rate Shock																								
t	1.11	(3.47)	1.55	(2.60)	0.60	(2.12)	1.56	(2.80)	0.78	(2.44)									1.05	(3.05)			0.62	(3.56)
t-1	0.73	(2.99)	1.16	(2.03)					0.52*	(1.90)	0.80	(2.31)	1.66	(2.96)	0.76	3.63	0.88	(2.98)	0.57	(2.24)	1.45	(2.57)	0.41	(2.44)
t-2											0.89	(2.10)	1.23	(3.33)	1.13	4.25	0.66	(2.86)						
t-3													0.80	(2.29)										
t-4																								
% Change in Real Exchange Rate																								
t					0.70	(3.12)																		
t-1					0.64	(4.01)			0.65	(2.19)					0.53	(2.39)								
t-2					0.58	(4.26)			0.73	(3.31)					0.53	(2.78)								
t-3	0.70	(2.24)			0.53	(3.03)			0.81	(4.28)					0.53	(2.93)	0.51*	(1.96)	0.56	(2.24)				
t-4					0.47*	(1.92)			0.89	(4.02)					0.53	(2.71)			0.66	(2.22)				
t-5									0.97	(3.27)					0.54	(2.32)								
t-6																								
% Change in Real Wage Rate of Taiwan																								
t					0.51	(2.13)	0.47	(2.18)	0.38	(2.06)							-0.203*	(-2.11)						
t-1					0.42	(2.51)	0.34*	(2.00)	0.29	(2.60)							-0.162*	(-2.09)						
t-2					0.34	(2.75)			0.20	(3.03)														
t-3					0.25*	(1.91)							0.69	(2.82)										
t-4													1.02	(3.02)									0.31	(2.41)
t-5																							0.43	(2.42)
t-6																							0.54	(2.29)
% Change in Labor Productivity of Taiwan																								
t																								
t-1																								
t-2							0.43*	(2.15)																
t-3							0.43	(2.26)																
t-4							0.42	(2.23)	0.37	2.02														
t-5							0.42*	(2.06)																
t-6																								
% Change in Real Income of Taiwan																								
t																								
t-1																								
t-2																								
t-3																								
t-4									-0.21	(-2.05)														
t-5									-0.30	(-2.28)														
t-6																								
% Change in Real Income Income of Foreign Country																								
t					-1.25*	(-2.00)			-1.29*	(-1.95)														
t-1					-1.03	(-2.25)			1.07	(-2.24)														
t-2					-0.81	(-2.33)			-0.84	(-2.37)							-0.97	(-2.35)						
t-3																	0.92	(-2.71)						
t-4																								
t-5																								
t-6																								
Regression R Square	0.67		0.66		0.82		0.78		0.82		0.69		0.71		0.84		0.75		0.67		0.70		0.86	
Durbin-Watson	2.25		2.98		2.12		3.20		1.89		2.02		2.51		2.63		2.09		2.64		2.44		2.71	

The figures in parentheses are t-statistics.
* - Reject the hypothesis that the coefficient equals zero at 0.10 significance level. Others reject the hypothesis at 0.05 significance level using the two-tail test.

Commodity Group

1	Agricultur	5	Textile mill products	Rubber Products	13 Machinery
2	Food	6	Apparel & other Textile Prods	Plastic Products	14 Electrical & Electronic Equipments
3	Wood & B	7	Paper products	Primary Metal Products	15 Misc. Manufacturing
4	Leather	8	Industrial Chemical	Fabricated Metal Products	

Table 4

Sectoral Wage and Labor Productivity

Taiwan Area

Nominal Average Wage (NT $)

	Food 1	Wood 2	Leather 3	Textile mill 4	Apparel of Textile 5	Paper 6	Chemical 7	Rubber 8	Primary Metal 9	Fabricate Metal 10	Machinery 11	E&E Equipment 12	Misc 13
Q3, 1985	$12,445	$10,699	$10,748	$19,396	$9,828	$15,026	$12,120	$12,271	$16,646	$11,949	$13,086	$11,401	$10,272
Q3, 1992	$24,896	$20,147	$18,554	$23,145	$17,073	$27,496	$34,832	$23,187	$34,739	$23,813	$25,402	$24,869	$20,890
Growth Rate	100.05%	88.31%	72.63%	19.33%	73.73%	82.99%	187.40%	88.96%	108.69%	99.29%	94.11%	118.14%	103.36%

