A Study of the Relationship between Exchange Rate and Domestic Producer Price in the Thai Economy

By

SUWATCHAI CHANTARATTANAKORN

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of

Master of Business Administration

Graduate School of Business
Assumption University
Bangkok Thailand

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ABSTRACT

This study investigates the net effects of exchange rate on the domestic producer price during 1985-1999. It also aims to develop a model to explain the domestic producer prices that are affected by exchange rate.

In explanation of domestic producer price, there are four variables to be tested. They are index of wage, GNP, exchange rate and expected exchange rate.

The study on domestic producer price, the analysis is conducted on data from 1985-1999. All data is collected from BOT library, United Nations, Ministry of wage and social welfare and Department of technical and economic cooperation. OLS regression is used to estimate the parameters of the model.

The Research Methodologies used was regression model adopted from industrial organization model(Feinberg,1986). Stepwise method in selection for included variables and remove the excluded variables.

The findings show that the exchange rate can explain the domestic producer price at 95 per cent level of confidence. This result indicates that exchange rate is the factor in increasing or decreasing the domestic producer price. While the others factors such as wage,GNP and expected exchange rate are excluded in this model.

It is hoped that this study will benefit academic and the owners of manufacture: The owners of manufacture can use this study as a planning strategy to optimize the price. The academicians can use this study to explain the relationship between exchange rate and domestic producer price.

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Chapter I

Introduction

1.1 Background

The impacts of exchange rate fluctuation have direct and indirect effects. On the direct impact, it is in the form of finished good imported that will compete with domestic finished good. The indirect impact is in the form of raw materials. This study will illustrate ways for Thai manufacturers to cope with the fluctuation of exchange rate.

1.1.1 Definition of key terms

Domestic price means the price of the product that domestic manufacturers set for selling in the domestic market. The price in different countries may vary according to the strength of currency. Every businessman would like to hold currency that can store the value not to fluctuate over time. In addition, the soft currency countries have no other choice because they want money from their export so they cannot charge high price. The final price may come from the complete set of product that pass-through the process of currency transfer from the raw materials import plus the parts in domestic which not import.

Exchange rate is the value of one currency relative to another. In the international business, the domestic producers must import raw materials and intermediate goods from abroad to manufacture the final product in their country for sell locally or to re-export to other countries. In doing this transaction, the need of exchanging currencies is inevitable. The exchange in today's world is fluctuating day by day so the domestic producer must forecast and plan in advance to cope with the fluctuation of the

exchange rate. If their home currency is soft, the risk of the cost of production in term of imported raw materials will be higher. If they cannot reduce other cost(s) they will have to increase the final price of the product. It can be say that exchange rates volatile are risky for their import transactions.

Real interest rates is the rate of interest which adjusts the nominal interest rate for inflation:

Real interest rate = Nominal interest rate – Inflation rate.

The real interest rate is commonly compared among countries to assess exchange rate movements because it combines nominal interest rates and inflation. In which, both nominal interest rates and inflation influence exchange rates. Other things held constant; there is high correlation between the real interest rate differential and dollar's value.

1.1.2 Domestic Prices and Exchange Rates

The structure of each industry will be different from one another; therefore, the price they set will also differ. For example, the fishery products industry, fishery products industry may differ from other industries, for example, the wage. As fishery products industry is allowed by the government to apply the lower rate than minimum wage rate. On the other hand, other industries must use at least minimum wage rate. The fishery product industry is government protection sector. If this sector uses the same standard of minimum wage rate as other industries, the fishery sector will not be competencies enough to stay in the business. If they have too high cost, finally they

will have to hire foreign workers from neighbor countries such as Myanmar, Laos, Cambodia, etc.

In different manufacturing industry, the degree of exchange rate exposure will not be the same. The degree of exposure will mostly influenced by how much they import or export their products to foreign countries, in other word, how much they are using foreign currencies in transaction. US dollar is the most commonly used currency in the international transaction, if the dollar is appreciate over their own currency, the cost for raw material and intermediate goods will be higher than normal. The results will be the increasing of final product price. The direct impact to importer after they increase the final product price, the substitute products (with less imported parts) will be more competence and may overtake their market share. In addition, the indirect impact to the producers may results in increasing imported final products from foreign countries.

Most domestic manufacturers can choose to avoid the risk of fluctuation in currencies by the substitution of imported raw material and intermediate goods to locally made products. Many manufacturers will inevitably face with the situation of not be able to find the substitute for raw materials and intermediate goods with the same standard as imported goods locally. The solution that they should consider are other factors like lower the wage cost by using more capital intensive or restructure the industry.

1.1.3 Economic trend of Thailand

At present time the Ministry of commerce announce the overall economic growth expect to increase by 2%, in which, decrease from expect 7% increase. The

decreasing of Thailand economic growth as well as other foreign countries' economic growth may put the world economic to move into recession period. The export volume of Thailand is now decreasing and Thailand is now facing with the problems of the removal of GSP that had previously been offered by U.S. as they do to compensate their loss in duplication of the intellectual products that Thailand has violated.

Bank of Thailand (BOT) announced the economic forecast of Thailand in the second half of the year 2001. BOT indicated that the economic situation in Thailand is still fragile in which affect by the world economic downturn, the exchange rate fluctuation, and decreasing volume of export products of Thailand

Bank of Thailand expect Thailand economy to expand 2% of GDP in the second quarter of 2001, the third quarter will be stable at 2%, and final quarter will expand by 2.5-3%. The first half of 2001's export is decreasing by 1.5% while the import is increasing. The import of first half of 2001 is increasing by 7.2% that made the balance of payment to become deficit by $487 million for current account. The overall balance of payment with the adjusted current account is deficit by $2,542 million.[1]

The next thing that Bank of Thailand has announced are the economic indicators which are PPI (Producer Price Index) and CPI (consumer Price Index). The first half of 2001, the Producer Price Index is expanded only 1.4%, which expand decreasing

[1] Source: Thairath news paper, August 14, 2001

from last year of 6.5%. The Consumer Price Index of first half of 2001 is expand only 2.4% that also decrease from 3-4% last year.

The inflation of this year is expect to be 2-2.5% that is within the range of the Bank of Thailand's objective for the inflation (BOT estimate the inflation level at 0-3.5%). For next year, BOT expected inflation rate to increase by 2-3%. Bank of Thailand also think of the ways to improve the revenue from the decrease export by increase the revenue from the tourist sector which expect the volume of 67,400 million baht.

The balance of payments for January 2001 is presented on a surplus of U.S. $513 million, but when combine to be for the first five months of 2001, the figure change and decrease down to surplus only U.S. $467.5 million.

1.1.4 Thailand's performance

The first five months of 2001 performance of Thailand is declared to be as follows: Thailand export is $5,754 million, increased from last year by 8.50% while the import until May is $5,327.6 million that also increase from last year by 13.29%. The export sector of Thailand is increasing in the decreasing rate in which export amount is decreasing as the amount of five months export is $27,218.2 million, decreasing from last year $27,259.2 million by 0.15%. The import of first five months of 2001 is increasing from $23,337.6 million to $26,750.7 million by 14.62%. This made the balance of payment for the current account to become surplus by $467.5 million. The trend of export/import business will still headed to the deficit of balance of payment.

