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Exchange Rate Pass-Through, Asymmetric Responses and Market Shares

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ABSTRACT

This study examines ERPT with asymmetric response and both import and export market shares, using wool trade data. The study found that, asymmetric response may be as common as symmetric response. In addition, the responses (both in price and quantity demanded) to the changes in exchange rate are considerably different across goods, and even for the homogenous goods, across countries. In case of depreciation, the export price changes more than appreciation case in general, and as a result the destination price changes less. It is also found that the cases of excessive or perverse pass-through are found more frequently than reported by previous studies. This finding points out that strategic behavior of firms or unexpected response to exchange rate fluctuation takes place more frequently than we commonly expect or take, in particular at disaggregated levels. When the model considers asymmetric responses of the export price to appreciation and depreciation (of exporter's currency), the estimation provided that for 39 trade cases out of 83, export price responded to appreciation and depreciation in different fashions, although the normal response was the dominating phenomenon with 99 cases or about 60% out of 166 cases. Market shares affected the extent and direction of responses in select cases. These findings will have important implications for policy makers and traders.

본 연구는 국제경제학, 산업조직론 등 경제학의 여러 분야에서 광범위한 관심을 끌어온 환율의 변화와 이에 따른 교역재의 가격변화, 즉 환율의 전이현상을 분석하였다. 세분화된 양모(wool)의 교역 데이터를 사용하여, 자국통화의 가치 상승과 하락에 따른 가격변화가 대칭적인지, 그리고 수출국과 수입국의 시장점유율이 미치는 영향이 있는지를 중점적으로 분석한 본 연구는 다음과 같은 결론을 제시한다. 우선 매우 동질적인 재화임에도 불구하고, 교역대상국과 재화의 종류에 따라 환율의 전이정도와 방향이 상당히 다르다. 그리고 정상적인 전이현상(normal pass-through)이 전체의 60%를 차지하고 있지만, 실증적으로 과도한 전이현상(excessive pass-through)이나 특이한 전이현상(perverse pass-through)이 약 40%에 다다른 것도 특기할 만하다. 과도하거나 특이한 전이현상은 교역당사자들의 전략적 행태의 결과로 이해되는데, 본 연구의 결과는 매우 세분화된 데이터를 사용할 때 이런 현상이 기존 연구보다 많이 발견됨을 보여준다. 또한 83개의 교역관계 중 39개의 경우에 환율의 가격전이가 통화가치의 상승과 하락에 따라 다르게 나타나 비대칭적 전이가 광범위한 현상이며, 시장점유율이 경우에 따라 전이의 정도를 결정짓는 중요한 변수가 될 수 있음을 시사하고 있다.

Ⅰ. Introduction

This study explores topics related to exchange rate pass-through (ERPT). More specifically, it analyzes the topics being received the widest attention in the discipline: the relationship between the degree of ERPT and market share when the asymmetric response of price to exchange rate fluctuation is considered. While the relationship between ERPT and market shares, or ERPT and asymmetric response has been explored previously, the analysis of the role of market shares in the presence of asymmetric response has never been attempted.

The post-Bretton Woods era that allowed the free fluctuation of exchange rates provided the impetus for research on the effect of exchange rate shocks on commodity prices. This topic was explored more intensively in the 1980s as economies experienced an unprecedented fluctuation in real exchange rates accompanied by the appreciation (until 1985), and then the subsequent depreciation of the US dollar, the vehicle currency, in the same decade. While the first few years of the 1990s have been characterized as a period of stability in foreign exchange markets as Goldberg and Knetter (1997) point out, there were still some notably large fluctuations in various currency values. In the 1980's and 1990's, it was frequently observed that the price of commodities in an importing country did not fluctuate as expected or predicted by the traditional models such as the law of one price. In other words, recent observations on the changes in commodity prices due to those in exchange rates were not consistent with the idea of the absolute Purchasing Power Parity (PPP). In addition, they violated the relative PPP as well, showing that the price gap between exporters and importers is not sustained when exchange rates fluctuate.

The frequent observation of the incomplete pass-through (when changes in the exchange rate are not fully transferred to commodity prices), or perverse pass-through (when changes in the exchange rate influence commodity prices in unexpected directions), was, in general, attributed by researchers to the intertemporal profit or market share maximization behaviour of the producers operating in imperfectly competitive markets. For example, foreign producers may respond to an appreciation of the Korean won by partially decreasing their prices (in Korea) and also increasing their profit margins. In this case, the exchange rate pass-through to the importer's price is less than one. In other words, when the exchange rate of the exporter depreciates by 1 percent, its price at destination decreases less than 1 percent, or the elasticity of the exchange rate pass-through is inelastic. On the other hand, in periods of depreciation of Korean won, it is frequently observed that the foreign exporter increases its prices but not in the full extent, by also reducing its profit margins, in order to keep up sales and defend its market share. Accordingly the exchange rate pass-through to the importer's price is again less than 1 (for example, Gagnon & Knetter, 1995; Krugman, 1987; Tivig, 1996; Varangis and Duncan, 1993).

Tivig's (1996) research on the perverse pass-through of exchange rates may be the seminal achievement in exploring the seemingly idiosyncratic phenomena in the context of dynamic oligopoly competition. He theoretically proves that an exporter

who aims to maximize its profit over time may change destination prices different from the normal case when exchange rate changes. For example, while it is expected that the destination price would increase when the destination's currency depreciates, an exporter operating in an imperfect market may strategically decrease its destination price in the current period. While this strategic behaviour is rigorously proved by Tivig (1996) and developed further by Gross and Schmitt (2000), this is in fact an extension of previous studies on incomplete pass-through such as Froot and Klemperer (1989). That is, the current perverse pass-through is the strategy to take a large market share, and practise the power in the next period to maximize the intertemporal profit, at the expense of the first period's profit loss.

Notwithstanding some unexpected outcomes such as perverse movement or no pass-through of commodity prices, most studies that utilized disaggregated data (such as 4-digit country specific industry data) reported the existence of pass-through. However, the extent of pass-through was partial and differentiated by periods and market structure, across regions and products (for example, Feenstra, 1989; Feenstra, Gagnon & Knetter, 1996; Gagnon & Knetter, 1995; Knetter, 1989, 1995; Marston, 1990; Martin & Rodriguez, 2004; Nagataki, 2002).

While intensive research has been carried out to find the existence of incomplete or perverse pass-through, both theoretically and empirically, on the other hand, the possibility of the asymmetric response was theoretically dealt with by a few economists as early as the mid 1980s (for example, Foster & Baldwin, 1986). Nevertheless, it was not until the late 1990s that the empirical phase on this asymmetric response of the price to exchange rate fluctuation attracted interest of researchers. The literature on the asymmetric response of trade prices to exchange rate changes is still rare. Only a few papers contribute to both the empirical and theoretical literature in the area. Webber (2000) argues that the theoretical literature offers three basic explanations for asymmetry: (i) marketing constraints, (ii) production technology switching, and (iii) market share objectives.