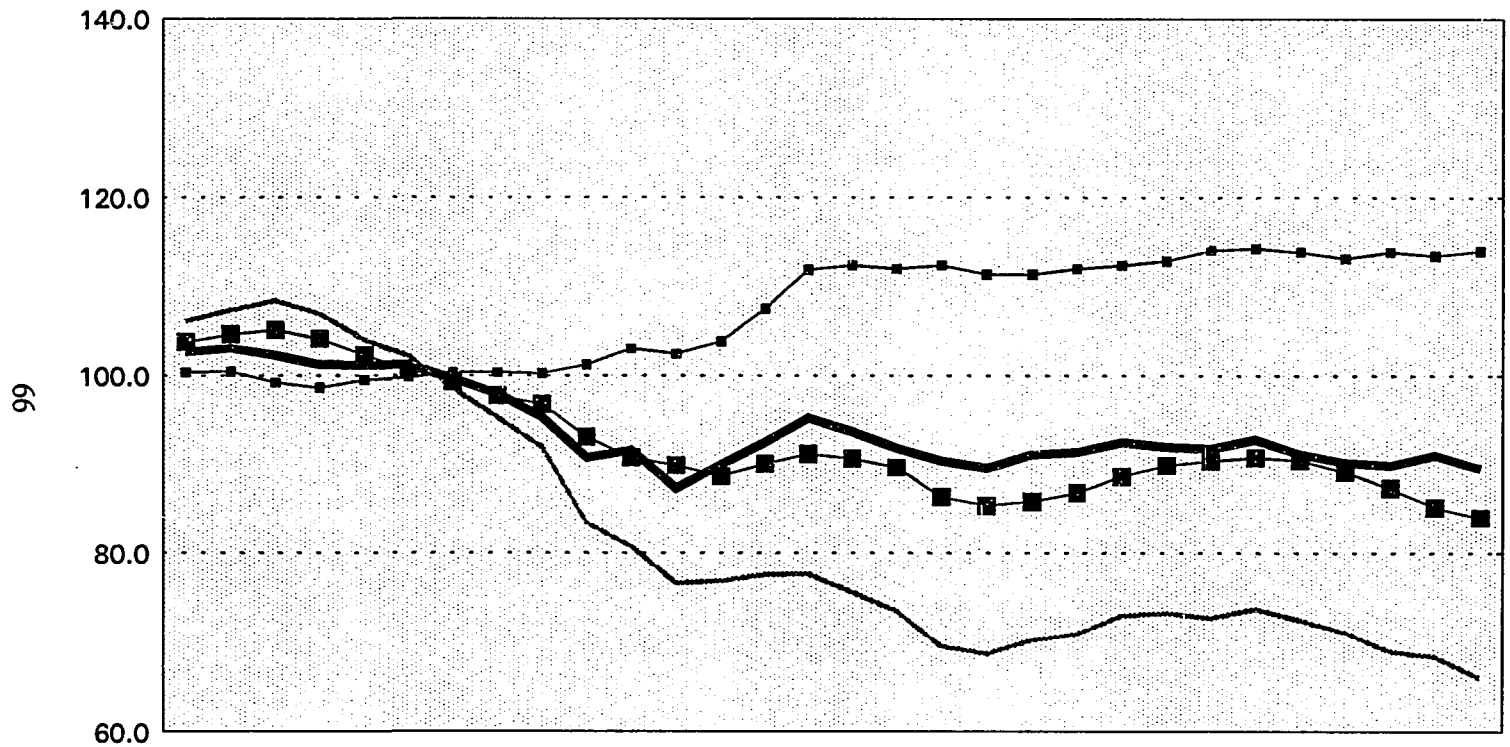
Labor Productivity (1986=100)

Q3, 1985	87.45	89.90	92.41	90.60	97.73	87.06	87.01	95.18	81.42	95.43	89.59	86.16	90.18
Q3, 1992	110.31	118.60	121.64	154.47	107.66	132.63	142.55	162.72	148.76	135.33	132.00	169.64	152.51
Growth Rate	26.14%	31.93%	31.63%	70.49%	10.15%	52.34%	63.82%	70.96%	82.71%	41.81%	47.33%	96.88%	69.11%