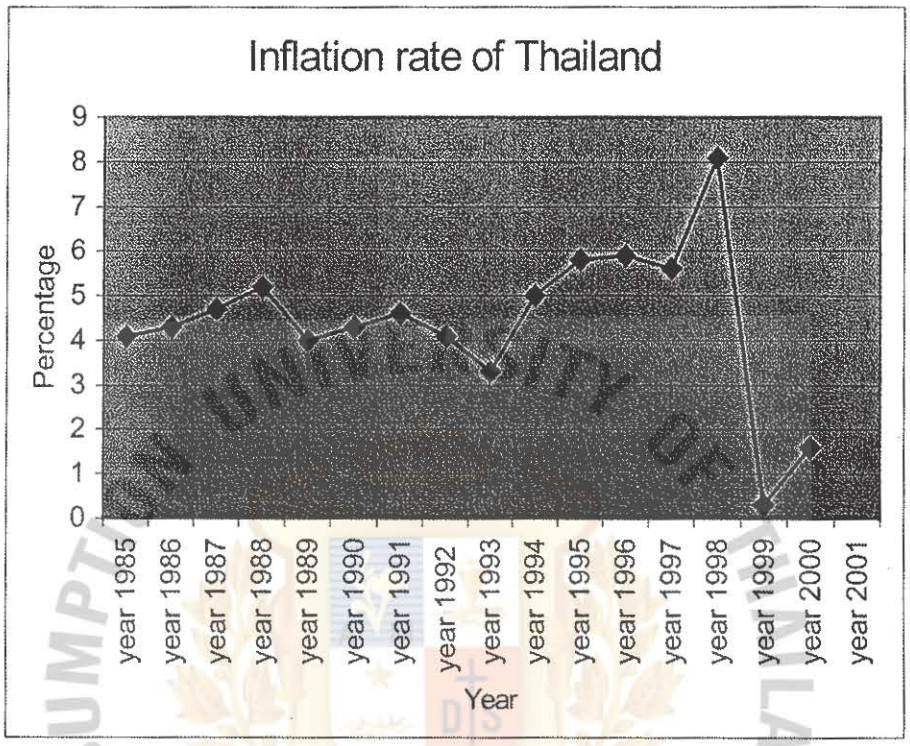


Figure 1.1 Inflation of Thailand

From figure above, the inflation of Thailand in the past ten years is around 4 percent. After Thailand has changed to float the exchange rate, the inflation rise up to 5.6 percent in 1997. Then in year 1998 inflation still rise up to 8.1 percent and decrease down to only 0.3 percent in 1999. For the year 2000, inflation is 1.6% and the coming 2001 is expected to be 1.3% of inflation.

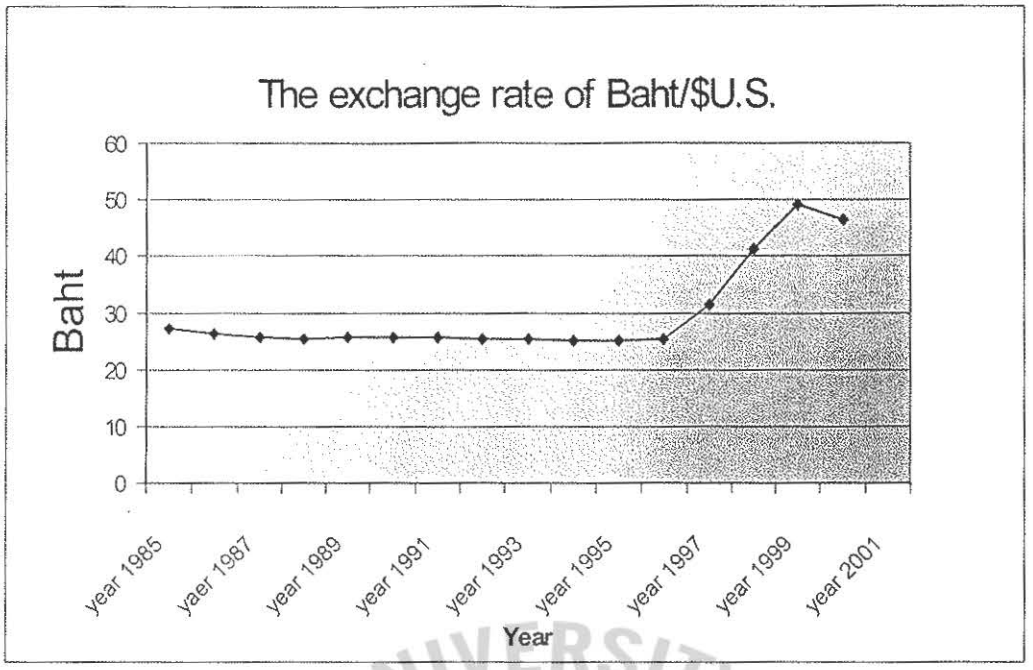
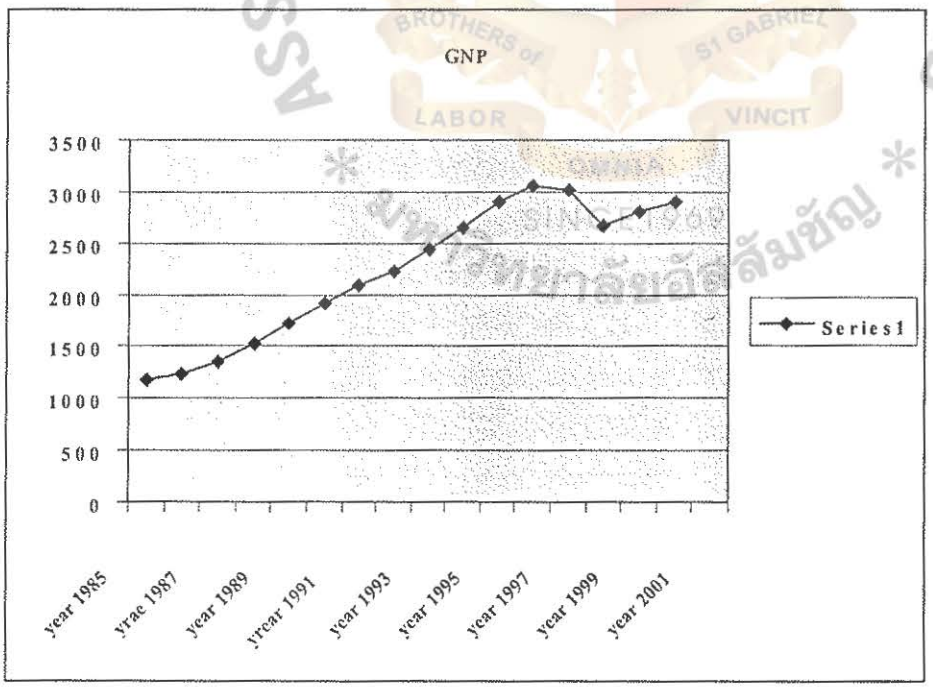


Figure 1.2 The Exchange rate of Baht/$U.S.

From the figure above, the past ten years exchange rate of U.S. dollar per Thai baht is around 25-26 baht/ dollar. But after Thailand, inevitably adopted floatation of currency system, Thai baht had decreased to 30-46 baht per dollar.



(Unit: Thousand million baht)

Figure 1.3 Gross National Product of Thailand

From the figure above, the Gross National Product of Thailand tend to be smooth and not change so much. It stays around 1500-2500 thousand million baht. Thus it can be predict that the national income will be sufficient for growing.

