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EDITH COWAN UNIVERSITY

EXCHANGE RATE PASS THROUGH INTO DOMESTIC PRICES IN MAINLAND CHINA

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

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ABSTRACT

The present study sets up an empirical framework to study the exchange rate pass through (ERPT) issue in China's domestic markets, within the Chinese economic reform period from 1978 till present. The results show a relative low degree of pass-through to consumer and retail prices, but high degree of pass-through to producer and purchasing prices. It suggests that the degree of ERPT tends to diminish along the price chain. In addition, the results also show an increasing trend of the degree of ERPT in recent years. The speed of price reaction to exchange rate shocks may be quicker in recent years as well. Overall, this study reveals a relatively complete picture of the ERPT in China's domestic markets.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i)   incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education; or

(ii) contain any material previously published or written by any person except where due reference is made on the text; or

(iii) contain any defamatory material.

Full name: Xiangyu ZHANG

Signature:

Date: 21st December 2010

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

According to the data published by the National Bureau of Statistics of China, the gross domestic product (GDP) in the first half of 2007 increased by 14.5% comparing to the same period in the last year.[1] Together with the strong growth of the economy, the growth rate of the consumer price index (CPI), which is often used as a measure of inflation, reached at 5.6% in July 2007, the highest in the last 10 years.[2] It is from that time that China's domestic markets began to experience intense inflationary pressure.

As a reaction to the high inflation rates, the central bank of China, the People's Bank of China, increased the Renminbi (RMB) Deposit Reserve Ratio for more than twenty times in four years time, hoping to reduce the credit expansion capability of financial institutions and then, have an impact on the inflationary situation.[3] However, increasing the Deposit Reserve Ratio does not seem to be an effective way to reduce the pressure. Till the end of 2010, high inflation still exists and has drawn more and more public attention.

During the same time, RMB appreciation has been suggested as a way to solve this problem. The rationale behinds this is that there is an inverse relationship between exchange rates and domestic prices and RMB appreciation should lead to reduced goods prices in the domestic markets. How effective RMB appreciation can be in controlling the inflation is a question belongs to the exchange rate pass through (ERPT) issue.

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[1] http://www.stats.gov.cn/
[2] Monthly CPI is compared to the CPI for the same month last year
[3] http://www.pbc.gov.cn/

There have been abundant studies of the ERPT issue for developed economies. However, given the very different economic system and conditions in China, one should not simply apply the empirical findings from other economies into Chinese economy, as the degree of ERPT in China may be very different from others. For this reason, studies specifically designed for China are needed to reveal the relationship between exchange rates and goods prices in China. It is for this purpose that the current research is carried out.

1.2 MOTIVATION OF STUDY

Firstly, China has achieved rapid economic growth for more than three decades. However, there are problems behind this significant achievement. High inflation rate is one of the most significant ones. When RMB appreciation is suggested as a way to curb the high inflation, the lack of empirical studies on Chinese economy prevents people from reaching a consensus on the effectiveness and efficiency of this solution. To provide some inputs to the discussion regarding the impact of exchange rate movements on domestic prices, a comprehensive study to reveal some features such as the degree and trend of the ERPT in China is desired.

Secondly, the ERPT issue itself is worthwhile to be studied. Knowing the trend of the ERPT in China provides a deeper understanding of China's development. A detailed analysis of the ERPT at each level of the price chain gives an overview of how prices react differently to exchange rate movements. In addition, the degree of ERPT can be used by the central bank and policy makers to improve the quality of future policies. More detailed policy implications are discussed in the following section.

1.3 SIGNIFICANCE OF STUDY

The knowledge of ERPT has some important policy implications.

Firstly, the degree of pass-through forms important part of the information that is

often used by the central bank and policy makers in influencing and forecasting future inflation. High pass-through implies large impact of exchange rate movements on inflationary situation. If inflation forecasts are based on inaccurate estimates of ERPT, the forecasts could be misleading and policies may be less effective. Therefore, knowledge about the degree of pass-through is beneficial, and even crucial in providing quality information for forecasting and policy making.

Secondly, understanding the determinants of pass-through is an important contribution to market competition policy debate. A low degree of pass-through implies greater market power of foreign exporters in the Chinese market. Market power brings market inefficiency and is a source of market distortion. Both of them are of the opposite interest of consumers and domestic producers.

Finally, there are only a few studies in this area that include China, and most of the existing studies focus only on the relationship between exchange rates and import and export prices. In addition, these studies differ significantly in terms of model estimations, variable selection and duration of study, and the results are also mixed. There is no a clear conclusion about the ERPT at the different stages of China's economic development. This study aims to fill in this gap using more comprehensive data series with longer time period to reveal a more complete picture of the ERPT in China's domestic markets.

1.4 PURPOSE OF STUDY

Given the paucity of empirical research on China, the present research attempts to provide a comprehensive analysis regarding the ERPT issue in China for the period from 1978 to 2009. The purpose is to reveal the degree and trend of the ERPT to a range of China's domestic prices within the Chinese economic reform time frame. Results for the same period are compared among each level of the price chain to show how prices react differently to exchange rate movements. Results for a particular price are compared over different periods to show the trend of the ERPT. Overall, the

findings should be able to provide a clear and relatively complete picture of the ERPT to China's domestic prices.