Data Source : Monthly Bulletin of Manpower Statistics in Taiwan Area, Republic of China

Export Price Index & Real Exchange Rate Index

Taiwan Vs USA (1986=100) __Chart 1

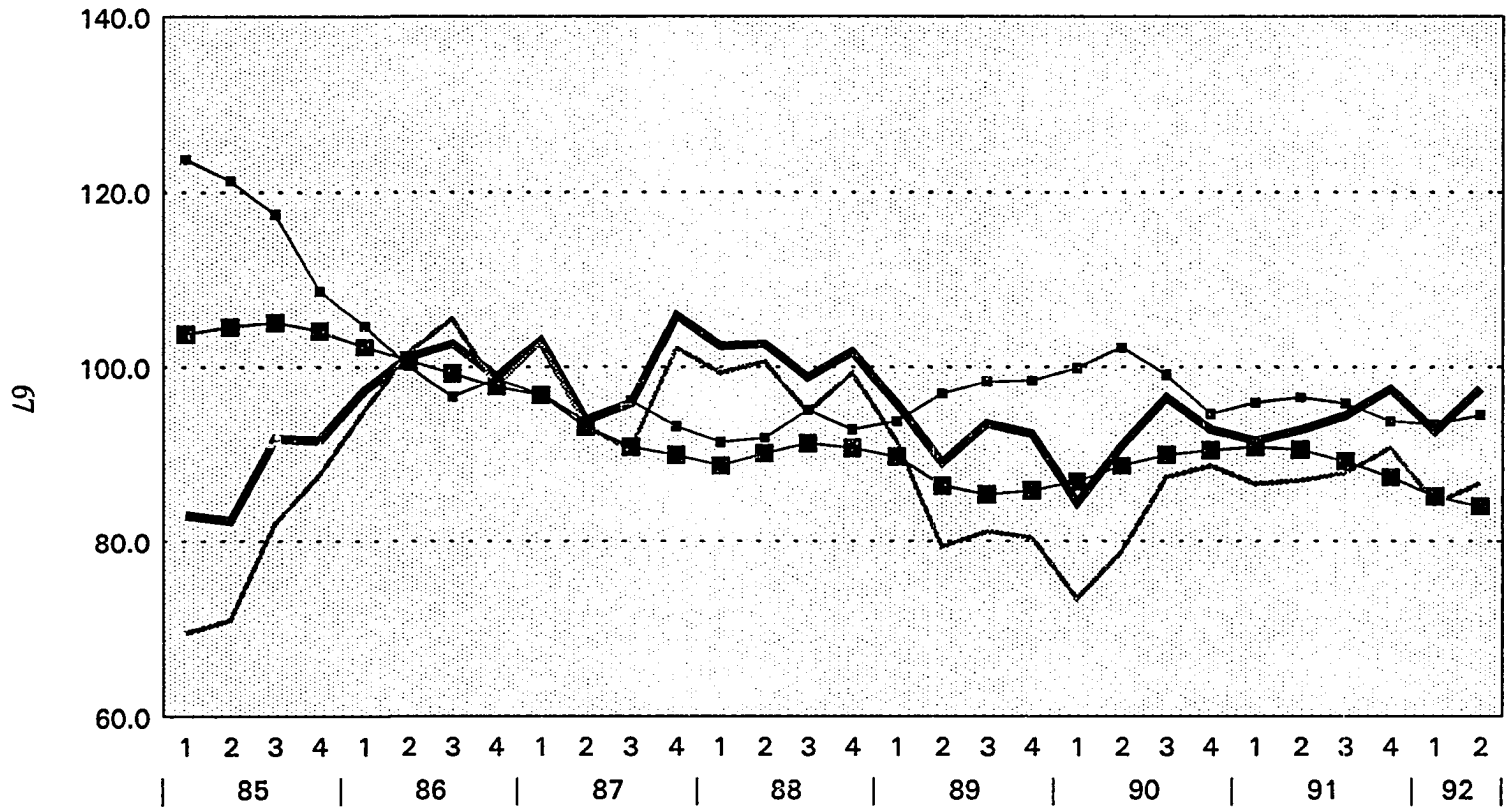


	85 1	85 2	85 3	85 4	86 1	86 2	86 3	86 4	87 1	87 2	87 3	87 4	88 1	88 2	88 3	88 4	89 1	89 2	89 3	89 4	90 1	90 2	90 3	90 4	91 1	91 2	91 3	91 4	92 1	92 2
Taiwan PI (NT $)	103.8	104.6	105.1	104.1	102.3	100.7	99.3	97.7	96.7	93.1	90.6	89.9	88.7	90.1	91.2	90.7	89.7	86.4	85.4	85.8	86.9	88.7	89.9	90.4	90.6	90.5	89.2	87.3	85.2	84.0
U.S. PI (US $)	100.4	100.5	99.2	98.6	99.5	99.8	100.4	100.4	100.3	101.3	103.0	102.5	103.8	107.5	111.9	112.4	112.0	112.4	111.4	111.4	112.0	112.4	112.9	114.0	114.2	113.8	113.2	113.8	113.5	113.9
Nom Exchange rate Ind	106.1	107.3	108.4	106.9	104.0	102.2	98.5	95.3	91.9	83.4	80.7	78.6	76.8	77.5	77.6	75.6	73.5	69.5	68.7	70.2	70.9	73.0	73.2	72.7	73.7	72.4	71.0	69.0	68.4	66.0
Real Exchange rate Ind	102.6	103.1	102.3	101.3	101.2	101.3	99.6	97.9	95.3	90.8	91.6	87.3	90.0	92.5	95.2	93.7	91.9	90.4	89.6	91.1	91.4	92.5	92.0	91.8	92.8	91.2	90.2	89.9	91.1	89.5

Data Source: Quarterly National Economic Trends (Executive Yuan, Republic of China)