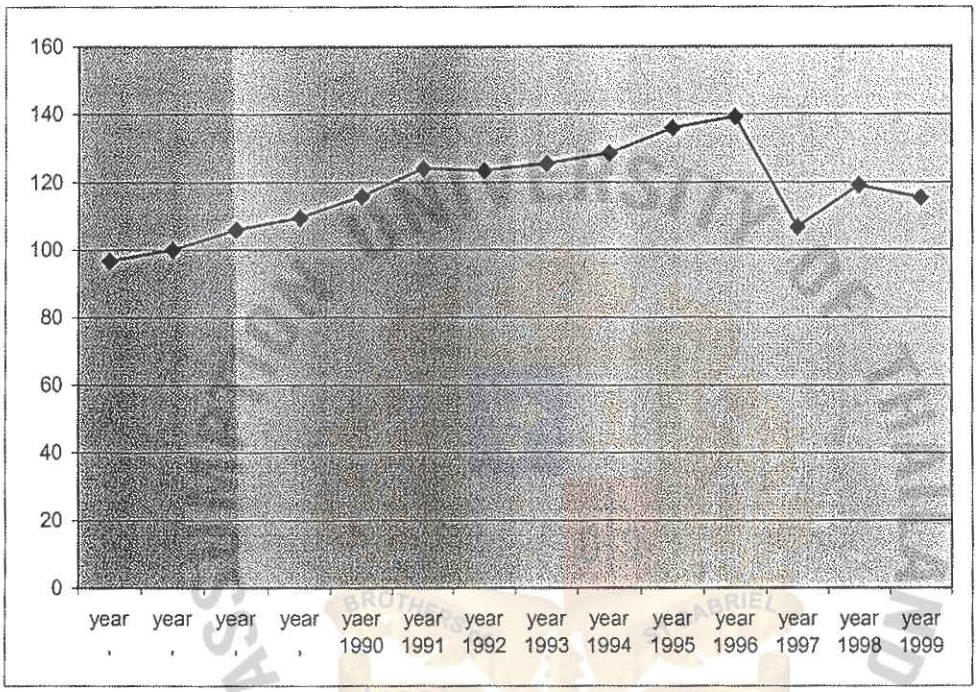


Figure 1.4 Overall Manufacture Price Index

From the figure above, the manufacture price index is increase by slowly as compliment to the rising inflation. The overall manufacture price index has been falling after 1997 as economic downturn.

1.2 Statement of the Problem

After Thailand adopted the floating exchange rate in 1997, the economists here in Thailand think they can boost the export to help recover Thais economic. In reality it does help export business only in short run, but in the long run it isn't help much. In the long run, the cost of domestically manufactured products are increasing

dramatically as some raw materials and intermediate goods has to import from foreign countries. It increase burden for importers and debtors to pay back the debt using Thai baht for Thai baht is depreciate from 25.34 baht / dollar to almost 60 baht / dollar during the short period after baht floated.

1.3 Research objective

The objective of this research is:

-To study the impact of exchange rate toward domestic manufacturing price

1.4 Scope of the study

This study concentrates on Thais Manufacture industry

1. Time - yearly data from 1985-1999.

2. Variables - Producer price index, GNP, wage index, dollar exchange index, expect dollar exchange index

The following are the industries in which are chosen in the study.

Table 1.2 List of Manufactures included in the study

- Construction materials
  Petroleum products
  Hide and leather products
  Textiles and textiles products
  Chemicals and chemical products
  Paper and paper products
  Rubber and rubber products
  Transportation equipment
  Machinery and equipment
  Miscellaneous product

The weight for 10 industries in this study is accounting for 65.6%[2] of the overall commodities. The amount of imported raw materials for these 10 industries are more than 50%. The medium for trade is using U.S. dollar for more than 95%.

1.5 Limitation of the study

1. The index data is yearly basis that may not show sensitivity in detail.
2. Some data cannot obtain from government, as they kept them confidential.
3. The PPI data after 1999 has changed in their classification so the latest data after 1999 cannot use with the data before 1999.

1.6 Significance of the study

This study may benefit the people as follows:

1. To entrepreneurs of the manufacturing industries

   With the forward-expected exchange rate, it can help manufactures to plan for the cost of raw materials.

2. To Academic

   This study may be benefit for further study of some researchers.

1.7 Definition of Terms:

Deflation – is the circumstance in which price levels of goods and services decline continuously the opposite condition from inflation(Bank of Thailand)

[2] source: Bank of Thailand

Domestic – pertaining to one's own country, not foreign, made or produced in one's own nation or country(Bank of Thailand)

Exchange rate - the value of one currency relative to another(Melicher,Welshans, and Norton,1997)

Exchange rate pass-through- The phenomenon whereby changes in the value of foreign exchange are reflected in change in import price (Fisher,1989)

Expected exchange rate - The exchange rate that expect to be in the future time(Feinberg,1986)

Gross Domestic Product(GDP) - is the value of all final goods and services produced within the territory of a country by using domestic factors of production within a given period. GDP includes the value of goods produced as well as the value of services(Bank of Thailand)

Gross National Product(GNP) – is the value of final goods produced within the country by using factors of production of that nationality, including all income earned abroad by residents(Bank of Thailand)

Inflation - is a general rise in the price level of good and services(Bank of Thailand)

Per capita GNP – measures the value of output according to the size of population and is obtained by dividing the GNP by total population(Bank of Thailand)

Transaction cost- The cost of undertaking exchange, including fees, bank charges, communications expenses, and so on (Berry, Conkling and Ray, 1997)

Real exchange rate – The exchange rate of currency that already been determine by bank for the convert(Mann,1986)

Wage – money paid to an employee for work done, and usually figured on an hourly, daily, or piecework basis: often distinguished from salary(Bank of Thailand)

CHAPTER II

LITERATURE REVIEW

Chapter 2 has divided into three parts. The first part talks about the response of domestic price toward expected exchange rate. The second part is industrial organization model. The third part is the previous research and studies.

2.1 Domestic price and exchange rate

The response of domestic producers to actual exchange-rate movements is more straightforward. Actual appreciations will elicit price reductions as demand shifts away from the domestically produced substitute. This effect is reinforced on the supply side where reductions in the cost of traded intermediates put downward pressure on prices (Feinberg,1986)

The surprising implication of the above argument is that(current) and expected(future) exchange –rate movements have qualitatively apposite effects, actual dollar appreciation's increasing domestic producer prices. This implies that during continuous actual and expected appreciations or deprecations, pass-through will be less than full. Only during "switch points." Where actual appreciations are accompanied by expected deprecations (or vice versa), will actual and expected exchange-rate changes reinforce each other's effect on pass-through.

It should also be noted that the industry determinants of these actual and expected exchange-rate responses will differ. Actual exchange rate changes will imply both cost and demand effects on the current pricing: cost changes through the price of traded intermediaries, and demand changes through the price of traded substitutes.