1.5 STRUCTURE OF STUDY

The rest of the paper is organised as follows. Chapter Two reviews a wide range of literatures regarding the relationship between exchange rates and prices. It includes early and recent theories and empirical evidences from both developed and emerging economies. The background of Chinese economic reform is briefly discussed as well. Chapter Three discusses the research methodology. It raises a few research questions and develops hypotheses for empirical testing. It also explains the empirical framework used to test the hypotheses and describes the data used for empirical testing. Chapter Four tests the hypotheses and then, presents and analyses the empirical findings. The final chapter, Chapter Five, concludes by summarising the findings, discussing policy implications and pointing out future research directions.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Goldber and Knetter (1997) defines the exchange rate pass through (ERPT) as the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing countries. A one-to-one response of price changes to exchange rate movements is known as "full" or "complete" ERPT. Less than one-for-one response is said to be "incomplete" ERPT. Intuitively, the price changes will not simply stop at the level of import prices. They will inevitably find their way down the price chain to a range of domestic prices such as producer prices and consumer prices. Therefore, the concept of ERPT is often extended to refer to the impact of exchange rate movements on domestic prices as well. In general, the higher the degree of pass-through into import prices, the higher the long-run impact on domestic prices and price inflation following exchange rate movements (Kiptui, Ndolo, & Kaminchia, 2005).

The earliest discussion linking exchange rates and prices can be traced back to the concept of the Law of One Price (LOP). It says that identical products should sell for the same price in different countries (Goldber & Knetter, 1997). Though it is based on a series of unrealistic assumptions, LOP is the first to suggest the relationship between exchange rates and prices in theory. That is if there is a type of common currency, a product should have the same common currency value when the prices in other currencies are converted into this common currency. In other words, when a currency changes its value relative to another currency, the price of a certain product should change simultaneously to the same extent so that when the price is converted into the common currency, the common-currency price remains constant. To this extent, the LOP implies complete ERPT.

Because the assumptions of costless transportation, distribution, and resale are unlikely to hold in practice, the LOP can hardly bear any empirical testing. As noted by Rogoff (1996), researchers have tested and rejected the LOP for a variety of products and countries, using a variety of data sources and empirical methods. Since the failure of the LOP, there have been considerable theoretical and empirical works attempting to analyse the incomplete ERPT and identify factors influencing the ERPT.

2.2 THEORY

2.2.1 MARKET POWER

Kreinin's (1977) suggests that importer's market power influences goods prices. His methodology, which is called "natural experiments" approach, is very different from the standard regression analysis methodology. He estimates the degree of pass-through that occurred following the realignment of exchange rates among the world's major currencies in 1971. Kreinin uses an import price from a second exporter whose exchange rate did not change relative to the importer. The difference in the change in the U.S. import prices between the two exporters is attributed to the exchange rate change and used to calculate a pass-through coefficient. Kreinin finds that the ERPT into import prices is incomplete in U.S. and other economies such as Germany, Japan, Canada and Belgium. Kreinin interprets the incomplete ERPT as a result of the importer's market power in influencing the world prices.

2.2.2 PRICING TO MARKET

Krugman's (1987) and Dornbusch's (1987) studies forms the basis of the "pricing to market" (PTM) theory. Both papers assume an oligopolistic market and firms can adjust their mark-ups in response to an exchange rate shock. A foreign exporter may cut its price in terms of its domestic currency when the importing country's currency depreciates. In this way, its price is stabilised in terms of the importing country's

currency. Marston (1990) interprets this action as a defensive response to temporary exchange rate movements. Hooper and Mann (1989) argue that stabilising prices is to maintain the market share. Among the factors affecting the extent of PTM, the degree of competition, the exporter's market share in the destination country and product differentiation are considered to be the most important. As noted by Knetter (1993), the existence of competitors in a market will impose discipline on an exporter's pricing. The higher the firm's market share in the destination market, the lower its incentive to absorb nominal shocks in home currency prices and the more it is likely that the exchange rate changes will be passed on to destination markets.

2.2.3 STRATEGIC PRICING BEHAVIOUR

A closely related strand of literature is the strategic pricing behaviour. Obsfeld and Rogof's (1995) study shows that "pricing-to-market" is only one extreme of the strategic pricing behaviour, known as the local currency pricing (LCP). Under the LCP behaviour, nominal appreciation of the exchange rate will have a limited impact on the export volume, as the real exchange rate does not change despite the movements in the nominal rate. This would be the case if the exporter is a price taker in the destination market. Exchange rate movements are to be fully absorbed by the exporter's currency, which leads to zero ERPT. At the other extreme, exporters can opt to keep the domestic currency price stable and fully pass on the exchange rate changes to prices in the destination market. When the home currency appreciates, the real exchange rate would move by the same extent as the nominal rate, having a much larger impact on real exports. Exports are in fact priced in the producer's currency, and referred as the producer currency pricing (PCP). In this case, ERPT will be one.

Between the two extremes, the price adjustments due to exchange rate changes can be partly borne by the producer and partly by the buyer. Price adjustments made by an exporter can be decomposed into two parts, the first owing to changes in production cost brought by exchange rate movements, and the second reflecting the exporter's

strategic pricing behaviour (Athukorala & Menon, 1996).

2.2.4 CURRENCY INVOICING

An alternative method to study the prices and exchange rates relationship is from the currency invoicing perspective. Friberg (1998) argues that the choice of the invoicing currency in trade depends upon a similar set of factors that determine ERPT, including most importantly demand and cost conditions. Key papers in this literature include Devereux and Engel (2001) and Bacchetta and van Wincoop (2003). Their studies endogenise a firm's choice of invoicing currency and then show that countries with low exchange rate variability or stable monetary policies are more likely to have their currencies chosen for transactions invoicing and, hence, are more likely to have low import-price pass-through.