Foster and Baldwin (1986) believe that the asymmetry may come about because foreign exporters fix the ratio of sales to investment in marketing capacity. When the importer's currency depreciates against the exporters, say 1 percent, if there is insufficient investment in marketing technology, then the exporter will not be able to attract extra importers to buy the product. In this case, the optimal action for the exporter may be to increase export price by 1 percent, which leaves the importer's price stable. Therefore, the import pass-through is zero. In contrast, if the importer's currency appreciates, the increase in import price will lead some importers to leave the market. This reduction in demand will cause a reduction in the market price, which will find pass-through of fluctuation of exchange rates to both export and import price.

The production technology switching is suggested by Ware and Winter (1988). They assume that there exists a price-taking firm that exports to both a domestic and an export market. The firm purchases its inputs from overseas or domestically. When exchange rate changes, the firm can alter from where it gets its inputs and the type of production technology it uses. When domestic currency depreciates, the exporter will switch to domestic inputs (as foreign inputs are now more expensive) and technology. It will increase cost to some degree (as the foreign inputs were cheaper

before depreciation), and accordingly increase domestic (export) price. If this increase in exporter's price is the same ratio as the depreciation of the currency, the two effects are offset, and the import pass-through will be zero. During the appreciation phase of domestic currency, the producer will switch to foreign inputs, which make the cost lower, and consequently makes the domestic price lower. There is no guarantee that these depreciation effects and appreciation effects are symmetrical.

The third type of explanation for asymmetry was researched by Klemperer (1989) and Marston (1990), since Krugman (1987) first time considered "pricing-to-market"(PTM) behaviour in imperfect markets. In this regard, this argument is in line with a bunch of research conventionally developed in the field of ERPT. In imperfect markets, market price is higher than marginal cost, whose degree is called "mark-up". This price mark-up plays a role of shock absorber, especially when the producer's aim is to capture gains in market share. When the exporter's currency appreciates, if the exporter (producer) wants to keep market share, she will reduce price mark-up (and profit) and try to keep the destination price. In contrast, when the exporter's currency depreciates, she can choose optimal degree of pass through (decreasing the destination price) by absorbing some shock with the mark-up, and transferring some shock to exporting price.

Ⅱ. Framework and Data

1. Aims and Significance of the Study

The purpose of this paper is to explore how much of the exchange rate shock is absorbed by exporter and importer's prices, taking these into account that (i) response of prices to exchange rate fluctuation may be different in case of appreciation and depreciation, and (ii) market shares matter.

Previous sections reviewed the recent development in the field of ERPT studies, and discussed that an asymmetric response of price to exchange rate fluctuation started to attract interest of researchers. Nevertheless, only a few studies explore this issue as yet, for example, Coughlin and Polland (2000) and Webber (2000), where some of them found the existence of different response of the price to appreciation and depreciation of currencies.

While prior research has investigated the extent to which exporters' market power in the world market, no previous study has analyzed the changes in destination prices within the rigorous PTM (pricing-to-market) framework, which emphasizes the joint roles of market structure and exchange rates in international pricing. This research aims to reveal how monopolistic exporters react differently (or similarly) to fluctuations in exchange rates against each of its major trading partners. This study also takes into account the impact of the importer's market power (i.e., how large a portion of the exporter's total exports the importer takes), as well as the exporter's market share (i.e., how large a portion of the importer's market the

exporter takes), as the importer's market power may affect exporters' response to exchange rate fluctuation.

This study investigates the possibility of asymmetric responses further. In other words, it will empirically test the existence of the asymmetry for each type of wool for each trade case, and discuss the implication.

As well as the integration of asymmetry and market shares, another contribution of this study can be found from the use of highly disaggregated data. Eight-digit wool data, defined by World Trade Organisation (cf. Harmonized System Numbers), classify each kind of wool by its stage of processing and quality. For example, 51012120 is scoured wool, degreased shorn but not carbonised, carded or combed, and its diameter ranges from 20μm to 23μm. More benefits from using this data are provided in the following section.

This study also has strong policy implications. First, it is very important to understand the mechanism of the impact of exchange rate fluctuation to prices, which is related to various fields of economics such as international trade, international finance and industrial organization. Second, in a more macroeconomics aspect, this study is critical in understanding the effect of exchange rate changes on changes in trade account. While it is commonly believed that depreciation of currency will improve trade account, this is not always true and depends on constellation of parameters and variables, such as the changes in prices due to exchange rate changes and the elasticity of demand. In this regard, it is dangerous to discuss the impacts of appreciation or depreciation without deep understanding of ERPT. Third, the analysis will contribute to understanding pricing strategies of the exporter with limited monopolistic power. Fourth, this study has substantial importance to the Korean economy. The Korean economy is facing an era of rapid exchange rate change, and has to deal with impacts expected from this fluctuation. An analysis of price response to exchange rate fluctuation provides significant implications for Korea.

2. Data

This study uses Australian wool trade data for empirical analyses. There are at least four reasons to use the data for this study. First reason is the reliability of data. The Department of Agriculture, Western Australia (DAWA), collated the relevant data in a very disaggregated level, classified by the exporting ports and destinations. Second, once disaggregated to a reasonable level, wool in the same category is completely homogeneous. There is no more differentiation as can be found in manufacturing goods, hence, we can minimize the level of noise coming from differentiation of goods in the same category. Third, wool is raw material and usually free from trade restriction. While it is controversial how tariffs or non-tariff barriers affect ERPT, this characteristic of wool can exclude disturbance coming from trade barriers. Fourth, Australia is a major producer of wool, and its market share (and importers' share) varies across destinations. This is helpful in investigating the relationship between ERPT and market shares in particular with homogenous goods. Furthermore, Australian dollar showed reasonable fluctuation with major currencies

in the late 1990s and early 2000s, which is useful in analyzing the asymmetric response to exchange rate fluctuation.

The database "Australia's Wool Export (AWX)" provided by the DAWA records a total of 72 observations (monthly data for six financial years from July 1995 to June 2001) for the value and quantity of each type of wool exported and from each state to each destination. These monthly data were converted into quarterly data due to a large number of missing values.

The database AWX originally gives two variables for a variety of wool exported from each state to destinations: The quantity of export and the value of export for each period. The quantity is given in kilograms while the value is given in current Australian Dollar(AUD). The price of wool was computed in a straightforward fashion by dividing the value by the quantity yielding to a new variable denominated in AUD/kg. According to the data from the DAWA, the three main ports for wool export are Sydney, Melbourne and Fremantle.

As some variables remained with too many missing values even after converted into guarterly data, three kinds of Greasy wool and one Scoured wool are selected; the number of unobserved variables is too large for other kinds of wool. These Greasy raw wools were labeled as RAW 1, RAW 2 and RAW 3 respectively throughout the paper. For each quarter a quantity weighted average price was computed.