However, the strategic aspects of responses to anticipated exchange-rate changes will depend primary on theatre of competition between domestic and foreign producers(which will in turn determine the anticipated demand shock to domestic producers from exchange-rate movements).(Feinberg,1986)

The oligopolistic domestic producers set price with an eye on current market share and consequent effect on future profits. Current and future market shares are linked by consumers who, facing a costly search(suggesting the importance of brand loyalty or "goodwill") adjust slowly to changes in the relative prices of domestic and imported substitutes. As a consequence, a larger market share today implies greater demand tomorrow.(Tirole, 1988)

The imperfect substitutes model treats domestic prices as being influenced both directly by exchange-rate induced cost changes (through imported intermediary goods) and indirectly by changes in the prices of competing final product imports.(Feinberg, 1986)

Law of one price is an starting point of an analysis of the pass-through of exchange rate changes to import and export prices. The concept based under the conditions of perfect competition in domestic and international goods markets (zero profits or no profits in excess of "normal economic" profits) the exchange rate equates the domestic currency prices of similar traded goods produced at home and abroad. This relationship, given in equation 1, says that the U.S. price (in dollars) of a product equals the foreign price (in foreign currency) times the exchange rate:

(1) $$P_d = P_f \times E,$$

Where

P_d = price of the product in the United States, in dollar terms

P_f = price at which the foreign supplier sells the product, in foreign currency terms

E = the exchange value of the dollar in terms of dollars per unit of foreign currency

Under these condition, if the exchange rate changes and foreign prices remain unchanged, the domestic price changes one for one: pass through of the exchange rate change to domestic prices is 100 percent.(Catherine,1986)

Profit margin are a key link between the exchange rate and prices of traded goods that extends the analysis based on the law of one price. Relaxing the assumptions of perfect competition allows for short-run variability in profit margins that may help explain the short-run variations in the pass-through relationship observed in the macroeconomic data. Equation 2 and 3 together show two important identities that relate the dollar price of imports, the exchange rate, and profir margins:

(2) $$P_f = C_f + M_f$$

(3) $$P_d = (C_f + M_f) \times E,$$

Where C_f is the cost, in foreign currency terms, of producing the product in the foreign country and M_f is the margin over costs, in foreign currency terms, chosen by the foreign producers. Equation 2 says that the foreign currency price of products imported into the United States equals the foreign cost of producing the product plus some profit margin. Equation 3 combines equation 1 and 2 and shows that U.S. dollar price equals the sum of the foreign costs of production and profit margins, all times the exchange rate. The concept of pass-through is presented in equation 4.

(4) $$\Delta P_d = \Delta C_f + \Delta M_f + \Delta E;$$

That is, the change in the dollar price equals the change in foreign costs plus the change in margin plus the change in exchange rate. If foreign costs are constant, dollar import prices will change little (and pass-through will be less than 100 percent) if foreign profit margins adjust to offset some of the exchange rate changes. If foreign costs changes as well, profit margin can change and buffer the ultimate effect on the dollar price.

Introducing profit margins into the aggregate equation allows more flexibility in the speed and amount of pass-through of exchange rate changes to import prices. But what factors can lead to variable profit margins? Profit margins vary in part because of the characteristics of market structure in the individual industries and in part because of overall changes in the macroeconomic environment.(Catherine,1986)

The law of one price version of Gustav Cassel which asserted in the PPP literature implies as follows:

$$P_i = ep_i^*,$$

Where P_i, P_i^*, and e denote the price of good i in the home country and currency, the foreign price, and the home-currency price for foreign exchange. Prices of goods are geographically arbitraged and, adjusted for tariffs and transport costs, they are equalized in different locations. The idea of this equation is that relative national price levels in a common currency are independent of the exchange rate, since exchange rate movement merely reflect, passively, divergent national price trends. That is, of course, an application of the homogeneity postulate which holds when money is fully neutral.(Dornbusch,1987)

2.2Industrial Organization Model

The industrial organization model examines the relationship between currency-value fluctuations and domestic producer prices. The major focus is the issue of whether(and why) domestic industries differ systematically in their response to exchange rate changes.

A model presented in de Melo and Robinson (1981), based on the assumption that domestic goods (D) and imports (M) are imperfect substitutes in use, is extended here to consider the implications of imported inputs and oligopolistic domestic market structures in determining the relationship between movements in import price (P_m) and in the price of a similar (through not perfectly substitutable) domestic product (P_d). A composite commodity, Q, is defined as a constant elasticity of substitution (CES) function of D and M. Demands for D and M are then derived demand depending on demand for Q and relative prices.

$$a = -(dp_m/dE)(E/P_m) < 1.$$

Then the foreign exchange movements are measured by an index of the trade-weighted external real value of the dollar (REXCH), while the dependent variable of interest is relative producer price ($RPPI_i$), calculated as PPI_i/GNPDEF, where PPI_i is the producer price index for industry *i* and GNPDEF is the overall GNP price deflator. While it is true that movement in domestic price affect REXCH, it seems reasonable to regard the latter as exogeneous from the perspective of pricing decisions in a particular industry.

$$\ln RPPI_{ti} = \hat{a}_{oi} + \hat{a}_{1i} \ln GNP_t + a_{2i} \ln REXCH_{t-1} \qquad (i)$$

By modifying equation (i) we can identify the influence of the various industry factors on the exchange rate pass-through.

$$\ln RPPI_{ti} = \hat{a}_{oi} + \hat{a}_{1i}\ln GNPt + f(X_i)\ln REXCH_t \qquad (ii)$$

Where $f(X_i)$ is the estimated elasticity of domestic prices with respect to the exchange rate, and is a linear combination of the industry variables define above.

The methodology follows Feinberg(1989) steps that the First, pooled cross-industry/time-series data are used to estimate an elasticity of response specific to each industry between the actual and anticipated real exchange rates and relatively producer prices. Second, differences across industries in the estimated response elasticities are explained by a series of industry variables, intended to proxy competitive conditions, substitutability between domestic and imported goods, nontariff barriers to trade, import penetration, and importance of imported inputs.

$$\ln RPPI_{ti} = \hat{a}_{0i} + \hat{a}_{1i}\ln GNP_t + \hat{a}_{2i}\ln WAGE_t + \hat{a}_{3i}\ln REXCH_{t-1} + \hat{a}_{4i}\ln E_t(REXCH_{t+1})$$

The independent variable of interest is relative producer price ($RPPI_i$), calculated as $PPI_i/GNPDEF$, where $PPI_i$is the price index for industry i and FF is the overall gross national product (GNP) price deflator. Actual foreign exchange movements are measured by an index of the trade-weighted external real value of the dollar (REXCH), while expected (1-year forward) real exchange rates (E(REXCH)) are measured by a trade-weighted index that adjusts expected future spot exchange rates by expected relative inflation rates.(Feinberg,1989)

The expected exchange rate = normal exc. Rate * (1+ inflation of Thailand)/(1+ inflation of the U.S.A).

2.3 Previous research and studies

The study of Robert M. Feinberg (1989) was carried out to see the changes in the external value of the U.S. dollar between 1974-1987 passed most fully into domestic prices of industries heavily reliant on imported inputs and producing goods highly substitutable for imports. Feinberg(1986) also study about the exchange which he want to study about the domestic price of West Germany over the period of 1977-1983 by which exchange rate passthrough be examine over the concept of market concentration.

Robert M. Feinberg found out that changes in the real external value of the U.S. dollar since the start of floating rates in the mid-1970s have passed most fully into domestic prices of industries heavily reliant on imported inputs and producing goods highly substitutable for imports.

Feinberg(1986) found that market concentration and import penetration differing by industries influenced the pass-through of change in exchange rates into prices of domestic goods in West Germany.