2.2.5 MARKET REFORMS AND INFRASTRUCTURE DEVELOPMENT

Feinberg and Meurs (2005) use a pooled sample of between 8 and 10 years of annual data for 13 industry sectors in Bulgaria, Hungary, Poland, Romania, and Slovenia to examine how market-oriented liberalisation affects market performance. Their results indicate that market reforms and infrastructure development do influence the pass-through of changes in exchange rates to domestic prices, although the estimated impact of infrastructure development is weaker than anticipated.

2.2.6 OTHER FACTORS

Other factors are also attributed to the incomplete ERPT. They include trade distortions, transportation and distribution costs (Burstein, Neves & Rebelo, 2003); cross border production by multinational companies (Aksoy & Riyanto, 2000), the use of currency hedging (Mann, 1986) and so forth.

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2.3 EMPIRICAL FINDINGS

2.3.1 DEVELOPED ECONOMIES

In parallel with the theoretic development, the empirical work on ERPT is as voluminous as the theoretical literature, particularly for developed economies.

Kreinin (1977) first reports the ERPT to U.S. import prices is around 50 percent, 60 percent for German, 70 percent for Japan and 90 percent for Canada and Belgium.

Goldberg and Knetter (1997) later report that ERPT to import prices is found to be around 0.6 for the US, and slightly higher in other economies.

Recent studies (Campa & Goldberg, 2002, and Campa, Goldberg & Gonzelez-Minguez, 2005) find that ERPT to import prices is around 0.5-0.6 in the short run, and around 0.6-0.8 in the long run for developed economies such as the G7, euro area, or OECD countries.

Notwithstanding the evidences (mentioned above) showing the stable ERPT for the developed economies, other researchers argue that ERPT has declined in the past decade. Olivei (2002), who studies disaggregated U.S. import prices for manufactured goods from 1981 to 1999 and reports that the degree of pass-through declines from about 0.5 on average in the 1980s to 0.2 in the 1990s. Nevertheless, Sekine (2006) and Ihrig, Marazzi, and Rothenberg (2006) report similar findings to those observed by Olivei. Taylor (2000) attributes the declined ERPT to the low inflation environment and more credible monetary policies in the industrialised economies.

However, Campa and Goldberg (2004) hold opposite opinion on this issue. They re-examine the ERPT to import prices in U.S. and split their sample into two periods (1975-87 and 1988-1999). No evidence has been found to support a statistically significant shift in ERPT in U.S.

2.3.2 EMERGING ECONOMIES

Empirical studies on ERPT in emerging economies have also been increasing in the past decade. Ca' Zorzi, Hahn and Sánchez (2007) present a very comprehensive study that covers 12 emerging markets in Central and Eastern Europe, Asia and Latin America. The study shows that degrees of ERPT are very high for emerging economies, and are usually above 80 percent for import prices and 60 percent for consumer prices.

2.3.3 COMPARISON BETWEEN DEVELOPED AND EMERGING ECONOMIES

There are also studies comparing the ERPT between developed and emerging economies. Calvo and Reinhart (2000) show that the average ERPT is 6 percent for developed economies and 23 percent for emerging economies. Goldfajn and Werlang's (2000) study also shows that ERPT is higher for emerging economies than for developed economies.

2.4 CHINESE ECONOMY AND THE EXCHANGE RATE PASS THROUGH

Among the voluminous literatures on the ERPT issue, few studies focus on the Chinese economy. China has a very different economic structure and the structure has been changed dramatically over the last three decades. To have a better understanding of the structure of the Chinese economy, a brief description of the evolution and reform of the Chinese economy is very necessary.

2.4.1 CHINESE ECONOMIC REFORM

The Chinese economic reform was initiated in the year of 1978. The purpose of the reform was to tackle the problems caused by the former Soviet-style centrally planned economic system.

Firstly, the reform substantially increased the role of market mechanisms in the system and reduced government planning and direct control. Domestic business activities were stimulated by the reform. This significantly shifted the burden of allocating resources, goods and services from the central government to the market. Private entrepreneurship was legalised and domestic business activities became more and more active. By 1987 the state-owned system of commercial agencies and retail outlets coexisted with a rapidly growing private and collectively owned system that competed with it vigorously, providing a wider range of consumption choices for Chinese citizens than at any previous time (Hart-Landsberg, 2008).

Secondly, China began to open its door to the world and restrictions on foreign trades and investments were gradually loosened. Before the reform period, the combined value of imports and exports had seldom exceeded 10 percent of the GDP. However, since the reform, the ratio of the foreign trades to the GDP increased to 23 percent in 1985, 30 percent in 1990 and remained above 40 percent after 2000.[4]

Thirdly, economic transactions began to be determined by market prices. According to the OECD Economic Survey of China (2005), the share of retail sales made according to market determined prices rose from 3% in 1978 to 96.1% in 2003. For producer goods, the share rose from zero to 87.3% over the same period. These figures reflect that prices were strictly controlled by the central government before the reform period and in the early stage of the reform. In addition, it is worth noting that resource and energy related industries and prices are still fully controlled by the central government till nowadays.

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[4] Author's estimates based on data obtained from China Data Online

Fourthly, the industry structure changed dramatically. The industrial dominance shifted from the State-Owned Enterprises (SOE) to private sectors. In 1978, SOE accounted for all value added in China's industrial sector (defined as mining, utilities, and manufacturing). By 2003, the private sector share was larger than the state sector share: 52.3% to 41.9% (OECD Economic Survey of China, 2005).