The four kinds of wool data have a minimum of 21 observations (i.e. a maximum of three missing observations) out of 24 quarters, and missing observations were computed by extrapolation. This extrapolation allowed us to include keeping a wide range of importing countries, which will increase the quality of the system estimation.[1]

The extrapolation was carried out as suggested by Dagenais (1975). He asserts that missing observations can be extrapolated without hurting the result of the original estimation by regressing the variable with unobserved values on independent variables which are not included in the original equation but somehow related to the variable with missing observation. On a quarterly basis, prices from the different exporting port are characterised by smoother fluctuations and a strong positive correlation. Therefore, it is possible to regress a series on another and to use the estimated relationship between the two series to infer the missing values. Melbourne has the greatest number of continuous time series (24 observations) and thus it was used most of the time to conduct the extrapolation for the two other ports.

[1] Note, that the export of Scoured wool from Sydney to the United Kingdom presents an exception where a series with less than 21 observations is considered for extrapolation. Since the missing values for this particular series were disperse enough, it may be possible to make a sensible extrapolation and again may add some information when estimating the system of equation described later.

<Table 1> The Types of Wool Used in the Study

Number	Name	Description
51011110 (RAW 1)	Greasy shorn wool (incl. fleece-washed wool)	Not carded or combed, 19 μm and finer
51011120 (RAW 2)	Greasy shorn wool (incl. fleece-washed wool),	Not carded or combed, 20 μm to 23 μm
51011130 (RAW 3)	Greasy shorn wool (incl. fleece-washed wool),	Not carded or combed, 24 μm to 27 μm
51211130 (Scoured)	Scoured wool (Degreased shorn wool)	Not carbonized, carded or combed, 20 μm to 23 μm

Ⅲ. Analysis of the Exchange Rate Pass-Through

1. Introduction - The General Concept of Pricing to Market

Most of recent studies on ERPT or PTM have built their models based on Froot and Klemperer (1989) and Knetter (1986). This PTM model involves a firm, which produces and sells identical goods in multiple markets. The firm maximizes its profit by selling in n separate markets at different prices, $p_1, \ldots, p_n$. The profit function of the firm is:

$$\Pi(p_1, \ldots, p_n) = \sum_{j=1}^{n} \frac{p_j q_j(p_j)}{e_j} - C\left[\sum_{j=1}^{n} q_j(p_j), w\right],$$

where p_j is the price in destination j in the destination's currency; q_j is corresponding quantity demanded, which is a function of the price in the importer's currency, p_j, with e_j the exchange rate (the value of export-country's currency in terms of the importer's currency); and $C(q,w)$ is the cost function, with q denoting total sales and w input prices. The first-order conditions result in the well-known expression for the price in destination j, expressed as a fraction of marginal cost and the elasticity of demand:

$$p_j = e_j \times MC \times [\xi_j / (\xi_j - 1)], \quad (1)$$

where ξ_j is the price elasticity of demand in destination j, and $[\xi_j / (\xi_j - 1)]$ is mark-up. This first order condition shows that, in imperfect markets, the price of a homogeneous commodity in each market depends on the market structure as represented by the value of the elasticity of demand. One of the implementations of this approach, which has been widely used since its introduction, was conducted by Knetter (1989), who estimated

$$\log p_{jt} = \theta_t + \lambda_i + \beta_j \log e_{jt} + \varepsilon_{jt}, \quad (2)$$

where p_{jt} is the price of exports to country j (in terms of the exporter's currency) measured at the export port; θ_t is a set of time effects; λ_j is a set of destination-specific effects; β_j is the exchange-rate elasticity; e_{jt} is the exchange rate; and ε_{jt} is a disturbance. In a perfectly competitive market, prices are equalized across destinations, so that $\lambda_j = \beta_j = 0$ for all destinations, and only the time effects will be nonzero as they measure the common price in each period. However, if the market is not perfectly competitive, λ_j and/or β_j will not be zero.

While equation (2) shows a general framework to empirically test issues related to ERPT phenomena, it basically presumes that the extent of ERPT is symmetric to appreciation and depreciation. However, it was argued by some economists that there is no guarantee that ERPT is symmetric. The following section discusses how the model can be developed when the asymmetric response is taken into account.

2. The Model of Asymmetric Response

The current exchange rate e_t (in logarithmic values) can be decomposed into three parts as explained in Webber (2000):

$$e_t = e_0 + e_t^A + e_t^D$$

where e_0 is the initial value of the logarithm of the exchange rate series,

$$e_t^A \equiv \sum_{\tau=1}^{t} \lambda_\tau (e_\tau - e_{\tau-1}), \quad \lambda_\tau = 1 \ \text{if} \ e_\tau \geq e_{\tau-1}$$

$$\lambda_\tau = 0 \ \text{if} \ e_\tau < e_{\tau-1},$$

$$e_t^D \equiv \sum_{\tau=1}^{t} \lambda_\tau (e_\tau - e_{\tau-1}), \quad \lambda_\tau^* = 1 \ \text{if} \ e_\tau < e_{\tau-1}$$

$$\lambda_\tau^* = 0 \ \text{if} \ e_\tau \geq e_{\tau-1}.$$

Therefore, the variable e_t^A represents the accumulated sum of the appreciation episodes, and e_t^D the accumulated sum of the depreciation episodes where e is defined as the value of importers' currency in term of exporters' currency. It is not necessary to include the depreciation force in the estimation, since an analysis using both e_t and e_t^A will allow us to form conclusions about the influence of depreciation, e_t^D.

The four variables are price (P), wage (w), exchange rate and exchange rate in appreciation episode, as to be discussed soon. Consider the time-series process that describes each of the variables in the set of four is assumed to be embodied within the following general structure:

$$x_{kt} = m_{kt} + \nu_{kt}, \ \text{and}$$
$$m_{kt} = \rho_k m_{kt-1} + \phi_k \varepsilon_{kt}$$

for all variable x_k, where $\rho \in (-1,1)$, $\varepsilon_{kt} \sim IID(0, \sigma_{\varepsilon k}^2)$, $\nu_{kt} \sim IID(0, \sigma_{\nu k}^2)$, $\forall k$, *and* ϕ_k are non-zero real numbers determining the potential long-run relations between the variables. Then the variable x_k can be expressed as

$$x_{kt} = \delta_{k0} + \phi_k \sum_{\tau=0}^{t-1} \rho_k^{\tau} \varepsilon_{k\,t-\tau} + \nu_{kt}, \tag{3}$$

where δ_{ko} is the initial values of variables. As we have only 24 observations, we do not pay special attention to the co-integration relationship between the variables. Nevertheless, if we have a vector of coefficient such as $\beta' = [\beta_1\ \beta_2\ \eta_1\ \eta_2]$ which satisfies $\beta'\phi = 0$, for $\phi' = [\phi_p\ \phi_w\ \phi_e\ \phi_A]$, then, from (3), a (kind of single co-integral) relationship is given by

$$\beta' x_t = \beta' \delta_0 + \beta' \nu_t = z_t \tag{4}$$

where δ_0' is a vector of initial conditions and v_t' is a vector of independent white noise disturbances.