CHAPTER III

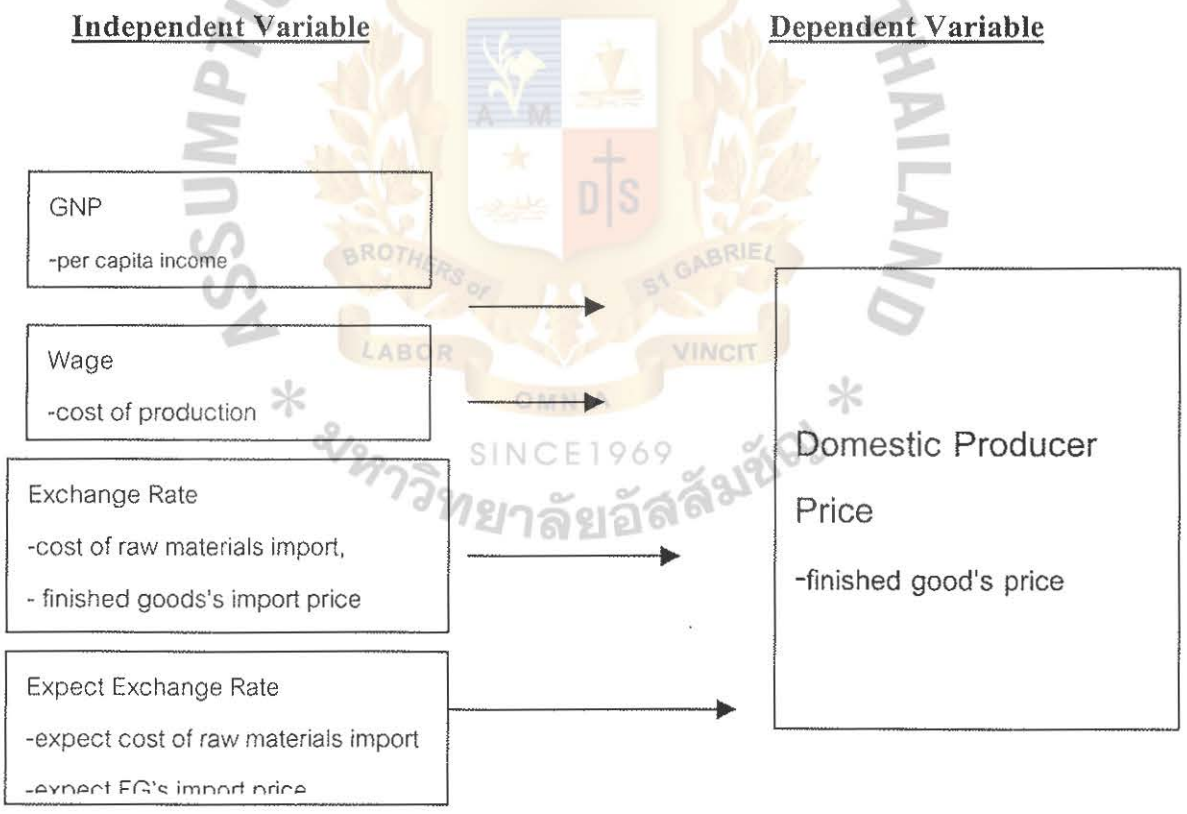
THEORETICAL AND CONCEPTUAL FRAMEWORK

This chapter includes four parts. The first part presents the conceptual framework. The second part presents the regression model. The third part presents operationalization of the dependent and independent variables. The fourth part presents research hypotheses.

3.1 Conceptual Framework

The following conceptual framework is based on the industrial organization model.

Figure 3.1 Conceptual framwork



For the **GNP**, the per capita GNP provide the information about the consumer elasticity of demand as it can finding out the level of output per individual in a country. GNP in the overall includes the annual outputs of both the private sector and public sector as been known that most manufactures are private. GNP also provide

about disposable income for the whole country, the income per person or per capita income. When the GNP is in high level it means that the economic is good and people have more income. But when GNP is at low level that also means people have less income to spend so the manufacturers cannot charge the final price high(Feinberg,1986)

Wage is the money paid to an employee for work done, and usually figured on an hourly, daily, or piecework basis. Wage is also important variable that has effect to the final goods price, if wages are initially equal between countries, the effect of an exchange rate change on the industry price and on the relative price depends merely on the fraction of firms that has wage fixed in foreign currency, and hence experiences a reduction of their costs in dollars when the dollar appreciates.

Given the wages in domestic and foreign currency, the industrial organization model provides strong predictions about the impact of dollar appreciation:

The prices of imported variants fall in proportion to the decline of dollar unit labor costs of foreign firms and the prices of domestic variants would remain unchanged.

Exporting firms at home, although they have to compete in foreign markets, still follow their mark up pricing on dollar wages.(Feinberg,1986)

Exchange rate is the value of one currency relative to another, the industrial organization model explain the links between exchange rate and prices in terms of market concentration, import penetration, the substitutability of foreign and domestic products and the nature of oligopoly competition. The real exchange rate impact on

the relative producer price as in the form of raw material imports to be the part of finish good and it is consider the cost of good sold. When the dollar appreciate it means higher cost of production so the manufacturers have to charge higher price. On the other hand, if dollar depreciate it means that the cost is low then the price of good will be low(Feinberg,1986)

Expected exchange rate is the exchange rate that people think in advance for computing in their business. It would be unusual if they ignored the available indicators of future currency movements. The fact that the time path of the exchange rate will directly affect the path of both input costs and the price of substitutes strongly suggests that expected exchange-rate movement will influence the intertemporal pricing decisions of profit maximizing firms. The expected exchange have the impact on the relative producer price in the opposite way from the real exchange rate because it is the expected not the actual so when the time come it may not be the same as we expected it to be.

The example for how expected exchange rate will impact on the relative producer price is that the manufacturers that expected for the dollar to appreciate, they think about their cost of production will be high and cost of the finish good will be charge high. On the other hand when the manufacturers expected the dollar to depreciate, they will think that the cost of production and cost of finish good will be low the their finish price they charge can be low and competitive (Feinberg,1986)

3.2 Regression Model

The Econometric Regression model:

$$\ln RPPI_{ti} = \hat{a}_{0i} + \hat{a}_{1i} \ln GNP_t + \hat{a}_{2i} \ln WAGE_t + \hat{a}_{3i} \ln REXCH_{t-1} + \hat{a}_{4i} \ln E_t(REXCH_{t+1})$$

Where the variables stand for the following:

$\ln RPPI_{ti}$ = Index of Thai manufacture price index divide by GNP deflator

$\ln GNP_t$ = Index of real GNP(1985=100)

$\ln WAGE_t$ = Index of average wage per day(1985=100)

$\ln REXCH_{t-1}$ = Index of real Baht/Dollar as 1985=100 as effective rate and year1986-1999 is nominal rate

$\ln E_t(REXCH_{t+1})$ = Index of expect dollar value(1985=100) the expect dollar base on the relative inflation of Thailand and U.S.A.

$\hat{a}$'s = parameter to estimated

i's = industries(manufacture in the study)

The purpose of this study is to help the domestic manufactures to set the optimal price in order to compete with the import goods. This study also to see the relationship of independent variables such as the wage cost that are direct cost to the final good price, the real and expect exchange rate are also significant variables that influence the final good price as some raw materials have to import and final independent variable is GNP that examine the price elasticity of demand as GNP shows how people will spend their money. The dependent variable is the domestic producer price for final product.