The reform changed China from a planned economy to a more market-based economy, and has generated significant and steady growth in production, investment and consumption. A direct result of the reform is that China experienced a fast growing period. The real GDP has been growing at a rate of 10% on average for more than 30 years and now has become the second largest economy in the world (Hamlin & Li, 2010).[5]

Table 1: Selected summary indicators for Chinese economy

Sample period	1978-1991	1992-1999	2000-2009
Average inflation (%)	6.2	8.2	1.8
Average NEER depreciation (%)	2.1	4.4	-1.0
Average real GDP growth (%)	8.8	10.3	9.8
Average foreign trades/GDP (%)	20.0	35.0	52.5

Source: author's estimates based on data obtained from China Data Online.

2.4.2 EXCHANGE RATE PASS THROUGH IN CHINA

The fundamentals of the ERPT issue in China are similar to the theories discussed previously. However, there are a number of differences between Chinese economy and other economies. Firstly, there is a significant shift in relation to the prices control during the economic reform period. Prices moved from central control to almost fully market-based. Prices are able to fluctuate to a larger extent to reflect the demand and supply conditions, market competitions, producers' pricing behaviours, and even exchange rate movements. Secondly, the degree of openness of China has changed.

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[5] Author's estimates based on data obtained from China Data Online

Foreign trades increased dramatically at an annual rate of more than 20 percent in average.[6] Increased foreign trades expose China to the world. Thus, the present China's domestic markets become more sensitive to international factors such as exchange rate shocks. Thirdly, the infrastructure development of China has been as dramatic as its economic growth. The dramatic development reduces the transaction and transportation costs significantly. In turn, this will reduce the proportion of domestic inputs to products, which makes prices more sensitive to exchange rate movements. All these characteristics of Chinese economy could make the ERPT in China very different from other economies' ERPT.

On the empirical side, a study by Ca' Zorzi, Hahn and Sánchez (2007) found that the ERPT into consumer prices is 8 percent within one year and 77 percent within 2 years. Fan and Xiang (2006) study the impacts of the exchange rate and foreign prices on some domestic prices and find that a 1 percent change in the exchange rate will lead to 0.2 percent change in China's producer prices and 0.1 percent change in consumer prices. Shu and Su (2009) suggest that if exchange rate appreciates by 1 percent, purchasing and producer prices will decline by 0.5 and 0.3 percent, respectively.

2.5 SUMMARY

We have discussed incomplete ERPT from different perspectives in this section. Major theories include the market power in influencing the prices, pricing to market, strategic pricing behaviours, invoicing currencies and so forth. Previous studies have shown that the degree of ERPT varies across countries. As a summary of international experience, ERPT is found to be incomplete in most cases. Some studies show the trend of declining ERPT in industrialised economies in recent years, although the opposite opinion argues the prevalence and magnitude of the decline. With respect to the ERPT for different prices, it is found that pass-through to consumer prices is normally smaller than for import prices.

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[6] Author's estimates based on data obtained from China Data Online

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 RESEARCH QUESTIONS

In response to the international experience, the present study attempts to answer the following questions:

- What is the degree of exchange rate pass through (ERPT) to the domestic prices in China?

- Does ERPT diminish along the price chain?

- What has been the trend of the ERPT during the Chinese economic reform period?

3.2 EXPECTED OUTCOMES

Several outcomes can be expected from the successful completion of this empirical study. First, as indicated by most literatures for developed economies and other emerging economies, pass-through should be neither complete, nor no pass-through. Secondly, due to the increasing contents to domestic inputs, the degree of ERPT should decline along the price chain, which is consistent with the international experience. Finally, in respect to the trend of the ERPT, it may be different from the international experience. The reason is that the price control is gradually loosened throughout the reform period. As a result, the degree of ERPT could have increased over time due to the more market-determined prices. In addition, the dramatic development of the infrastructure and other facilities in China may decrease the proportion of the domestic inputs (e.g. reduced transportation and transaction costs) to a product, which leads to higher ERPT. Therefore, both factors will lead to increased ERPT. This will be evidenced by the empirical results.

3.3 HYPOTHESES

Regression models are employed to examine the following three hypotheses:

Hypothesis 1: The degree of pass-through is incomplete, but significantly different from zero;

Hypothesis 2: The degree of pass-through varies at each price level, and declines along the price chain;

Hypothesis 3: The ERPT has an increasing trend in recent years.

3.4 EMPIRICAL FRAMEWORK

The sample period for estimation starts in 1978 through 2009. The year of the 1978 was the starting year of the Chinese economic reform. Two sub-periods are used, which are 1992 to 2009, and 2000 to 2009. The year 1992 is chosen because this is the year when China started its large-scale privatisation. The private sector grew remarkably since then. The reason for choosing 2000 as the start year of the other sub-period is simply because the quarterly data are available from that time. To investigate the trend of the ERPT, nonoverlapping sub-periods should have been used. However, if the whole sample period is divided into three nonoverlapping sub-periods, the number of observations for each sub-period will be too less to be testable. Therefore, to make this study feasible, the current method of dividing the sub-period is used.

To pre-estimate the relationship between exchange rate movements and price changes, correlations of exchange rate with all price series are calculated before running the ordinary least square (OLS) regression.