From equation (4) and variables used in this study, a stochastic form of the export price vector normalized on export prices can be written in a general equation such as

$$ln\, p_t + \beta_0 + \beta_1\, ln\, w_t + \eta_1\, ln\, e_t + \eta_2\, ln\, e_t^A = u_t \tag{5}$$

where $\beta_0 = -\beta'\delta_0$ and $u_t = \beta'\nu_t$. Consequently the extent of appreciation export pass-through is $(\eta_1 + \eta_2)$ and the extent of depreciation pass-through is η_1 [3]. If it is found that $\eta_2 = 0$, then the hypothesis of asymmetry is not held, and we have symmetric ERPT, which is estimated as η_1 .[4]

3. Estimation and Discussion

Before the results are discussed, it will be helpful to investigate the structural relationship between the magnitude of the elasticity of export ERPT and that of import ERPT, as many previous research concentrates on import ERPT. In this study, due to the availability of data, the export price is used. The conversion of export ERPT to conventional import ERPT is summarized in Table 2.

It was hypothesized in previous models that the ERPT elasticities are a function of market shares, particularly a quadratic function as suggested by Feenstra, Gagnon and Knetter (1996). Unfortunately, the small number of observations used in this study does not allow using market shares directly into the model when asymmetry is

[2] This equation is what Webber (2000) used in his empirical study.

[3] In other words, $(\eta_1 + \eta_2)$ and η_1 are % change in price due to a 1% appreciation and depreciation of the currency respectively.

[4] While the equation is used to test and find asymmetric pass-through, it can be also used to test for other issues related to prices in international markets, such as PPP. For more information, see Webber (2000).

<Table 2> The Export ERPT Elasticity and Import ERPT Elasticity

Magnitude of Export ERPT Elasticity	Interpretation to Import Pass-Through
	Excessive
$0 < \eta$	The import price moves in the expected direction but the effect is excessive.
	Complete
$\eta = 0$	The import price moves in the expected direction, and all the exchange rate shock is absorbed by the import price.
	Incomplete
$-1 < \eta < 0$	The import price moves in the expected direction, and the exchange rate shock is shared by the exporter and importer.
	No Pass-Through
$\eta = -1$	The import price does not change.
	Perverse
$\eta < -1$	The import price moves in the unexpected direction.

hypothesized. [5]

At present it appears to be the only resolution of the problem to estimate the ERPT elasticity directly from the model without using market shares as regressors. Then for RAW 3 and Scoured wool, as we have 35 and 36 cases each, the elasticity is regressed on the exporter's market share and the importer's market share. This method cannot be applied to RAW 1 and RAW 3 as they have nine cases only, from three ports to their destinations each. The results of estimating equation (5) are rearranged and summarized in Table 3. All the coefficients (ERPT elasticities) reported in the table should be interpreted referring Table 2.

It is reported in Table 3 that asymmetry is revealed for 39 cases out of 83 pairs of [port-destination] for the 4 types of wool, where for 32 cases, depreciation pass-through is found to be larger than appreciation pass-through.[6] Several studies have examined the price response of traded goods under appreciations and depreciations, but the results were mixed and the direction of asymmetry was unclear, as Pollard and Couglin (2003) concluded. For example, Mann (1986) reports that ERPT into US was greater when dollar appreciated (or the exporter's currency depreciated) than when dollar depreciated (or the exporter's currency appreciated), which is consistent with the findings in this study. However, Kadiyali (1997) and Goldberg (1995) point out that the price of the photographic film and automobile imports in the US was more affected by depreciation of dollar (or appreciation of the exporter's currency). The pattern of the movement of price is also controversial in the field of industrial organization. For example, while Blinder et al (1998) conclude that there was essentially no evidence for the common belief that prices adjust more rapidly upward

[5] As we have two exchange rate variables (e and e^A), by using a quadratic function for the ERPT elasticity, we have to estimate 12 coefficients, which is a half of the total observation for each trade case. In addition, it is well accepted in the empirical research of ERPT to estimate the ERPT elasticities without market shares.

[6] Depreciation pass-through is usually the case that the destination price decreases and appreciation pass-through the case that the destination price increases.

<Table 3> ERPT Elasticities for Appreciation and Deprreciation

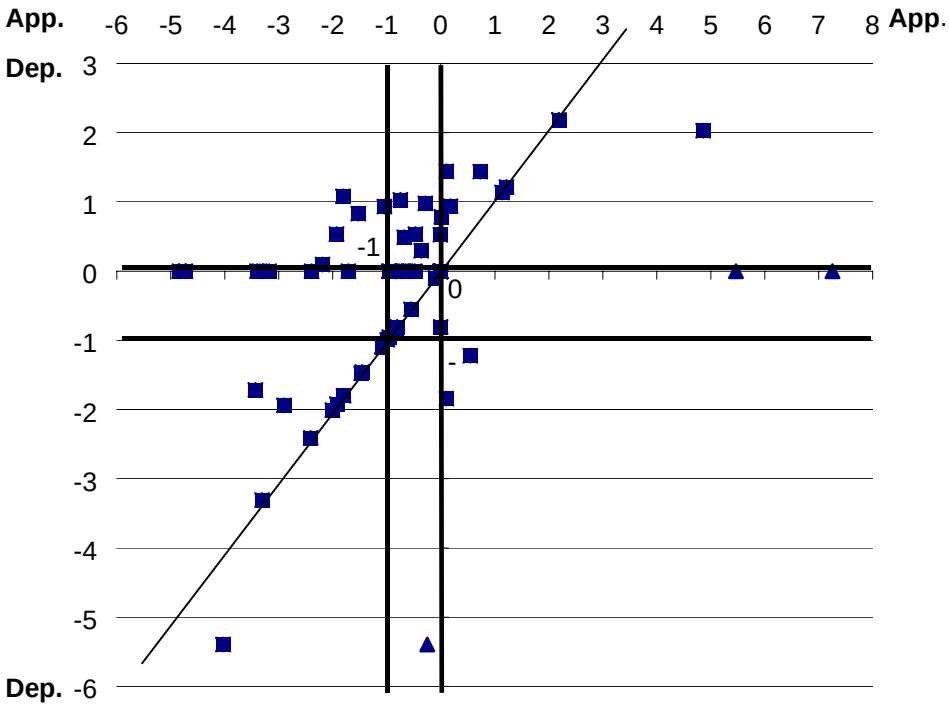
Exporters / Importers	Sydney		Melbourne		Fremantle	
	App.	Dep.	App.	Dep.	App.	Dep.
			Raw 1 (Greasy 51011110)			
China	0.00	0.00	0.00	0.00	0.73	1.44
Italy	0.00	0.00	-0.29	0.98	2.18	2.18
France	0.00	0.00	-1.48	-1.48	0.00	0.00
			Raw 2 (Greasy 51011120)			
China	-1.71	0.00	0.00	0.00	-0.85	0.00
Czech	0.00	0.00	0.00	0.00	0.00	0.00
France	-0.69	0.00	-0.71	0.00	0.00	0.00
Germany	-0.47	0.53	-0.36	0.30	0.00	0.00
India	-2.41	-2.41	0.00	0.00	0.00	0.00
Italy	0.00	0.00	-0.65	0.00	0.00	0.00
Japan	4.86	2.03	0.00	0.00	-	-
Spain	0.00	0.00	-0.99	-0.99	-2.19	0.09
Turkey	-0.10	-0.10	7.25	0.00	5.47	0.00
Taiwan	-0.83	-0.83	-1.09	-1.09	0.00	0.00
United Kingdom	-0.55	-0.55	-0.48	0.00	0.00	0.00
United States	-1.80	-1.80	0.55	-1.22	-0.96	-0.96
			Raw 3 (Greasy 51011130)			
China	-2.39	0.00	0.00	0.00	-3.40	0.00
India	-3.31	-3.31	-3.43	-1.72	-2.01	-2.01
Spain	0.00	0.00	-1.04	0.93	-0.96	0.00
			Scoured (51012120)			
China	-1.46	-1.46	-	-	-	-
Germany	-	-	-1.53	0.83	-0.95	0.00
India	-1.92	-1.92	-2.91	-1.94	0.00	0.00
Italy	0.00	0.00	-1.93	0.54	0.00	-0.80
Japan	0.00	0.00	-0.68	0.49	1.13	1.13
Korea	0.00	0.00	-0.01	0.53	1.22	1.22
Malaysia	0.11	-1.84	0.00	0.00	-	-
Spain	-	-	-0.81	-0.81	-0.75	1.03
Thailand	0.18	0.94	0.01	0.78	0.11	1.44
Taiwan	0.00	0.00	-4.03	-5.39	-	-
Turkey	-	-	-0.25	-5.39	-	-
United Kingdom	-3.35	0.00	-1.81	1.08	-3.18	0.00
United States	-	-	-4.84	0.00	-4.73	0.00