3.3 Operationalization of the Independent and Dependent variables

Table 3.1 Operationalization of the independent and dependent varibles

Variable to be tested	Operationalized by	Sources
Dependent variable		
Relative producer price	Index of producer price divided by GNPdeflator $RPPI_t=PPI_t/GNPDEF$	Calculated by using Industrial organization model Feinberg(1986)
Independent variables		
Index of GNP	GNP_t	Feinberg(1986)
Index of wage cost	The average wage per day	Ministry of wage and social welfare
Index of exchange rate	$REXCH_{t-1}$	Feinberg(1986)
Index of expected exchange rate	$E_t(REXCH_{t+1})$ = calculate by using domestic and foreingn inflation with real exchange rate	Feinberg(1986)

3.4 Research Hypotheses

From the conceptual framework and research questions, the research hypotheses are as follow:

Ho: Producer price index cannot be explained by ln GNP_t, ln $WAGE_t$, ln $REXCH_{t-1}$ and ln $E(REXCH_{t+1})$

Ha: Producer price index can be explained by ln GNP_t, ln $WAGE_t$, ln $REXCH_{t-1}$ and ln $E(REXCH_{t+1})$

CHAPTER IV

RESEARCH METHODOLOGY

This chapter presents the methodology used to conduct this study that divided into Data Sources, Data Collection, Measurement and Data Analysis.

The study based on secondary data from different sources.

4.1 Data Source & Data Collection

Secondary data was collected from different sources include: BOT library, Ministry of Commerce, Ministry of wage and social welfare, internet and Department of technical and economic cooperation.

The following table represents sources of data.

Table 4.1 Data Source & Data Collection

Data	Name of Book
GNP, Exchange rate	International Financial Statistics Yearbook
PPI	Economic and Financial Statistics
Wage index	Basic wage cost and work hour

The monetary unit is US dollar for purpose of comparison across each manufacture.

4.2 Measurement

Table 4.2 Measurement

Data	Level of Measurement
In GNP_t	Ratio Scale
In $WAGE_t$	Ratio Scale
In $REXCH_{t-1}$	Ratio Scale
In $E_t(REXCH_{t+1})$	Ratio Scale

4.3 Data Analysis

The analysis covers the time period from 1985-1999. The analysis will conduct with selected 10 Thais manufacture.

The study of domestic producer price will be based on regression analysis by statistical computer software-SPSS program. There are several tests to perform as follows:

- **T-test**

T-test that will conducted is test at the 95% confidence level with the following null and alternative hypothesis:

Ho: Producer price index cannot be explained by ln GNP_t, ln $WAGE_t$, ln $REXCH_{t-1}$ and ln $E(REXCH_{t+1})$

Ha: Producer price index can be explained by ln GNP_t, ln $WAGE_t$, ln $REXCH_{t-1}$ and ln $E(REXCH_{t+1})$

The null hypothesis states that the In $RPPI_{ti}$ cannot be explained by the independent variables. To reject null hypothesis means the In $RPPI_{ti}$ can be explained by independent variables.

- **F-Test**

F-test is the testing for the validity of all variables, if the result each coefficient is 0, it means rejected. The significant is 95% confidence level.

Ho: $\hat{a}_{11} = \hat{a}_{21} = \ldots\ldots \hat{a}_{41} = 0$

Ha: Ho is not true

-Co-efficient of Determination : Adjusted R-square

The regression model can be analyzed by recognize the value of R-square and adjusted R-square. The value of R-square is between 0 and 1 while value of adjust R-square is less than R-square as adjust R-square is use to compensate for the bias of R-square.

-Assumption of Ordinary Least Squares: Multicollinearity, Autocorrelation, Heteroskedasticity

1. Multicollinearility

What might go wrong: Some of the independent variables are(imperfectly) correlated.

How to solve: Drop some redundant variables, combine variables.

2. Autocorrelation

What might go wrong: Some error terms for different observations are correlated.

How to solve: Add the omitted variables

3. Heteroskedasticity

What might go wrong: The variance of error terms is not constant for all observations.

How to solve: Add the omitted variables, redefine variables.

CHAPTER V

RESULTS OF THE STUDY

This chapter represents the result of the model in chapter 3. This chapter is divided into four sections. The first section is the regression equation. The second section is the results of the T-test, F-test, R^2 and adjust R^2. The third section is the validity of Ordinary Least Square(OLS). The last section is the interpretation of the results.

5.1 Regression Equation

The industrial organization model adopted by Feinberg(1986), is employed in this study. In this model, the research pooled data of relative producer price from 1985-1999 with which all variables are estimated by the OLS method with stepwise method. All variables are in the log form except for the parameter for the interpretation of the estimated coefficient.

In the result of this study, the regression equation is as follows:

$$\ln RPPI_{ti} = \hat{a}_{oi} + \hat{a}_{3i} \ln REXCH_{t-1}$$

$$= 8.618 + -0.829$$

$$(25.963) \qquad (-12.213)$$

Significant at 95% confidence interval. Number of observations = 140

Where:

$\hat{a}$'s = parameter to estimated

$\ln RPPI_{ti}$ = Index of Thai manufacture price index divide by GNP deflator

$\ln GNP_t$ = Index of real GNP(1985=100)

$\ln WAGE_t$ = Index of average wage per day(1985=100)

$\ln REXCH_{t-1}$ = Index of real Baht/Dollar as 1985=100 as effective rate and

year1986-1999 is nominal rate

ln $E_t(REXCH_{t+1})$ = Index of expect dollar value(1985=100) the expect dollar base on the relative inflation of Thailand and U.S.A.

i's = industries(manufacture in the study)

5.2 Quality of the model in term of T-test, F-test, R, R square and adjusted R square

5.2.1 **T-test**

Table 5.1 The Estimation Result by OLS Assumption

SMPL 1985-1999

140 observations

LS // Dependent variable is $RPPI_{ti}$

Variables	Coefficient	T-Statistic	Significant
Parameter	8.618	25.963	.000
ln $REXCH_{t-1}$	-0.829	-12.213	.000

5.2.2 F-test

Table 5.2 F-test

Model	Sum of Square	Degree of Freedom	Mean Square	F	Significant
Regression	3.625	1	3.625	149.149	.000
Residual	3.354	138	2.430E-0.2		
Total	6.978	139			

The F-test is 149.149 or P(F>149.149) = .000. Ho is rejected and accept Ha because the significant level is .000 < .05

This show that there is at least one independent variable that has a relationship with the dependent variable ($RPPI_{ti}$). From the hypothesis,

Ho: $\hat{a}_{1I} = \hat{a}_{2I} = \ldots\ldots \hat{a}_{4I} = 0$

Ha: Ho is not true

5.2.3 R, R^2 and adjusted R^2

Table 5.3 R, R^2 and adjusted R^2

R	R^2	Adjusted R^2	Std. Error of Estimation
.721[a]	.519	.516	.1559

5.3 Validity of Ordinary Least Square (OLS) Assumption

The result of Assumption of the (OLS) are as follows:

Table 5.4 Validity of Ordinary Least Square(OLS)

Durbin-Watson	Variance Inflation Factor	Plot spread
2.635	1.00	Good

5.4 Interpretation of Results

The results of the F-test show that the F value = 149.149 and the significant level is equal to 0.000. This means that there is at least one independent variable in the model that can explain the dependent variable(Table 5.2).

The analysis of T-test is to see which variable will be included in the equation so the significance value is still .000 by using the stepwise method(Table 5.1). There is one independent variable included in the equation. It is the ln REXCH $_{t-1}$ and the T-test of ln REXCH $_{t-1}$ is negative.

The coefficient of the variables measures the impact of the exchange rate on the relative producer price. The coefficient of the exchange rate variable is negative and significant at five percent indicating that the exchange rate represents as cost of raw materials and intermediate goods import cost has a negative impact on the relative producer price.