ERPT is commonly measured in a linear regression. The degree of ERPT is estimated as the 'coefficient' obtained from regressing changes in price indices on movements

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in nominal effective exchange rates (NEER). Following Goldberg and Knetter (1997), Campa and Goldberg (2002) and Ihrig, Marazzi and Rothenberg (2006), the ERPT model is specified as follows:

$$p_t = \alpha + \sum_{i=1}^{j} \varphi_i p_{t-i} + \sum_{i=0}^{j} \beta_i neer_{t-i} + \sum_{i=0}^{j} \delta_i gdp_{t-i} + \sum_{i=0}^{j} \gamma_i x_{t-i} \qquad (1)$$

where

p = a range of domestic prices indexes;

neer = nominal effective exchange rate;

gdp = nominal GDP;

x = other control variables.

(note: lowercase letters denote variables in the log-difference form)

In Equation (1), all variables are the first-difference of their logarithmic form. This is to overcome the unit roots issue that has occurred in the original level data series. The equation is designed to investigate ERPT for a range of domestic prices in China along the price chain. The price series include purchasing prices (PurPI), producer prices (PPI), retail prices (RPI) and consumer prices (CPI). Among these domestic prices, the purchasing prices are the most upstream in the price chain, measuring the costs paid by firms for production inputs such as raw materials, fuels and power. The next down the price chain is the producer prices, which measure those of industrial products when they are sold for the first time after production. Retail and consumer prices represent the most downstream prices. The difference between the two is that the consumer prices include the consumption of most services while retail prices do not.

The explanatory variable, neer, is calculated as geometric weighted averages of bilateral exchange rate. Following the previous works of Feinberg and Meurs (2005), the nominal GDP is used as a proxy for the domestic demand and is the primary control variable. This is to capture the response of prices to aggregate supply and demand trends in the economy during the rapid growth period of Chinese economy. X

denotes other control variables. It includes foreign price (FP) and two types of commodity prices, namely, the world non-fuel primary commodity price (NonFuel) and the world metals price (Metals). The foreign price is calculated as the trade-weighted average of the consumer prices of China's major trading partners.[7]

3.5 DATA

All datasets are obtained from two databases, the *China Data Online* (CDO) and the *International Financial Statistics* (IFS).[8]

Annual data are used for the whole period from 1978 to 2009 and the sub-period from 1992 to 2009. The indexes of China's purchasing, producer, retail and consumer prices, and the nominal GDP are obtained from the CDO. Due to the unavailability of the purchasing and producer prices for the years before 1992, ERPT to these two prices is only available for the sub-period. The NEER, two types of commodity prices and the data used for calculating foreign price, which include the consumer prices of China's major trading partner and foreign trades between China and each of its trading partners, are available at IFS. In average, the total foreign trades between China and all of its major trading partners account for more than 80 percent of China's total trades.

Quarterly consumer and producer prices and other data series became available in 2000. Therefore, for the period from 2000 to 2009, ERPT to consumer prices and producer prices are estimated using quarterly data. As the other two price series, purchasing and retail prices are not available at quarterly frequency, ERPT to these two prices has not been included in the estimation. All quarterly data are obtained from IFS.

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[7] see Appendix 1 for the list of China's trading partners that are included in calculating the foreign price
[8] China Data Online is compiled by the China Data Center at the University of Michigan, US

CHAPTER FOUR

HYPOTHESES TESTING AND RESULTS ANALYSIS

4.1   INTRODUCTION

In this chapter, we first estimate the model, and then test the hypotheses and analyse the results. Figure 1 shows a comparison of nominal effective exchange rate (NEER) and the consumer and retail prices; and Figure 2 compares NEER and the producer and purchasing prices. The RMB is the base currency in the NEER. The rise in NEER indicates appreciation of RMB, and vice versa, decrease in NEER indicates depreciation.

As can be seen in Figure 1, there is a very clear inverse relationship between exchange rates and consumer and retail prices during 1978 to 2009. NEER declines from well above 300 in early 1980s to around 100 in the 2000s. Prices show steady growth from the beginning to the end. An anomaly is that RMB appreciated about 50 percent in 1978, but prices barely changed. That is much due to the strict price control by the government at that time.

During the shorter period from 1992 to 2009, Figure 2 shows an overall increasing trend of both prices, in spite of a short declining period after the 1997 Asian Financial Crisis. Overall, prices changes correspond negatively to the exchange rate movements.