Export Price Index & Real Exchange Rate Index

Taiwan vs Japan (1986=100) __Chart 2

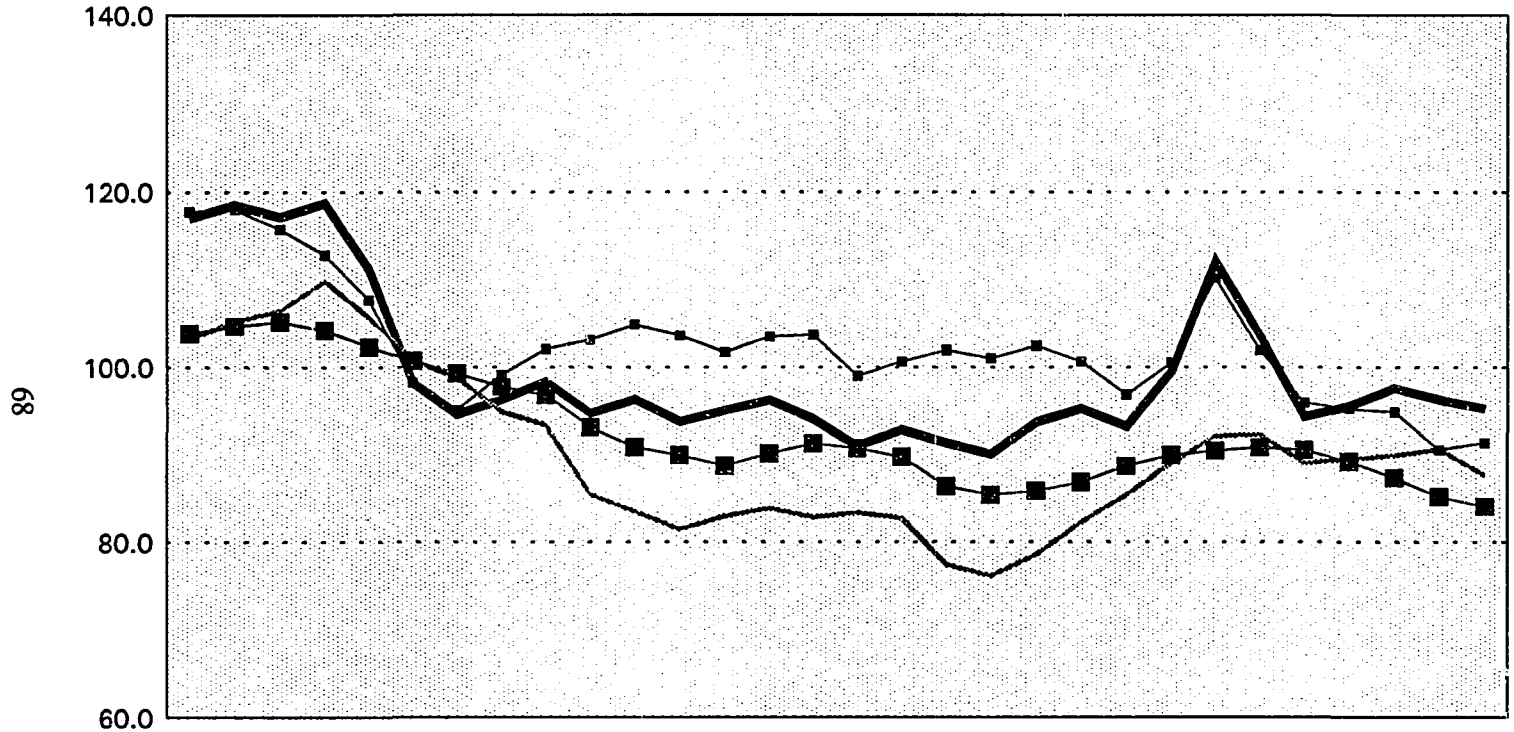


Taiwan PI (NT $)	103.8	104.6	105.1	104.1	102.3	100.7	99.3	97.7	96.7	93.1	90.8	89.9	88.7	90.1	91.2	90.7	89.7	86.4	85.4	85.8	86.9	88.7	89.9	90.4	90.8	90.5	89.2	87.3	85.2	84.0
Japan PI (Yuan)	123.8	121.3	117.4	108.7	104.7	100.1	98.6	98.7	96.8	93.7	96.1	93.1	91.4	91.8	95.0	92.8	93.7	96.9	98.3	98.4	99.9	102.2	99.1	94.6	95.8	96.4	95.7	93.7	93.4	94.4
Nom Exchange rate Ind	69.5	71.0	82.1	87.6	95.0	101.7	105.5	97.8	102.9	93.1	90.5	102.2	99.3	100.6	94.8	99.3	91.5	79.3	81.1	80.4	73.4	78.8	87.3	88.6	86.6	86.9	87.8	90.7	84.4	86.7
Real Exchange rate Ind	83.0	82.4	91.7	91.5	97.3	101.1	102.7	98.9	103.0	93.9	95.8	105.9	102.4	102.7	98.8	101.7	95.7	89.0	93.4	92.3	84.5	90.9	96.4	92.8	91.5	92.7	94.4	97.4	92.6	97.5

Data Source: Quarterly National Economic Trends (Executive Yuan, Republic of China)