There are three variables are excluded from this equation. They are ln GNP_t , $WAGE_t$ $E_t(REXCH_{t+1})$. They are excluded from the model because all the variables have significant value higher than 0.05. The variables which are excluded in the equation are ln $WAGE_t$, ln GNP_t, ln $E_t(REXCH_{t+1})$ with the significant values of .531,.580 and .497 which are not equal to .000 level. The beta for each are -.039, -.041, and .357. and the T-value are -.629 -.555 and .681.

The reasons why these three variables are not significant are as follows:

Wage in the case of the research conducted in U.S.A. used the unit of wage as hourly compensation rate while in the case of Thailand used the unit of wage as average daily wage for overall manufactures. This implies that in the case of U.S.A. may come up with the result that is more significant.

GNP in this case is not significant may be come from the base year using is at year 1985 and at the period of crisis(year 1997 onward) may adopted little weighted.

Expected exchange also not significant may come from the inflation rate in Thailand and U.S.A. has little difference. In the research conducted U.S.A., the methodology to find the expected exchange rate is used six different kind of currency to calculate for the expected exchange rate.

The â of each variable included in the equation can be shown as follows:

$$\hat{a} = 8.618$$

$$REXCH_{t-1} = -.829$$

The above coefficient shows that the exchange rate is the important factor for the domestic producer price. One percentage increase of $REXCH_{t-1}$ will lead to the

decrease of the producer price by .829 percent. From this result, it implies that when dollar appreciate and Baht depreciate, the relative producer price will be at low price.

The overall goodness of fit of the model measured by R^2 is 51.9%. This means that the independent variables can explain the changed of the dependent variable ($RPPI_{ti}$) 51.9%. Another 48.1% are explained by other factors, which are not included in this model. The adjusted R^2 is 51.6%, which is close to R^2.

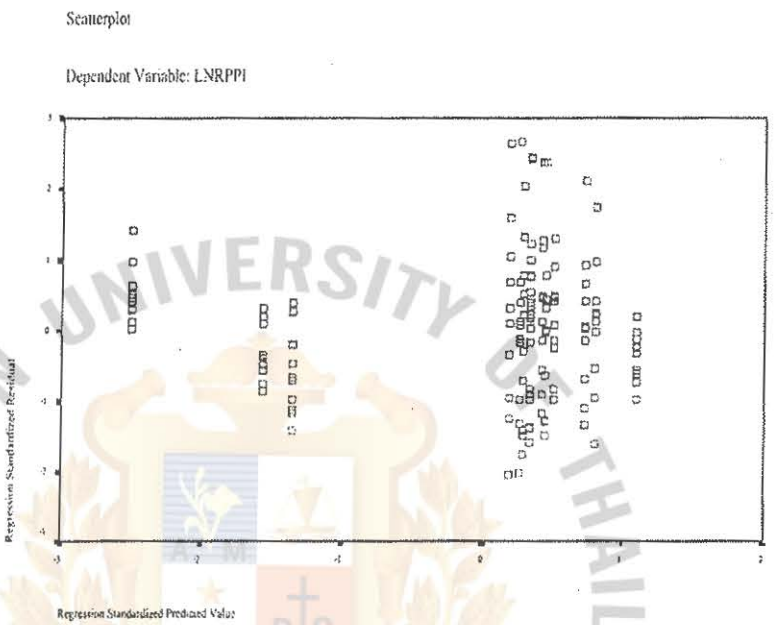
The validity of Ordinary Least Square (OLS) are as follows:

Durbin-Watson- is used to test the Auto-correlation. The best value of Durbin – Watson is 2. It shows that e_i and e_t are independent of each other where e_i is the random error of i and e_t is the random error of t. If the value < 2 and close to 0, it shows that e_i and e_t have a positive relationship. If the value > 2 and close to 4, it shows that e_i and e_t have a negative relationship. The value of Durbin-Wayson in this study is 2.635. Therefore it can be explain that e_i and e_t in this model have no relationship.

Variance Inflation Factor(VIF)- is used to test the Multicollinearity to see whether there is a relationship among the independent variables or not. If VIF is >5, it means that there is a high correlation among independent variables. VIF of each variable is close to 1 this means that there is no relationship among independent variables in the model.

Plot the Spread- is used to test the Heteroskedasticity. From the figure

X axis = ln $RPPR_{ti}$ and Y axis = Predicted value. In this model, there are some error in the raw data. From the graph, the Var(e) will be higher when the values of X and Y increase.



CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

This chapter will be divided into 2 parts. The first part is a summary of findings. The remaining part is the recommendations.

6.1 Summary of Findings

From the result of this study, there is one variable significant to the model. That is REXCH $_{t-1}$ or the exchange rate.

The equation can be presented as follows:

$$\ln RPPI_{ti} = \hat{a}_{oi} + \hat{a}_{3i} \ln REXCH_{t-1}$$

$$= 8.618 + -0.829$$

$$(25.964) \quad (-12.213)$$

Where:

â's = parameter to be estimated

ln $RPPI_{ti}$ = Index of Thai manufacture price index divided by GNP deflator

ln $REXCH_{t-1}$ = Index of real Baht/Dollar as 1985=100 as effective rate and year 1986-1999 is nominal rate

i's = industries(manufacture in the study)

From the above equation, it can be explained that the relative domestic producer price during 1985-1999 is affected by the exchange rate.

The coefficient value of the exchange rate is a negative sign, this implies that when the dollar appreciates and Baht depreciate, the relative producer price will be low. On

the other hand, when the dollar depreciates and Baht appreciate, the relative producer price will be high.

The alternative hypothesis is accepted because the value of F-test is not equal to 0 and the value of F-test significant is at 0.000 level that is lower than 0.05. The R value is 72.1%. The overall goodness of fit of the model measured by R^2 is 51.9%. There is no violation of the assumption of Ordinary Least Square(OLS). The Durbin-Watson value is 2.635. VIF is 1 which is lower than 5. The spread is in good plot.

6.2 Recommendations

This study is beneficial to manufacturers who are interested in preventing/protecting their businesses from the risk of fluctuating exchange rate. The manufacturers that have to import goods to produce the final products (contain mostly of imported substances) will have a choice to hedge with derivatives (buy future, forward, or option). By doing this, the manufacturers (importers) intend to pay an up-front price or premium to buy a certain level of protection for their business. Importers can plan for the alternatives to reduce the risk of rising cost of import items by watching closely the movement of the exchange rate.

The other method like making an agreement with the foreign suppliers to have some discount or make contract to buy raw materials and intermediate goods with agree upon dollar price forward will be beneficial. So in the future when the dollar appreciates, it may not affect on the cost so much.

Not only following up the exchange rate movements and overall economic situation, the importer must also consider other factors like inflation, interest, process of production and other factors in order to stay competitive.

For the researchers, this exchange rate and domestic price may benefit them for better understanding about how the exchange rate affects on each sector of the businesses. The exchange rate that is fluctuating will affect directly and indirectly every business locally. In business that has nothing to do with imported products because it could produce/find materials locally, it is still affected by the appreciation or depreciation of the exchange rate. For instance, the leather industry, this industry may need less or even no raw materials from import product, but the exchange rate movements could still affect it. The rising cost of the leather industry may not be from the cost of raw materials, instead it may come from the higher living cost that causes the minimum wage to rise and finally makes the cost of the finished goods higher.