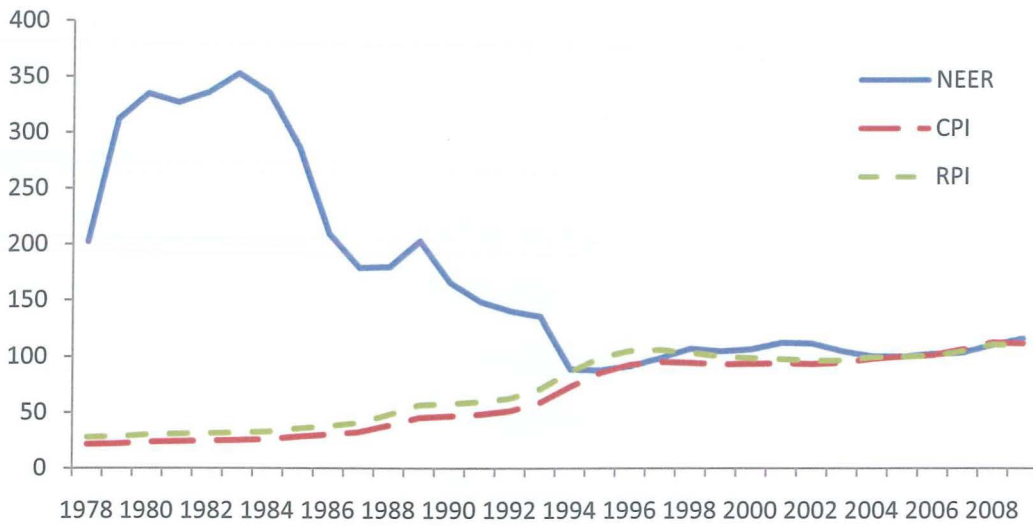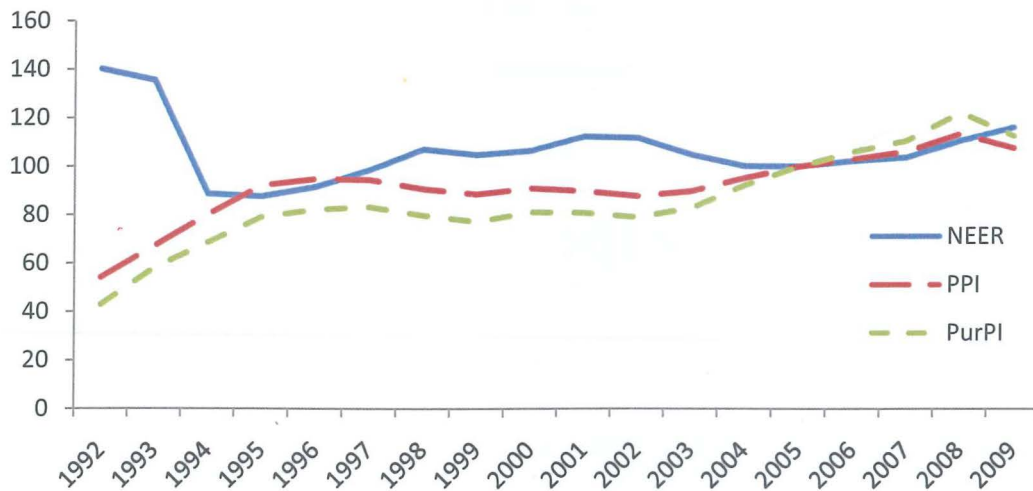**Figure 1: Nominal Effective Exchange Rate, Consumer and Retail Prices (1978 – 2009) (2005=100)**

Figure 2: Nominal Effective Exchange Rate, Producer and Purchasing Prices (1992 – 2009) (2005=100)

4.2 SPEARMAN'S RANK CORRELATIONS

Spearman's rank correlations are calculated to pre-estimate the relationship between the exchange rates and prices. According to Figure 1 and Figure 2, prices move to the opposite direction of exchange rate movements. Therefore, the correlations between prices and exchange rates are expected to be negative. Table 2 presents the results and confirms the expectation. The purchasing price shows the strongest negative correlation with the NEER, which may suggest the highest exchange rate pass through (ERPT) to the purchasing price. The correlation has a decreasing trend along the price chain for the period from 1992 to 2009.

Table 2: Spearman's rank correlations of NEER with prices

	CPI	RPI	PPI	PurPI
1978-2009	-0.337	-0.321	-	-
1992-2009	-0.270	-0.309	-0.468	-0.537
2000-2009	-0.038	-	-0.015	-

Source: author's estimates.

4.3 ORDINARY LEAST SQUARE REGRESSION ESTIMATION

Equations are estimated using ordinary least square (OLS) method. The general-to-specific modelling approach is adopted for each period. The number of lag for each variable, i, is initially set to be 3 for annual data, and 7 for quarterly data. Specification selection is based on the Schwarz information criterion (SIC). Before any estimation is conducted, all data series are tested for unit roots using Augmented Dickey–Fuller (ADF) test. After taking the first difference of their logarithmic form, all series become stationary. Diagnostic tests show that the equations are well

specified with well-behaved residuals. Heteroscadastisity and serial correlation do not present in any estimations. Applying Equation 1 to each prices at each period confirm the negative relationship between exchange rates and prices. A summary of the ERPT results are presented in Table 3. Detailed results for each period are presented in the following.

Table 3: Estimated ERPT Equations for Period 1: 1978 to 2009 (Annual data)

	cpi	*rpi*
cpi_{t-1}	0.53***	-
	(3.58)	-
rpi_{t-1}	-	0.46***
	-	(3.31)
$neer_{t-2}$	-0.09**	-0.15***
	(-2.27)	(-2.80)
gdp_{t-1}	0.63***	0.59***
	(5.13)	(4.76)
gdp_{t-2}	-0.47***	-0.54***
	(-3.65)	(-4.38)
$nonfuel_{t-2}$	-0.16**	-
	(-2.14)	-
fp	-	0.33**
	-	(2.08)
Adjusted R^2	0.85	0.83
Estimated standard error	0.03	0.03
LM for serial correlation	0.03 [0.86]	0.42 [0.52]
Normality test: χ^2	1.27 [0.53]	1.99 [0.37]
Heteroscedasticity	25.59 [0.14]	25.80 [0.13]

Notes: t-values are in ( ), p-values in [ ]. *, ** and *** indicate that variables are significant at the 10, 5 and 1% level, respectively.