than downward, Peltzman (2000) still argues that prices tend to rise faster than they fall. The case of wool exports used in this study reports that in general downward adjustment of price in destination is more widely observed.

In this study, while ERPT for appreciation is larger than ERPT for depreciation for seven cases only, for all of these seven cases, the elasticities are extremely irregular. Figure 1 illustrates the relationship between the two types of ERPT elasticity (for appreciation and depreciation) for each trade cases with symmetric responses are on the 45 degree line. It is noteworthy that three exceptional cases are Australia's exports to Turkey, which might indicate the intrinsic data problem for Turkey. These three cases are in the extreme southeast area of the scatter diagram. While it is not clear why Australia's ERPT to Turkey shows such an irregularity, it should be reminded that Turkey has experienced extremely insecure monetary system and exchange rate markets during the period investigated in this study. It is frequently observed that ERPT is irregular when exchange rate changes too dramatically in a short period.

The second interesting finding is that, among these eight exceptions, four cases are for RAW 2 and the other four are for Scoured wool, where the four trade cases

[Figure 1] Scatter Diagram of ERPTs – for All Wools



Note: Small triangles are the elasticities for Turkey.

for RAW 2's lie in general in the north-east of those of Scoured wools. In other words, exports of RAW2 have relatively large appreciation and depreciation ERPT, implying that the response of export price of RAW 2 is relatively more excessive when the exchange rate changes. While it is expected that there are some relations between this irregularity of ERPT and exports of certain kinds of wool, this is beyond the scope of this study. Third, for most of these eight cases, the import market shares are very low. In contrast, exporter's market shares are either medium or large. This will be investigated in detail in the following section.

In case of appreciation, positive ERPT is discovered for 8 cases altogether, where 5 of them are from these eight exceptions and 3 cases are from 32 "expected" cases. As discussed, a positive appreciation ERPT implies that market response is excessive. The exchange rate shock is magnified and transferred to the importer. It would not be coincident that all the five cases from eight exceptional trade cases have very low import market shares, as the low level of market share would imply a very low level of negotiation power.

Figure 2 rearranges the scatter diagram of the elasticities for the entire sample as shown in Figure 1, to illustrate each trade case's distribution of the ERPT. For each ERPT, ERPT elasticities can be categorized into three groups; Excessive ERPT ($0 < \eta$), normal ERPT ($-1 \leq \eta \leq 0$) and perverse ERPT ($\eta < -1$). Therefore, the combination of appreciation and depreciation ERPT produces nine groups of responses. For example, Area I in Figure 2 is the case where export price shows excessive response to the fluctuation of the exchange rate, and results in magnified price changes at destination[7]. Seven trade cases out of 83 are included in this area. Area II is where appreciation ERPT is excessive but depreciation ERPT is normal. Only two cases are in this area, where both of them are exports to Turkey. Appreciation ERPT is unreasonably huge, and depreciation ERPT is zero. Area III is for excessive appreciation ERPT and perverse depreciation ERPT. Therefore, this case means that regardless of the direction of the exchange rate fluctuation, the wool price at destination always increases.

Area IV contains one trade case only, exports of Scoured wool from Melbourne to Turkey. Appreciation ERPT is normal, however, depreciation ERPT is perverse to a large extent, implying that in case of depreciation of Australian dollar against Turkey's currency, Australia's export price of Scoured wool to Turkey increases in large proportion. Area V includes trade cases of perverse responses for both appreciation and depreciation. 11 cases lie in this area, meaning that the destination price increases when the exporter's currency depreciates and decreases when it appreciates. For ten cases, depreciation pass-through is larger than appreciation pass-through. The only exception is scoured wool exports from Melbourne to Taiwan, which shows a large size of the two ERPT. Area VI is the group where appreciation ERPT is perverse and depreciation ERPT is normal. Therefore, the destination price decreases whenever the exchange rate fluctuates, regardless of whether it is appreciated or depreciated. Seven trade cases are in this area, and for all of them, depreciation pass-through is zero, meaning that depreciation of Australian dollar does not affect Australia's export price. In contrast, appreciation pass-through

[7] As one may see, area I is where $\eta_A > 0$ and $\eta_D < 0$, which is exactly the same as the North-East area in Figure 5.1. Area II is where $\eta_A > 0$ and $-1 \leq \eta_D \leq 0$, which is the middle-East area in Figure 1, and so on.