Export Price Index & Real Exchange Rate Index

Taiwan vs Singapore (1986=100)__Chart 3



Taiwan PI (NT $)	103.8	104.6	105.1	104.1	102.3	100.7	99.3	97.7	96.7	93.1	90.8	89.9	88.7	90.1	91.2	90.7	89.7	86.4	85.4	85.8	86.9	88.7	89.9	90.4	90.8	90.5	89.2	87.3	85.2	84.0
Singapore PI (S. $)	117.7	118.0	115.8	112.7	107.6	98.2	95.1	99.1	102.0	103.1	104.8	103.5	101.7	103.4	103.7	99.0	100.6	101.9	101.0	102.4	100.6	96.8	100.5	110.1	101.9	95.9	95.2	94.8	90.5	91.3
Nom Exchange rate Ind	103.2	105.1	106.4	109.7	105.7	100.7	98.8	94.9	93.3	85.5	83.4	81.4	82.9	83.8	82.7	83.3	82.7	77.4	76.1	78.5	82.2	85.4	89.0	92.0	92.3	89.0	89.5	89.9	90.8	87.8
Real Exchange rate Ind	117.0	118.5	117.1	118.7	111.1	98.1	94.5	96.2	98.4	94.8	96.2	93.7	95.0	96.2	94.0	90.9	92.8	91.3	90.0	93.6	95.2	93.2	99.5	112.0	103.5	94.3	95.5	97.5	96.2	95.2

Data Source: Quarterly National Economic Trends (Executive Yuan, Republic of China)

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