Table 4: Estimated ERPT Equations for Period 2: 1992 to 2009 (Annual data)

	cpi	rpi	ppi	purpi
c	-0.05***	-0.05***	-0.09***	-
	(-5.24)	(-5.08)	(-6.07)	-
cpi_{t-2}	0.16***	-	-	-
	(4.22)	-	-	-
rpi_{t-2}	-	0.10**	-	-
	-	(2.54)	-	-
ppi_{t-1}	-	-	-1.02***	-
	-	-	(-5.42)	-
ppi_{t-2}	-	-	-0.30***	-
	-	-	(-4.28)	
$purpi_{t-1}$	-	-	-	-0.62**
	-	-	-	(-2.69)
$purpi_{t-2}$	-	-	-	-0.44***
	-	-	-	(-3.37)
$neer_{t-1}$	-0.17***	-0.19***	-0.35***	-0.56***
	(-5.87)	(-5.07)	(-7.16)	(-5.20)
$neer_{t-2}$	-	-	-0.20***	-0.20**
	-	-	(-4.61)	(-2.60)
gdp	0.53***	0.49***	-	-
	(7.17)	(5.35)	-	-
gdp_{t-1}	-	-	0.99***	0.45***
	-	-	(7.39)	(4.63)
metals	-0.04**	-0.05***	0.07***	0.12***
	(-2.98)	(-3.44)	(4.60)	(3.50)
$metals_{t-2}$	-	0.04*	-	0.14**
	-	(1.97)	-	(2.87)
Adjusted R^2	0.96	0.97	0.96	0.89
Estimated standard error	0.01	0.01	0.01	0.02
LM for serial correlation	1.87 [0.22]	1.85 [0.21]	0.14 [0.72]	0.09 [0.77]
Normality test: χ^2	0.88 [0.65]	0.89 [0.64]	3.92 [0.14]	0.35 [0.84]
Heteroscedasticity	6.45 [0.60]	13.42 [0.20]	11.27 [0.51]	14.17 [0.36]

Notes: t-values are in ( ), p-values in [ ]. *, ** and *** indicate that variables are significant at the 10, 5 and 1% level, respectively.

Table 5: Estimated ERPT Equations for Period 3: 2000 to 2009 (Quarterly data)

	cpi	*ppi*
c	-0.01***	-
	(-4.00)	-
cpi_{t-2}	0.68***	-
	(5.95)	-
ppi_{t-1}	-	-0.99***
	-	(-35.77)
ppi_{t-2}	-	-0.96***
	-	(-56.08)
ppi_{t-3}	-	-0.99***
	-	(-34.07)
neer	-0.20**	-
	(-2.15)	-
$neer_{t-3}$	-	-0.63***
	-	(-2.89)
gdp_{t-1}	0.18***	0.17*
	(13.80)	(1.97)
gdp_{t-2}	0.14***	0.20**
	(6.44)	(2.31)
gdp_{t-3}	-	0.18**
	-	(2.22)
$nonfuel_{t-1}$	-	0.21***
	-	(3.13)
$nonfuel_{t-3}$	-	0.20**
	-	(2.33)
Adjusted R^2	0.86	0.99
Estimated standard error	0.01	0.02
LM for serial correlation	2.38 [0.13]	1.85 [0.13]
Normality test: χ^2	0.72 [0.70]	1.84 [0.40]
Heteroscedasticity	12.89 [0.54]	22.67 [0.16]

Notes: t-values are in ( ), p-values in [ ]. *, ** and *** indicate that variables are significant at the 10, 5 and 1% level, respectively.

Table 6: Accumulated response of prices to a 1% exchange rate shock

	CPI	RPI	PPI	PurPI
1978-2009	0.09	0.15	-	-
1992-2009	0.17	0.19	0.55	0.76
2000-2009	0.20	-	0.63	-

Source: author's estimates.

4.4   RESULTS ANALYSIS

4.1.1   HYPOTHESIS 1

First of all, the findings of this study confirm the statement of the Hypothesis 1. Exchange rate movements do have impact on all domestic prices, but the ERPT is incomplete in all cases. Low market power of foreign products, high degree of competition in particular markets, high proportion of China's domestic inputs and government interference in prices can be the reasons for incomplete ERPT.

The degree of pass-through to consumer and retail prices are around 10 to 20 percent, which is higher than the very low ERPT reported for some developed economies (e.g. Faruqee, 2004), but in the middle of the range reported for some developing economies (Ca' Zorzi, Hahn & Sánchez, 2007). Higher degrees of pass-through are found for producer and purchasing prices. More than half of exchange rate movements are reflected in these two prices.

4.1.2   HYPOTHESIS 2

The estimates show a clear declining trend of ERPT along the price chain. For the period from 1992 to 2009, ERPT is the highest for the most upstream price, purchasing price. A one percent exchange rate movement leads to 0.76 percent price change in the price. The degree of pass-through diminishes along the price chain, declining to 0.55 for producer price, 0.19 for retail price and 0.17 for consumer price.

This trend may be explained by the increasing proportion of domestic inputs, such as labour costs, transportation costs, distribution costs, etc. The higher the proportion of domestic inputs, the less sensitive to exchange movements the prices will be. Therefore, downstream prices are less affected by the exchange rate shocks. These results are in support of the Hypothesis 2.

4.1.3 HYPOTHESIS 3

To explore the trend of the ERPT in China, we focus on the degrees of pass-through to the consumer price in this study. In contrary to some findings for industrialised economies, this study finds an increasing trend of ERPT to China's domestic prices. The pass-through is estimated to be 9 percent when using the whole sample period. However, if the years from 1978 to 1991 are excluded, the degree of pass-through increases to 17 percent, almost double the ERPT for the whole period. Moreover, if the estimation period starts from 2000, the result shows a further increase in the pass-through, which reaches 20 percent for the consumer price. Similar results are found when estimating the pass-through to producer price in the two sub-periods. ERPT increases by 0.08 when the years from 1992 to 1999 are excluded for estimation. These results lend support to our early argument that the ERPT in China has an increasing trend. Thus, Hypothesis 3 holds.