The opportunity and threat of the importer/exporter will largely depend on the strength of their home currency compared to those of others. For example, if the home currencies depreciate compared to those of other currencies, the window of opportunity will be opened. The products that sell abroad will be more profitable when exchanging the currency back to the home currency. One thing that must not be neglected when they're in the import/export business is the risk of foreign exchange exposure.

The exchange rate either actual or anticipated will have a impact on the raw material and the intermediate goods imports and it affects both directly and indirectly the domestic producer price.

Moreover, avoiding risk from the exchange fluctuation, manufacturers can look for the alternative of using the raw materials and intermediate from domestic resources that are not much affected by the exchange rate. If the manufacturers must import the raw materials and inevitably face with the exchange rate exposure, they can find out other ways to reduce the cost of product. For example, when the manufacturers think they have paid a lot on the unproductive workers. They can replace the unproductive workers by the automatic machine or introduce the assembly method to reduce the cost and speed up the work with efficient utilizatism of resources.

From the results of this study, the coefficient of exchange rate is negative sign. It implies that when Baht has devaluation after 1997, the cost of raw materials and intermediate goods import will be at high cost and people think that the producer will charge the high price on the finished good but the overall manufacturers' price is drop down follow the economic downturn. This mean that the cost of raw material and intermediate goods is weight on little portion compare to final price of the product. The reasons for the drop down of overall manufacturers' price may come from the other factors beside exchange rate such as the interest rate for loans, the competition level, the economic condition, the government policies and the level of government subsidies on domestic manufacture.

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APPENDIX

Regression

Variables Entered/Removed [a]

Model	Variables Entered	Variables Removed	Method
1	LNREXCH		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: LNRPPI

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.721[a]	.519	.516	.1559	.519	149.149	1	138	.000	2.635

a. Predictors: (Constant), LNREXCH

b. Dependent Variable: LNRPPI

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.625	1	3.625	149.149	.000[a]
	Residual	3.354	138	2.430E-02		
	Total	6.978	139			

a. Predictors: (Constant), LNREXCH

b. Dependent Variable: LNRPPI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistic	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	8.618	.332		25.963	.000	7.962	9.274					
	LNREXCH	-.829	.068	-.721	-12.213	.000	-.963	-.694	-.721	-.721	-.721	1.000	1.00

a. Dependent Variable: LNRPPI

Excluded Variables [b]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNWAGE	-.039[a]	-.629	.531	-.054	.920	1.087	.920
	LNGNP	-.041[a]	-.555	.580	-.047	.635	1.575	.635
	LNEREXCH	.357[a]	.681	.497	.058	1.275E-02	78.423	1.275E-02

a. Predictors in the Model: (Constant), LNREXCH

b. Dependent Variable: LNRPPI

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.1574	4.7295	4.5674	.1615	140
Residual	-.3251	.4147	1.897E-15	.1553	140
Std. Predicted Value	-2.539	1.004	.000	1.000	140
Std. Residual	-2.086	2.661	.000	.996	140

a. Dependent Variable: LNRPPI

Average wage per day and their index number

year	baht/day(wage)	index
1985	72.46	100
1986	73.89	101.97
1987	77.56	107.03
1988	78.88	108.86
1989	91.87	126.78
1990	102.25	141.11
1991	116.32	160.52
1992	125.06	172.59
1993	133.16	183.77
1994	135.21	186.59
1995	136.39	188.22
1996	147.09	202.99
1997	159.53	220.16
1998	160.57	221.59
1999	159.84	220.59

Source(Ministry of wage and social welfare)

The exchange rate of Baht/Dollar

Year	Baht/dollar
1985	29.27
1986	31.96
1987	35.56
1988	33.95
1989	33.76
1990	35.98
1991	36.16
1992	35.09
1993	35.81
1994	36.62
1995	37.44
1996	36.28
1997	63.74
1998	51.62
1999	51.42

Source:(Bank of Thailand)

GROSS NATIONAL PRODUCT of THAILAND

Year	GNP(Thousand million baht)
1985	1172.5
1986	1233.4
1987	1353.5
1988	1535
1989	1727.8
1990	1921.7
1991	2082.2
1992	2232.7
1993	2427.6
1994	2657.2
1995	2905.3
1996	3061.4
1997	3010.2
1998	2671.2
1999	2802.3

Source:(Bank of Thailand)

The exchange rate conversion from spot rate to expected rate(Baht/Dollar)

year	spot rate	expect rate
1985	27.159	27.159
1986	26.299	26.864
1987	25.723	26.121
1988	25.294	25.634
1989	25.702	25.702
1990	25.585	26.342
1991	25.517	26.32
1992	25.4	25.895
1993	25.32	24.871
1994	25.15	25.915
1995	24.915	25.919
1996	25.343	26.622
1997	31.364	33.021
1998	41.359	44.709
1999	43.721	43.03

Source:(Bank of Thailand)

GDPdeflator

Year	GDPdeflator
1985	88.7
1986	90.2
1987	9404
1988	101.2
1989	106.1
1990	112.2
1991	118.7
1992	124
1993	128.1
1994	134.8
1995	142.3
1996	148.2
1997	154.2
1998	168.7
1999	161.4

Source:(Bank of Thailand)

Producer price index(1985-1999)

Year	1985	1986	1987	1988	1989	1990	1991	1992
construction materials	100	98.8	102.8	113.9	127.6	138.9	146.2	145
petroleum products	100	88.9	84.5	85.2	82.9	92.8	106.1	101.7
hideandleatherproducts	100	103.5	113.5	143.8	159.7	167.8	176.8	186.2
textiles	100	99.8	106.3	109.1	112.2	117.8	124.8	127.8
chemicals products	100	95.2	100	112	115.4	113.1	117.4	116.1
paper products	100	100.3	106.6	113.7	116.1	125	136.4	137.5
rubber products	100	87.9	96.6	100.7	103.5	106	104.9	104.9
transportation products	100	107.2	121.1	128.1	133	141	141.4	134.7
machinery equipments	100	101.7	105.2	117	122.6	124.7	128.2	128.5
miscellaneous products	100	94.2	94.8	94.6	96.9	96.5	103.4	105.1

Producer price index(1985-1999)

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
construction materials	100	98.8	102.8	113.9	127.6	138.9	146.2	145	146.8	150.5	157.3	162.3	106.6	138.9
petroleum products	100	88.9	84.5	85.2	82.9	92.8	106.1	101.7	101.6	98.5	102.3	113.3	123.7	136.1
hideandleatherproducts	100	103.5	113.5	143.8	159.7	167.8	176.8	186.2	189.8	205.8	213.1	205.2	105.8	104.5
textiles	100	99.8	106.3	109.1	112.2	117.8	124.8	127.8	133.8	136.9	143.4	142.6	104.5	116.8
chemicals products	100	95.2	100	112	115.4	113.1	117.4	116.1	114.1	116.1	121.7	118.2	100.8	108.7
paper products	100	100.3	106.6	113.7	116.1	125	136.4	137.5	137.5	138.2	166.5	184	115.4	126.8
rubber products	100	87.9	96.6	100.7	103.5	106	104.9	104.9	105	131.9	181.2	168.8	107.2	117.9
transportation products	100	107.2	121.1	128.1	133	141	141.4	134.7	141.5	144	148.6	154.8	103.5	109.3
machinery equipments	100	101.7	105.2	117	122.6	124.7	128.2	128.5	130.8	132.7	133.8	133.9	99.5	112
miscellaneous products	100	94.2	94.8	94.6	96.9	96.5	103.4	105.1	104.5	110	116.2	119.7	109.3	121.3