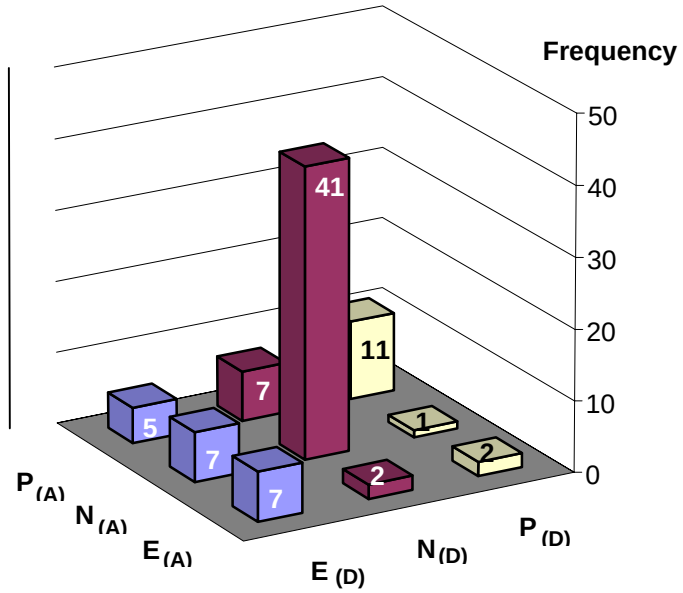
[Figure 2] Distributions of ERPTs

VII: $\eta_A < -1$ (Perverse) $0 < \eta_D$ (Excessive) Cases: **5**	**VIII**: $-1 \leq \eta_A \leq 0$ (Normal) $0 < \eta_D$ (Excessive) Cases: **7**	**I**: $0 < \eta_A$ (Excessive) $0 < \eta_D$ (Excessive) Cases: **7**	**Total Cases** **19**
VI: $\eta_A < -1$ (Perverse) $-1 \leq \eta_D \leq 0$ (Normal) Cases: **7**	**IX**: $-1 \leq \eta_A \leq 0$ (Normal) $-1 \leq \eta_D \leq 0$ (Normal) Cases: 41	**II**: $0 < \eta_A$ (Excessive) $-1 \leq \eta_D \leq 0$ (Normal) Cases: 2	**50**
V: $\eta_A < -1$ (Perverse) $\eta_D < -1$ (Perverse) Cases: 11	**IV**: $-1 \leq \eta_A \leq 0$ (Normal) $\eta_D < -1$ (Perverse) Case: 1	**III**: $0 < \eta_A$ (Excessive) $\eta_D < -1$ (Perverse) Cases: 2	**14**
Total Cases **23**	**49**	**11**	**83**

ranges widely, from –1 to –5. Trade cases included in Area VII show perverse response to appreciation and excessive response to depreciation. When Australian dollar appreciates, its export price decreases more than proportion that leads to a decrease in the destination price. Depreciation of Australian dollar results in excessive response of the destination price. This area has 5 trade cases. Area VIII collects seven trade cases, for which appreciation ERPT is normal, but depreciation ERPT is excessive. For two of them, appreciation ERPT is zero, meaning that Australian exporters absorb all exchange rate shocks. All the depreciation ERPT's lie in between zero and one, or very close to one. Area IX has the group of trade cases where the two ERPT's range between –1 and 0. For both appreciation and depreciation cases, the exporter and the importer absorb parts of the exchange rate shock. This is what the ERPT is conventionally believed to be. This area pertains 41 trade cases, which is about a half of the total trade cases examined in this study.[8]

[8] The degree of ERPT by ports are also categorized but not listed in this paper as it is not the major concern of this study.

[Figure 3] Summary of the Frequency of ERPT



Note: P, N and E stand for Perverse, Normal and Excessive respectively.
A and D in brackets represent appreciation and depreciation.

Frequency of the three possible ERPT is summarized in Figure 3. It is clear that while most export prices show normal ERPT, [Excessive- Excessive] and [Perverse-Perverse] combinations show generally higher frequencies than mixed combinations. When the depreciation ERPT is perverse to a destination, it is highly likely that the appreciation ERPT is also perverse.

4. Asymmetry and Market Powers Revisited

Most studies focusing on impact of market shares to the ERPT are about the influence of the monopolistic market power on pricing. While this study pursues the effect of market shares or power on ERPT, it has at least two distinctively different characteristics from previous studies. First, this study investigates the impact of the importer's power, as well as the exporter's power to the ERPT. It is expected that the buyer with a larger market share may practise its power in negotiating prices, as witnessed by the case of monopsony, which is an extreme case of concentration of purchasing power. Second, the importance of market share has never been explored in conjunction with asymmetric responses to exchange rates. All the studies that consider market shares are based on and built on the assumption of symmetric responses to appreciation and depreciation. Recent studies, including this study,

revealed that asymmetric responses are observed very frequently, which implies that the use of the results based on the assumption of symmetric responses may provide incorrect information. This study examines this important but under-researched issue, by integrating the significance of market power into an asymmetry model.

The most ideal method to explore the effects of market shares in an asymmetry model would be to include in the model the coefficient of (log) exchange rate as a function of the exporter's and importer's market share's. It is conventional in the study in this field that this ERPT function is expanded to the quadratic function as suggested by Feenstra, Gagnon and Knetter (1996). However, as we have only 24 observations, this method is at the risk of losing too large a portion of available observations. This is especially so as two more terms – linear and quadratic - with regard to the importer's market share should be included. In consequence, the appreciation and depreciation elasticities are first computed as shown in the previous section, and then these elasticities are regressed on the two kinds of market shares. As RAW 1 and RAW 3 have nine cases of wool exports only, the regression of the ERPT elasticity on the market shares are carried out for two kinds of wool only, RAW 2 and Scoured wool.

If the import share is larger, the importer is expected to practise its market power, as a monopsonist does. Suppose that the prevailing price is what the importer with a certain degree of market power accepts as an optimal price, given the exchange rate. When exporter's currency appreciates, an importing country, say F, experiences an increase in the price in its currency unless the ERPT is perverse or nil. Therefore, if the importing country F has a market power, it will try to stabilize the price it pays in its currency. If the importer's market power is successfully practised, and it can maintain the price of wool unchanged in its own currency, then export ERPT must be –1, and no import ERPT will be observed. In other words, the export price decreases (or increases) to the degree to completely offset the effect of appreciation (or depreciation) of the importer's currency, and the (import) price in F remains the same. If the importer's power exists but not sufficiently large to fully offset the effect of appreciation of the importer's currency (or depreciation of the exporter's currency), then incomplete pass-through ($-1 < \eta < 0$) will be observed. Or, if the importer's market power is far stronger, it may be the case that the importing country enforces exporters to further decrease the export price so that the import price is even lower in F's currency. This is the case of perverse pass-through, with $\eta < -1$.

In contrast, when exporter's currency depreciates, Country F with a large import market share will attempt to exploit all the benefit from depreciation of exporter's currency, by paying as low as possible in its currency. In an extreme case, export price is unchanged and F's importing price in its currency decreases proportionally as much as the depreciation of exporter's currency. Therefore, complete pass-through will be observed. If F's market share is negligible, the exporter will increase its export price while leaving F's importing price unchanged in F's currency, and maximize its profit in terms of exporter's currency. Therefore, no ERPT at destination will be observed.

Tables 4 and 5 summarize the results of regressing ERPT elsticities for appreciation and depreciation on different functional forms of market shares, as labelled as columns (1) to (7). While no estimation is found to be meaningful for

<Table 4> ERPT and Market Share with Asymmetric Responses – RAW 2

				Appreciation			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
C	-4.32***	-3.76***	-1.39*	0.53	0.35	-1.16	-4.23***
	(1.45)	(1.28)	(0.77)	(0.61)	(0.41)	(0.92)	(1.38)
S	27.23***	18.70**	4.19*	-	-	4.70	24.09***
	(9.20)	(7.24)	(2.33)			(2.84)	(8.50)
-	-29.26**	-19.50**	-	-		-	-25.84**
	(11.22)	(8.90)					(10.47)
IS	-19.15**	-	-	-8.24	-3.69	-4.70**	-6.31**
	(8.48)			(9.00)	(2.55)	(2.23)	(2.71)
IS²	37.55*	-	-	13.64	-	-	-
	(19.79)			(21.92)			
R²	0.23	0.12	0.07	0.03	0.03	0.12	0.20
R²-bar	0.13	0.07	0.05	0.00	0.00	0.06	0.12
Log Like.	-67.98	-70.35	-71.29	-72.02	-72.11	-70.41	-68.77
				Depreciation			
C	-2.04*	-2.05*	-0.51	-0.39**	-0.30**	-0.55	-2.04*
	(1.12)	(1.07)	(0.49)	(0.19)	(0.14)	(0.47)	(1.10)
S	10.20*	10.36*	0.90	-	-	0.80	10.20*
	(5.61)	(5.28)	(1.48)			(1.43)	(5.53)
S²	-12.53**	-12.71**	-	-	-	-	-12.53**
	(6.10)	(5.75)					(6.02)
IS	0.20	-	-	3.44	1.13*	0.96*	0.18
	(2.73)			(3.18)	(0.59)	(0.55)	(0.61)
IS²	-0.05	-	-	-6.92	-	-	-
	(6.85)			(8.15)			
R²	0.17	0.17	0.02	0.03	0.02	0.04	0.17
R²-bar	0.06	0.12	0.00	0.00	0.00	-0.02	0.10
Log Like.	-34.42	-34.43	-37.35	-37.27	-37.44	-37.10	-34.42

Least Squares with Newey-West HAC Standard Errors & Covariance

Sample: 35 Observations

Standard error given below the coefficients

***, **, *: Significant at 1%, 5%, 10% level of significance respectively

<Table 5> ERPT and Market Share with Asymmetric Responses – Scoured

				Appreciation			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
C	-1.31	-1.51	0.16	-0.99**	-1.38***	-0.09	-1.59
	(2.15)	(1.87)	(0.96)	(0.47)	(0.48)	(1.09)	(1.91)
S	8.96	8.46	-3.24	-	-	-3.12	8.18
	(11.93)	(11.10)	(2.23)			(2.25)	(11.41)
S^2	-16.69	-16.23	-	-	-	-	-15.75
	(15.66)	(14.85)					(15.37)
IS	-9.23	-	-	-6.42	3.31	2.32	1.16
	(6.93)			(7.29)	(2.68)	(2.33)	(2.52)
IS^2	41.92	-	-	39.41	-	-	-
	(31.32)			(27.34)			
R^2	0.20	0.18	0.11	0.04	0.02	0.12	0.18
R^2-bar	0.08	0.12	0.08	0.00	0.00	0.05	0.09
Log Like.	-53.37	-53.78	-55.10	-56.26	-56.53	-54.96	-53.74
				Depreciation			
C	0.33	0.44	0.52	-0.51	-0.31	0.61	0.50
	(1.04)	(0.97)	(0.65)	(0.99)	(0.72)	(0.77)	(1.06)
S	-1.85	-1.61	-2.19	-	-	-2.23	-1.37
	(7.10)	(6.96)	(1.86)			(1.83)	(7.11)
S^2	-0.62	-0.81	-	-	-		-1.20
	(11.29)	(11.08)					(11.27)
IS	5.35	-	-	4.97	-0.14	-0.85	-0.94
	(12.03)			(12.31)	(4.53)	(3.97)	(4.01)
IS^2	-25.40	-	-	-20.71	-		-
	(34.63)			(34.70)			
R^2	0.06	0.05	0.05	0.00	0.00	0.05	0.05
R^2-bar	0.00	0.00	0.01	0.00	0.00	0.00	-0.06
Log Like.	-56.31	-56.44	-56.45	-57.11	-57.18	-56.43	-56.42

Least Squares with Newey-West HAC Standard Errors & Covariance

Sample: 30 Observations

Standard error given below the coefficients

***, **, *: Significant at 1%, 5%, 10% level of significance respectively

Scoured wool (which could be predicted from the frequent irregularities of the results shown in the previous section), some interesting findings are revealed from the estimation for RAW2. For both appreciation and depreciation, as shown in columns (1), (2) and (7), the ERPT is significantly explained by quadratic and linear terms of exporter's market share, where the sign of the quadratic term is negative. These results are very robust to the inclusion of importers' market share, and the maximum is reached when the market share is about 0.46 to 0.48. While this result is different from previous studies, for example, by Feenstra, Gagnon and Knetter (1996), where a positive quadratic relationship is found, a close look at the data used in this study reveals that this result is not inconsistent with them[9]. It is very rare that a port's market share is larger than 50% for any kind of wool.[10] In other words, although the fitting using a quadratic function turns out to be significant, virtually the relevant market share ranges from 0% to about 50% in the most cases, and for this range of market share the elasticity of ERPT increases as market share increases. Fitting using a linear function shows a positive relationship between market share and ERPT elasticity, supporting this argument (as shown in column (3)), although its significance is slightly out of 10% in case of depreciation.

In contrast, the quadratic term of importer's market share has a positive coefficient, which has its minimum value at about 0.25. When a linear function is fitted together with a port's market share the importer's market share has a significant and negative coefficient (as shown in columns (6) and (7)). As the importer's market share rarely exceeds 25%, the results of the fitting of the importer's market share using a quadratic function are not inconsistent. The results reported in Tables 4 and 5 can be summarized in two parts.

(i) When the exporter's market share is larger, the larger the appreciation ERPT tends to be.

This result implies that, when the exporter's currency appreciates, it decreases its export price less to the market where it has a larger market share. More burden of the exchange rate shock is transferred to the importer, paying higher price in the importer's currency, compared to the importer with a large import market share. However, this result is applied to RAW 3 only and not found for Scoured wool.

(ii) When the importer's market share for exports is larger, the smaller the appreciation ERPT tends to be.

This result implies that, when the buyer takes a large share of the exporter's exports, exporters decreases their export price to that importer more when the exporter's currency appreciates. Therefore, the

[9] Nevertheless, it is still to be resolved that while the ERPT increases from the beginning in this study, Feenstra, Gagnon and Knetter (1996) find that the ERPT starts to increase after the market share is sufficiently large, such as at least 0.3.

[10] There are some exceptions like Fremantle's exports of scoured wool to Germany. Nevertheless, these represent only a small portion of the set of observations.

price the importer pays in its currency is not affected substantially, in spite of appreciation compared to the importers with smaller market shares, and exporters should bear the decrease in price in the exporter's currency.

For depreciation, only the quadratic term for the exporter's share turns out to be significant at the 5% level of significance while that for importer's share does not. The maximum ERPT is achieved when the market share is about 41%, which is surprisingly consistent with the appreciation case. The buyer's market share turns out to be significant for column (5) and (6), however, the fitness of the model is lower than (1) and (7).

For (1) and (7), it is found that the buyer's market share is not significant in case of depreciation, while the exporter's market share is important. When exporter's currency depreciates, exporters can increase its export price without hurting (increasing) the destination price. The findings from (1) and (7), combined with the market share range of Australian ports, explain that, the exporters can increase its export price by larger extent, when their market share is larger. Therefore, the buyers cannot fully enjoy the decrease in price due to the depreciation of Australian dollar .

5. Does Lagged Exchange Rate Matter?

While some studies consider current exchange rates only (e.g., Aw, 1993; Gagnon and Knetter, 1995; Salvador, 2003), lagged effects of exchange rate shocks on the price of a commodity have been in the centre of interest in the field of international economics, as this issue is in particular related to the exploration of the distinction between dynamic adjustment to temporary and permanent exchange rate changes.

Tcha and Sjaastad (1998) investigate the lagged effects of different exchange rates on the steel price in the US using a model developed from theoretical pursuit, nevertheless, most general approach is to use co-integration and vector auto regression (VAR), and analyze the dynamics, such as Gross and Schmitt (2000), Hung, Kim and Ohno (1993), Tcha and Kim (2002) and Varangis and Duncan (1993) among many. Froot and Klemperer (1989) find that the fall in the dollar price (in the US) of imports after a temporary appreciation is less than after a permanent appreciation. They also argue that purely temporary exchange rate changes lead to an unusually high degree of pricing-to-market.

Although the analysis of the dynamic effects of exchange rates change is useful, the data used in this study have only 24 observations, which are far too few to be used to draw out any useful and reliable results. As it is found from previous studies using impulse response that, when quarterly data is used, the exchange rate shock does not last longer than three to four quarters, this study attempts to find the lagged effects using a simple regression method where the equation to be estimated included exchange rate up to two lags. Unfortunately, the results did not present any interesting or meaningful findings, and consequently are not reported in this paper.

Ⅳ. Summary and Implications

This study examines ERPT with asymmetric response and both import and export market shares, using wool trade data. Altogether, 83 trade relationships are investigated using 24 quarterly observations that cover the period of 1995 to 2001. The major contributions of this study include the analysis of ERPT considering both symmetry and asymmetry response cases, comparison of ERPT across different major destinations, and investigation of the effect of importer's and exporter's market shares. Major implications from this study can be briefly summarized in what follows.

First, it should be taken into account that the responses (both in price and quantity demanded) to the changes in exchange rate are considerably different across goods, and even for the homogenous good, across countries. For instance, symmetric responses are found from 44 cases and asymmetric cases are found from 39 cases, out of 83 total cases. Among the 44 cases with symmetric responses, 27 cases are found to be the case of complete pass-through and 17 cases for incomplete. For 39 asymmetric cases, it is found that ERPT for depreciation is greater than that for appreciation for 32 cases. These results indicate that, asymmetric response may be as common as symmetric response, where in the real world both cases exist together.

In addition, in case of depreciation, export price changes more than appreciation case in general, and as a result the destination price changes less. In Korea, the impacts of exchange rate fluctuation are one of the most important concerns of the economy these days. However, regarding the impacts, irresponsible and inaccurate scenarios and forecasts are prevailing. This study shows that more microeconomic foundation is needed to discuss the impact of exchange rate fluctuation to changes in price, quantity exported, and current account.

Second, the policy makers have to enhance their understanding of pricing strategies of firms, and domestic firms have to improve their understanding of pricing strategies of foreign competitors. For example, in this study, the cases of excessive or perverse pass-through are found more frequently than reported by previous studies. Out of 166 cases (appreciation and depreciation cases for 83 trade relationships), perverse cases are reported for 37 cases and excessive cases are reported 30 times. This finding points out that strategic behavior of firms or unexpected response to exchange rate fluctuation takes place more frequently than we commonly expect or take, in particular at disaggregated levels.

Third, when the model considers asymmetric responses of the export price to appreciation and depreciation (of exporter's currency), the estimation provided somewhat different results. For 39 trade cases out of 83, it was found that export price responded to appreciation and depreciation in different fashions, although the normal response was the dominating phenomenon with 99 cases or about 60% out of 166 cases. Therefore, appreciation or depreciation of Korean currency will give different impacts to each commodity Korea exports and imports, and consequently, the argument based on symmetric response should not be applied.

Fourth, asymmetry approach with market shares shows that while the exporter's market share affects the export ERPT for RAW 2 when exporter's currency appreciates and depreciates, the importer's market share affects the export ERPT for RAW 2 only when the dollar appreciates. Their influences were not found significant for Scoured wool. Therefore, regardless whether the Australian wool exporters implicitly or explicitly collude a cartel or behave independently, it was statistically suggested that they practise market power in adjusting their export price of RAW 2 responding to exchange rates change. For Scoured wool, however, this practice was not confirmed. More specifically, the export ERPT is likely to increase as the larger the exporter's market share is, and the smaller the importer's market share is (for RAW 2). In other words, exporters decrease their prices less responding to appreciation of their currency, or increase their prices more responding to depreciation of their currency, when they trade with countries where they take large market shares.

In comparison, especially for RAW 2 when exporter's currency appreciates, the big buyers of the commodity practise their power to keep the export price, and maintain the import price in their currency stable. This finding provides a strong implication for discussion in progress in Korea regarding the profitability of firms depending on exchange rate. When the profitability of the domestic firms facing a rapid appreciation of the Korean currency is concerned, it should be considered how the prices of imported goods are affected by appreciation, which are used as inputs for exporting goods. Market shares will play an important role in determining the final incidence of exchange rate fluctuation to market price: the price of imported input changes, which will change the cost in Korean won, and in turn changes the price of the exporting good.

Fifth, when exchange rate fluctuates dramatically, it is found that ERPT elasticity is unreliable, as can be observed from the Turkey case. Korea experienced a dramatic changes in exchange rate in 1997 and 1998, which indicates that the study including that period may end up with idiosyncratic results from the conventional view. It also implies that, the recent appreciation of Korean currency, which is about 10% of appreciation in few weeks, may produce different outcomes depending on goods and export destinations, where some of them would be unpredictably excessive or perverse.

While the data used in this study is in very high quality, it is still possible that some observations are not accurate owing to aforementioned reasons. The lack of precision seems to be a function of volatile quantity data. This needs further investigation.

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