4.1.4 CONTROL VARIABLES

The nominal GDP has been used as a proxy for domestic demand. It is the primary control variable and captures prices reactions to the aggregate supply and demand trends in the economy. It has been included in all estimations and found to be significant in all cases. Overall, the estimations show a positive relationship between prices and GDP. As GDP is used to represents the demand side in the economy, increased GDP should lead to increased prices. This is consistent with the basic economic theory, i.e. the supply and demand effects on prices. Table 4 shows the

accumulated effect of GDP on prices.

Table 7: Accumulated response of prices to a 1% GDP change

	CPI	RPI	PPI	PurPI
1978-2009	0.16	0.05	-	-
1993-2009	0.53	0.49	0.99	0.45
2000-2009	0.32	-	0.55	-

Source: author's calculation

In respect to other control variables, prices respond differently and in some cases, show no response.

4.1.5 ADDITIONAL FINDING

In addition to the confirmations of the three hypotheses, there is another finding that may be worth noting.

The estimation results may suggest a trend in the speed of the price responses. During the whole sample period under estimation using annual data, both consumer and retail prices have only responded to the second lag of the NEER, which is the exchange rate movement two years before the price changes. In the second period, all prices have responded to the first lag of the NEER; and consumer and retail prices become sensitive only to the first lag. Producer and purchasing prices are found to respond to both the first and second lag of NEER. In the shortest period from 2000 to 2009, which employs quarterly data, the consumer price changes is affected by the same period exchange rate changes, and producer price responds to the third lag of exchange rate movements. The conclusion can be drawn from these results is that the shorter the period under estimation, the quicker the prices respond to the exchange rate movements. This may suggest that it takes shorter and shorter time for prices to respond to the exchange rate shocks in recent years.

CHAPTER FIVE

CONCLUSION

5.1 INTRODUCTION

Given the paucity of exchange rate pass through (ERPT) studies on Chinese economy, the current study attempts to investigate the ERPT issue for a range of Chinese domestic prices for the entire economic reform period from 1978 to 2009, and two sub-periods within the economic reform time frame. The purpose is to examine if the Chinese economy conforms with the international experiences on the exchange rates and prices relationship. Specifically, this study tries to assess the degrees and trend of ERPT in China, and the interrelation between the ERPT and prices at each level of the price chain.

5.2 FINDINGS OF STUDY

This study reaches a few conclusions on the ERPT issues.

Firstly, ERPT is incomplete to China's domestic prices for all three periods under estimation. Secondly, the degree of ERPT diminishes along the price chain. Purchasing price show the highest pass-through and consumer price the lowest. Thirdly, there is a declining trend of ERPT in recent years for China's domestic prices. This is in contrary to the international experiences, but reasonable given the very different economic structure in China.

In addition, the results suggest a quicker response of prices to exchange rate shocks in the recent years. However, this needs to be further examined by method specifically designed for this question.

5.3 DISCUSSION AND POLICY IMPLICATION

These empirical findings on ERPT in China, especially those relating to consumer prices, have a number of important implications for macroeconomic policy. They suggest that RMB appreciation can help to reduce price pressure only to a very limited extent, and its effect may be offset by the fast growing economy, as the GDP influences the consumer prices more than exchange rates do. In this regard, RMB appreciation should not be perceived to be a remedy to provide rapid relief to the current round of inflationary pressures. As suggest by Shu and Su (2009), RMB needs to strengthen in effective terms to exert the desired dampening impact on price pressures.

5.4 LIMITATION

There are a number of limitations on this study.

First of all, due to unavailability of data, ERPT to four price series, i.e. producer and purchasing prices between 1978 and 2009, and retail and purchasing prices between 2000 and 2009, has not been estimated in this study. Without these estimations, results may be less convincible.

Secondly, due to the unavailability of quarterly or monthly data over the three-decade period, the current study uses annual data, which has caused problem when dividing the whole period into sub-periods. The most desirable way is to have nonoverlapping sub-periods. However, if sub-periods are divided in this way, there will not be enough observations for the ordinary least square (OLS) regression. The problem of having overlapped sub-periods is that the results will not show how exactly the degree of ERPT has changed over time, but rather a trend of the ERPT over the whole period.

Finally, the econometric techniques employed in this study may be improved. As lagged dependent variables are included in the model, using OLS regression may

generate less accurate estimations. Therefore, more advanced econometric techniques, such as generalised methods of moment (GMM) or two-stage least squares regression, can be used to improve the quality of the estimation results.

5.5 SUGGESTIONS FOR FUTURE RESEARCH

This study can be seen as an initial step in assessing the degree, trend and determinants of ERPT in China at the country level. To explore further about the ERPT issue and overcome the limitations of present study, future studies are desired. To shed light on this issue, research examining the following areas may be fruitful:

- A detailed analysis at the industry level to exam how different industries react differently to exchange rate shocks;

- Other factors affecting the ERPT in China, such as the degree of openness, market freedom, infrastructures development, government regulations in particular industries, etc.;

- Practice in using RMB as the trade invoicing currency, e.g. what is the potential markets for using RMB as the invoicing currency.

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APPENDIX

Appendix 1: List of China's Major trading Partner

Asia	Hong Kong, China; India; Japan; Malaysia; Singapore; South Korea; Taiwan; Thailand;
Australasia	Australia;
North America	Canada; USA;
Latin America	Brazil;
Europe	United Kingdom; Eurozone, which consists of the following countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden.