

Chapter 2

Review literature

The objective of this chapter is to review the concepts of equilibrium real exchange rate, which consist of (1) purchasing power parity (PPP) and (2) macroeconomic balance. In PPP cases, the equilibrium real exchange rate is a constant value. The reason for constant PPP is that the nominal exchange rate movements tend to offset relative price movements. On the other hand, the macroeconomic balance approach believes in non-constant real exchange rate, the variability of the equilibrium real exchange rate is due to the change in the fundamental variables. Hence, the reinterpretation of equilibrium real exchange rate is needed.

2.1 Purchasing Power Parity (PPP)

Theoretically, there are several versions of PPP that can be used to determine the equilibrium real exchange rate. The differences among those versions of the theory of PPP depend on their specific assumptions. The variability of the real exchange rate is empirically tested for validity in the short and long run.

In the earlier work, Gustav Cassel suggested that a purchasing power exchange rate is measurable by the reciprocal of one country's price level, $1/P$, against its trading partner's, $1/P^*$. It measures the units of good of a country that could be purchased or exchanged with a unit of good of another country. In other words, the purchasing power rate is the rate toward which the nominal exchange

rate, s , defined as units of domestic currency per unit of foreign currency, would tend. PPP can be written as follow,

$$s = (1/P^*) / (1/P) = P/P^*.$$

Let $(sP^*)/P$ be the real exchange rate, r . This approach assumes that equilibrium real exchange rates remain constant over time. Because the nominal exchange rate movements tend to offset relative price movements.

Three versions of PPP have traditionally been discussed in the common international monetary economics literature as follow,

1. Law of one price (LOP). It states that the prices of identical goods sold in different countries should be the same when expressed in a common currency if there are neither transaction costs nor trade barriers.

2. Absolute Purchasing Power Parity (APPP). It extends the law of one price to the general price level; under the same assumptions as the law of one price, the same basket of goods and services should cost the same amount in all countries when expressed in a common currency. However, its usefulness as guidance to equilibrium values is fairly limited. Transportation and information cost as well as institutional impediments to trade such as tariffs and quotas limit the response of consumers and firms to cross-country price differences, even large ones, and thus prevent absolute price levels from being equalized.

There are several empirical examples showing the invalidity of the PPP. According to the Big Mac Index by the Economist, the relative prices of Big Mac Hamburger across selected countries¹ are used as a simple indicator for the PPP because Big Mac prices are widely disparate across countries. As a result, there are number of reasons for Big Mac price differentials such as non-tradable inputs prices, value-added taxes, and profit margins. Another example is the gold price. Gold is highly traded commodities but the law of one price does not hold very well. The dollar price of one troy ounce are different across countries. The reasons for the differences in price are transportation costs, containing non-traded components, tariffs, and non-tariff barriers.

3. Relative PPP (RPPP). In this case, the rate of change in the nominal exchange rate will be equal to the difference between the domestic and foreign rates of inflation on equivalent baskets of goods.

There are not only the differences in each PPP version, but the real exchange rate can also be measured in several ways. Some empirical works based on the same version of PPP, but measured the real exchange rate differently. For instance, price deflators are measured in different forms such as wholesale prices, consumer prices, export or import prices, value added, unit labor costs, and normalized unit labor costs.²

¹Kenneth Rogoff, "The Purchasing Power Parity Puzzle," Journal of Economic Literature XXXIV (June 1996): 649-650.

²Peter Clark, Leonardo Bartolini, Tamim Bayoumi, and Steven Symansky, "Exchange Rates and Economic Fundamentals: A Framework for Analysis" IMF Occasional Paper No.115 (Washington: International Monetary Fund, December 1994), pp. 6-8.

Instead of defining the real exchange rate as the multiplication of relative cross-country prices of the same basket of commodities and the nominal exchange rate, the real exchange rate can be defined as the relative prices of tradable to non-tradable goods. It often uses in the case of developing countries or a small open economy. In particular, it measures the incentives guiding resource allocation between the two key sectors of the economy.

While the real exchange rate indices based on either PPP or the relative price of tradable and non-tradable goods are easy to calculate, there are some problems related to movements in such indices with a change in an external competitiveness. As several recent studies have shown, an observed change in an index of real exchange rate may represent a change in the equilibrium real exchange rate arising from different types of external and domestic real shocks such as the fundamental variables changing, some empirical works (for example Edwards and other works that based on the Edwards model) explained by include the policy variables changing.

When different versions of PPP are adopted, the specifications used in empirical tests also differ. Therefore, it is necessary to test the validity in the theoretical PPP. Three types of specifications are considered: (1) the trivariate relationship between the exchange rate, the domestic price series, and the foreign price series. (2) the bivariate relationship between the exchange rate and the domestic-foreign price ratio, and (3) the univariate real exchange rate. The trivariate relationship is the most general case. It imposes neither symmetry (price coefficients of the same magnitude but opposite sign) nor proportionality (price

coefficients restricted to be $[1, -1]$). The bivariate specification implicitly imposes symmetry, and the univariate specification imposes symmetry and proportionality.

2.2 Empirical Works of PPP

In this section, we will briefly review the empirical testing of PPP in the short run and long run in both industrial and developing countries (there are other details in Table 2.1).

In short run, there are empirical evidences that support the validity of PPP such as Krugman,³ Frenkel,⁴ and Edison.⁵ Krugman and Frenkel used conventional regression analysis to test PPP under a bivariate framework and used the Cochrane-Orcutt procedure to correct for serial correlation. Frenkel tested PPP in levels and first differences for two dollar exchange rates (Dollar/Pound and Franc/Dollar) and cross rate using three price indices (the wholesale, the material and the food prices indices) over the period 1921:2-1925:5 and found results which were generally supported of PPP. However, the results obtained by Krugman were opposite to Frenkel's findings. He tested PPP using monthly data on three dollars exchange rates (Mark/Dollar, Pound/Dollar, and Franc/Dollar)

³Paul R. Krugman, "Purchasing Power Parity and Exchange Rates: Another Look at the Evidence," *Journal of International Economics* 8 (August 1978): 397-407.

⁴Jacob A. Frenkel, "Purchasing Power Parity Doctrinal Perspective and Evidence from the 1920's," *Journal of International Economics* 8 (May 1978): 169-91.

⁵Hali J. Edison, "Purchasing Power Parity: Quantitative Re-Assessment of the 1920s Experience," *Journal of International Money and Finance* 4 (1985): 361-72.

over the period 1920s and found results indicating the rejection of PPP. His explanation of the rejection is that the data did not support proportionality (or homogeneity) in all cases(over period 1920s and period 1970s), while he had solved the serial correlation. Edison also challenged Frenkel's findings on the grounds that he employed conventional tests which suffered econometric inadequacies. She re-examined the three exchange rates found in Frenkel, employing the general-to-specific methodology, and obtained results which were opposite to Frenkel's findings. The main conclusion that emerged from this study is that PPP did not hold for two (Dollar/ Pound and Franc/Pound) out of the three exchange rates. Moreover, while the data did not support proportionality for the pound, symmetry was not rejected in all cases.

The short run PPP poorly explain movement of real exchange rate are poor, the results of empirical tests are mixed in the long run. In particular, the modern time series analysis has greatly contributed to the new interpretation of PPP.

The development of modern time series has confirmed the validity of the long run PPP. The results have interpreted in stationary (its mean and variance are independent of time) rather than fixed value. Corbae and Ouliaris⁶ examined the six estimates of real effective exchange rate with trading partners during 1890-1984 (Belgium, Canada, France, India, Italy, Japan, United Kingdom, New Zealand, Germany, and USA) and concluded that because of the data follows a random walk process, PPP does not hold in the long-run equilibrium relation.

⁶Dean Corbae and Sam Ouliaris," A Test of Long-run Purchasing Power Parity Allowing for Structural Breaks," The Economic Record 67 No.196 (March 1990): 26-33.

However, Olekalns and Wilkins⁷ re-examined Corbae and Ouliaris by calculating non-parametric measures of persistence and estimating fractionally the integrated ARMA models. They concluded that the result was consistent with the long-run PPP.

Breuer⁸ reviewed literature of the PPP published in 1990s that used various methods to test the validity of PPP such as Dickey-Fuller and augmented Dickey-Fuller, Perron test, variance ratio tests, the Engle-Granger two-step methods, error correction model, the maximum likelihood estimation (Johansen methods), and fractional integration methods. His selected empirical works test for stationarity of real exchange rate imposing the coefficient restrictions but do not test whether the real exchange rate is a constant all time; rather they test whether there is a reversion back to a fixed value. Ten papers confirmed that the long run PPP exists. In sum, there are some points that is different from earlier studies, this PPP model admits changes in the real exchange rate but not in its mean and the real exchange rate needs only to be stationary rather than a fixed value.

⁷Nilss Olekalns and Nigel Wilkins, " Re-Examining the Evidence for Long-Run Purchasing Power Parity," The Economic Record 74 No.224 (March 1998): 54-61.

⁸Janice Boucher Breuer, "An Assessment of the Evidence on Purchasing Power Parity, " in Estimating Equilibrium Exchange Rate. ed. John Williamson (Washington: Institute for International Economics, 1994), pp. 245-277.

The recent interpretations of PPP have become increasingly crucial and have been regarded as confirmation stationary sense of long-run PPP such as the empirical work of Chinn.⁹ Chinn evaluated whether eight East Asia currencies were overvalued against US dollar and Japanese yen on the eve of the 1997 crises. The countries of interest are Hong-Kong-PRC, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand. The results confirmed the validity of the long-run PPP and concluded that the using of PPI based estimates yields overvaluation of currencies against the dollar for Thailand, Philippines and Malaysia by 7 percent, 19 percent, and 8 percent respectively. In contrast, the CPI based with trend measures imply larger overvaluations against with dollar of 13 percent, 24 percent, and 17 percent, respectively. However, the results of interesting currencies against the yen contrasted with above results (against with dollar). For PPI based, the results indicated that as of May 1997, all the East Asian currencies were undervalued except the Malaysian riggit and Philippine peso. On the other hand, the CPI based estimated yield very high overvaluations- as high as 29 percent for the Thai baht and 46 percent for the Indonesian rupiah.

In case of Thailand, there are many empirical works which tested the validity of PPP and used PPP to find out the equilibrium real exchange rate by using co-integration and error correction model. Rungsun¹⁰ examined the validity of purchasing power parity hypothesis for the Thai Baht with the currencies of

⁹Menzie D. Chinn, " Measuring Misalignment: Purchasing Power Parity and East Asia Currencies in 19990s " IMF working Paper WP/99/120 (International Monetary Fund September 1999).

¹⁰Rungsun Hataiseree, "Purchasing power parity and the behavior of real exchange rate: Thailand's experience under the basket currency system," Thammasat Economic Journal 14 No. 2 (June 1996): 5-52.

Thailand's key trading partners. The co-integration analysis provided that there was no evidence supporting a long run equilibrium relationship. This implied the rejection of PPP. The reasons of invalidity PPP are the result from econometric (Granger and Engle methods) which suggested that are not co-integration. Phongthorn¹¹ tested the validity of the PPP between Thailand and its major trading partners. The conclusion is that the PPP relationship is unlikely to hold true. The reasons that he reject PPP hold are the estimated coefficient fails to capture the symmetry and homogeneity (or proportionality) restrictions.

In sum, as econometric practices have advanced, confirmation of a stationary relationship between the exchange rate and the domestic and foreign prices series have become increasingly important and have been regarded as the confirmations of the long-run PPP. The new interpretations of PPP represent the weakening of the traditional or Casselian PPP. The new interpretation of PPP has contributed in many ways such as

1. The new interpretation began to require stationary process of the real exchange rate, rather than fixity as required by the traditional PPP.

2. The coefficient restrictions implicit in the traditional conception of PPP have been disregarded.

3. The distinction between the short and long run was made well prior to the newer literature on the PPP by a statistical construction.

¹¹Phongthorn Wrasai, " Purchasing power parity: a re-examination of Thailand's evidence " (Master's thesis, Faculty of Economics, Thammasat University, 1996), pp. 1-108.

The assumption that PPP is constant in the long-run is also rejected from economists who believed the equilibrium real exchange rate should change continually. The reason is that economic fundamentals are no longer constant but they change continuously. The next section will deal with the concept of PPP and the changes in economic fundamental.

Table 2.1 Selected Empirical studies of Purchasing Power Parity

| AUTHOR | EXCHANGE RATE/PERIOD | PRICE INDEX | TECHNIQUE | RESULTS |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------|--------------------------|
| Frenkel (1978) | bilateral exchange rate: Dollar/ Pound, Franc/Dollar, and Franc/Pound , period 1920s (monthly) | the wholesale, the material and the food prices indices | OLS | PPP hold (short-run) |
| Krugman (1978) | bilateral exchange rate: period 1920s: Mark/Dollar, Dollar/Pound, French Franc/Dollar. Period 1970s: Lira/Dollar, Pound/Dollar, Swiss Franc/Dollar (monthly) | wholesale price indices | OLS | rejected PPP (short-run) |
| Edison (1985) | bilateral exchange rate: Dollar/ Pound, Franc/Dollar, and Franc/Pound , period 1920s (monthly) | wholesale price indices | general-to-specific | rejected PPP (short-run) |
| Corbae and Ouliaris (1990) | real effective exchange rate with trading partner of Australia ; Belgium, Canada, France, India, Italy, Japan, United Kingdom, New Zealand, Germany, and USA during 1890-1984 | Consumer Price Index, and wholesale price index | Co-integration (Engle and Granger) | rejected PPP (long-run) |

Table 2.1 Selected Empirical studies of Purchasing Power Parity (continued)

| AUTHOR | EXCHANGE RATE/PERIOD | PRICE INDEX | TECHNIQUE | RESULTS |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------|---------------------|
| Olekalns and Wilkins (1998) | real effective exchange rate with trading partner of Australia ; Belgium, Canada, France, India, Italy, Japan, United Kingdom, New Zealand, Germany, and USA during 1890-1984 | Consumer Price Index, wholesale price indices | Fractionally integration ARMA model | PPP hold (long-run) |
| Rungsun (1996) | bilateral exchange rate: seven trading partner of Thailand; Japan, USA, UK, Germany, Hong Kong, Malaysia, Singapore November 1984 - July 1992 | Consumer Price Index, wholesale price indices | Co-integration and error-correction model (Engle and Granger) | reject PPP |
| Pongthon (1996) | bilateral exchange rate: six trading partner of Thailand; USA, UK, Germany, Japan, Singapore, Malaysia 1984.11- 1995.12 | Consumer Price Index, wholesale price indices | Co-integration and error-correction model (Engle and Granger, and Johansen Methods) | reject PPP |
| Chinn (1999) | eight bilateral exchange rate against USA and Japan; Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand. Period 1970.01-1998.03 | Consumer Price Index, producer price index | Co-integration and error-correction model (Johansen) | PPP hold |

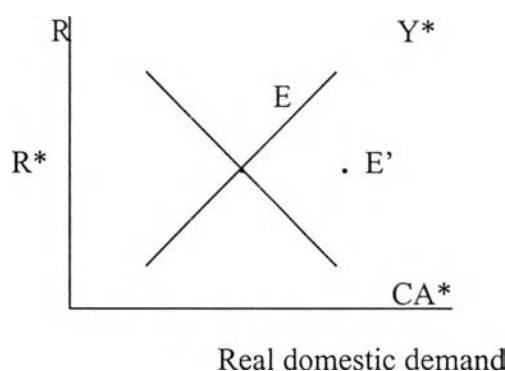


2.3 Macroeconomic balance

In this section, I will present the concept of macroeconomic balance and will review the empirical works that used macroeconomic balance to explore the equilibrium real exchange rate. The concept of macroeconomic balance begins with the equilibrium real exchange rate which can be found by the intersection on the internal and external balance. Internal balance is defined as the level of output which is consistent with both full employment and low sustainable rate of inflation. A broad definition of external balance would be the flow of international capital that corresponds to equilibrium levels of national saving and investment over the medium term. After defined the internal balance and external balance, the solution of equilibrium real exchange rate in empirical works can be solved from the large macroeconometric model or the reduce equation model. The example of empirical works can be seen from the above in the empirical works of macroeconomic balance section.

The concept of macroeconomic balance approach which is used to calculate the equilibrium real exchange rates can be shown by the relationships between internal balance and external balance in figure 2.1. The real exchange rate is measured on the vertical axis and real domestic demand on the horizontal axis.

Figure 2.1 Equilibrium real exchange rate in macroeconomic balance¹²



Note: an increase in the value of R means the exchange rate appreciates.

Internal balance is represented by positive sloping Y^* line, which represents the relationship of the real exchange rate and the real domestic demand at which the economy is in its full employment level, Y^* . The reason that it has positive slope is that when the real exchange rate appreciates, there is a lot of change in domestic demand from domestic to imported goods. Therefore, as foreign demand for export become less, the higher domestic demand is required in order to achieve the same level of output. Points to the right of Y^* indicate that output is above its potential level with the higher domestic demand being satisfied either by domestic output (lower quadrant) or by imports (right quadrant) while points to the left of Y^* (upper and left quadrants) indicate that output is below its potential level.

¹²Peter Clark, Leonardo Bartolini, Tamim Bayoumi, and Steven Symansky, "Exchange Rates and Economic Fundamentals; A Framework for Analysis," *IMF Occasional Paper* No.115, : 11.

External balance is shown by the CA^* line. This line shows the combinations of the exchange rate and domestic demand at which the current account is equal to its equilibrium level, CA^* . It is downward sloping because higher domestic demand, which worsens the current account, needs to be offset by a depreciation in real exchange rate in order to keep the external position unchanged. Points to the right of CA^* indicate that the real exchange rate is above (more appreciated than) the level required to achieve external balance, hence that the current account is less than the equilibrium level. Points to the left of CA^* indicate that the current account is above its equilibrium value.

The intersection of the two lines at point E indicates the real exchange rate, R^* , which is simultaneously consistent with both internal (Y^*) and external (CA^*) balances, and hence with appropriate underlying macroeconomic policies that achieve these desired macroeconomic positions.

The regions around E represent four types of disequilibrium. A point such as E' in the right quadrant of diagram is to a position where output is above its potential level and current account is below its equilibrium, as E' is to the right of Y^* and above CA^* . This combination of inflationary pressure and current account deficit (relative to equilibrium) and overvalued real exchange rate could reflect arise in domestic demand, for example, an expansionary fiscal policy. The left quadrant shows the opposite combination that the depress of output and current account surplus are above the equilibrium level. Points in the upper quadrant also

indicate a condition of depress output, but in this case it is combined with current account below its equilibrium level because of an appreciated exchange rate.¹³

Macroeconomic balance suggests that there is a misalignment of exchange rates. Appropriate policy responses to the case in which the current real exchange rate appears to be outside a range of values judged. Because the real equilibrium exchange rate, R^* , depends on the position of internal and external balance of economy, it will change in response to shocks that alter these balances.¹⁴

2.4 Empirical Work of Macroeconomics Balance

The empirical works can be explained in the both large countries cases and the small countries cases. In the large countries cases, the methods that we used to find the equilibrium real exchange rate are macroeconomic model and reduced single equation. The empirical works that used macroeconomic model begin with setting the target of the external balance under a condition of internal balance is met. On the reduced single equation in large countries, the model is also derived from the concept of internal balance and external balance but there are some difference points in the empirical works about the external balance concept.

¹³ Paul R Krugman, "Equilibrium Exchange Rate," in International Policy Coordination and Exchange Rate Fluctuations, ed. William H. Branson, Jacob A Frenkel, Morris Goldstein (Chicago: University of Chicago Press, 1990), pp. 159-95.

¹⁴ John Williamson, The Exchange Rate System Policy Analysis in International Economics No.5 revised ed. (Washington, D.C.: Institute for International Economics, 1985), pp.38-55.

In the small countries cases, the empirical works that used macroeconomic model to find equilibrium real exchange rate are few, there are not review in this thesis. But the case of reduced single equation are very popular. The empirical works in the case of using reduced single equation almost based on Edwards model that considered the role of non-tradable relative price as the equilibrium real exchange rate.

In the rest of this chapter, I will discuss as the following, the empirical works in case the large countries that used macroeconomic model and reduced single equation. The small countries cases will explain in the last.

The important same features of the empirical works are that they all used the macroeconomic model by setting the external balance target, given internal balance equilibrium(there are not serious problem in unemployment and inflation). However, there are some differences in detail about setting the target. Williamson¹⁵ defined fundamental equilibrium exchange rates (FEERs) by setting the rate that is expected to generate a current account surplus or deficit equal to the underlying capital flow over the cycle. Bayoumi and others¹⁶ derived the dynamic solution for the exchange rate and accessed the importance of hysteresis effects for a given path of adjustment and set of initial conditions (The hysteresis effects described the impact of changes in the external balance on the domestic economy).

¹⁵Ibid., pp.1-110.

¹⁶Tamim Bayoumi, Peter Clark, Steve Symansky, and Mark Taylor, " The Robustness of Equilibrium Exchange Rate Calculations to Alternative Assumptions and Methodologies," in Estimating Equilibrium Exchange Rate. ed. John Williamson (Washington: Institute for International Economics, 1994), pp.19-59.

However, Williamson¹⁷ re-examined the concept of an equilibrium exchange again by choosing current account targets which are changed by using the concept of life cycle and concept of demographic to set the target value of external balance. Other details can be seen in Table 2.2.

In conclusion, macroeconomic balance believes that equilibrium real exchange rate can change over time as a result of changes in the fundamental variables. The empirical works of Williamson and Bayoumi and others are large macroeconomic and normative economic since they need to set the target of the current account balance for industrial countries before finding out equilibrium real exchange rate. The weak points of macroeconomic are complicated to solve the equilibrium value and they are normative economic.

In case of using reduced single equation for the large countries, the concept of the equilibrium real exchange rate that determined by intersection of external balance and internal balance, and concept of productivity differential are used to derive the equilibrium value. All empirical works agree with the internal balance that the unemployment and inflation can be controlled. However, the concept of external balance can be interpreted in several ways such as current account balance, net debt balance, and capital flow. Faruque¹⁸ used the concept of net foreign assets and productivity differentials to share a long-run relationship

¹⁷John Williamson, "Estimates of FEERs" in Estimating Equilibrium Exchange Rate. ed. John Williamson (Washington: Institute for International Economics, 1994), pp. 177-243.

¹⁸Hamid Faruque, "Long-Run Determinants of the Real Exchange Rate: A Stock-Flow Perspective," IMF Staff Papers 42, No.1 (March 1995): 80-107.

with the real exchange rate. As Stein¹⁹ examined equilibrium real exchange rate for the US dollar responds to change in US thrift and productivity and G10 productivity. Clark and MacDonald²⁰ compared their results with Williamson's macroeconomic and used econometric methods to establish a behavioral link between the difference real interest rate and relevant economic variables such as term of trade, relative price of non-traded to trade goods, net foreign assets and real interest rates.

The results from three empirical works in the above can be discussed the followings. The variable that is introduced in Faruqee and Stein paper is productivity. But in Faruqee use in term of productivity differential. This variable base on Balassa's concept that the countries that has improvement in productivity tend to appreciation in real exchange rate. As foreign countries improve their productivities, it will tend to depreciate in real exchange rate. The results of Faruqee and Stein confirmed Balassa's concept.

Another variables that include in Faruqee is net foreign asset. A rise in net foreign asset tend to an appreciation in real exchange rate. However, this

¹⁹Jerome L Stein, "The Natural Real Exchange Rate of the United States Dollar, and Determinants of Capital Flows," In Fundamental determinants of exchange rates, ed. Jerome L Stein, Polly Reynolds Allen, and associates, (New York: Oxford University Press, 1995), pp. 38-84.

²⁰Peter B. Clark and Ronald MacDonald, "Exchange Rates and Economic Fundamentals: A Methodological Comparison of BEERs and FEERs" IMF Working Paper (May) WP/98/67 (International Monetary Fund September 1998).

variable is also include in the Clark and MacDonald paper and suggested the results in the same direction of real exchange rate.

Term of trade is the variable that Faruquee, and Clark and MacDonald included in the model. Clark and MacDonald showed that improvement in term of trade tend to an appreciation in real exchange rate. As Faruquee paper showed a positive sign in the case of USA, but in the case of Japan, it has a negative sign.

The time preference variable (or discount rate) is the important fundamental variable in Stein paper. He used this variable by plusing consumption and government expenditure to GNP. The rising time preference will lead to a depreciation in real exchange rate.

The reduced single equation in the case of industrial countries, one interesting empirical work is Clark and MacDonald, since they can replace the methods that use large macroeconometric such as Williamson approach. The variables that included in the model are term of trade, relative price of non-traded to trade goods, net foreign assets and real interest rates. The results showed that they all have positive sign as we expected. The results is consistent with Williamson approach, but Clark and MacDonald approach is an ex post sense. It does not set the target of the external balance. Other details can be see the Table 2.3.

In the small countries cases, the equilibrium of real exchange rate models are almost used the reduce single equation and based on the Edwards' model. In

addition to, the role of non-tradable market are considered to be cleared in the model, since the small countries can not change the world market price.

As for the selected empirical works, we began with Edwards²¹ paper. He examined a dynamic model of real exchange rate (RER) determination for a small open economy. The methodology equilibrium real exchange rate or long run sustainable equilibrium is attained when the non-tradable goods market and the external sector (current account and balance of payments) are simultaneously in equilibrium. The model of equilibrium real exchange rate depends upon the real disturbances. The monetary disturbances affect only the short run RER. The other empirical works that used Edwards' model to test in other countries and estimated by the modern time series are, for example, Elbadawi,²² Mongardini,²³ Shuji and Sukanda,²⁴ and Tan.²⁵ The details in econometrics methods and time periods can be see in Table 2.4.

²¹Sebastian Edwards, "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries," *Journal of Development Economics* 29 , (1988): 311-341. reprint in *Estimating Equilibrium Exchange Rate*. ed. John Williamson (Washington: Institute for International Economics, 1994), pp. 61-91.

²²Ibrahim Elbadawi, "Estimating Long-Run Equilibrium Real Exchange Rates," in *Estimating Equilibrium Exchange Rate*. ed. John Williamson (Washington: Institute for International Economics, 1994), pp. 93-131.

²³Joannes Mongardini . "Estimating Egypt's Equilibrium Real Exchange Rate" *IMF Working Paper* (January)WP/98/5 (International Monetary Fund September 1998).

²⁴Shuji Kasajima and Sukanda Lewis., " Real Exchange Rate, Current Account and Capital Flow: An Econometric Analysis of Thailand's Experiences," International Conference on A Macroeconomic Core of Open Economy for Progressive Industrialization and Development in Asia in the New Millennium, 16-18 December 1998. Bangkok, Thailand.

²⁵Eu Chye Tan, "Was the Real Exchange Rate of Malaysia Misaligned? : A Cointegration Approach," *The Indian Economic Journal* 46 No. 3 (1999), 76-90.

The variable that the selected empirical works use to explain the equilibrium real exchange rate movement in cases of small countries are terms of trade, the ratio of government consumption on non-tradable to GDP, import tariffs, technological progress, and capital inflows. The sign of each variables will be explained the following.

Term of trade. In Edwards' model the sign of term of trade coefficient can be positive or negative depend on substitution effect and income effect. If income effect grater than substitution effect, the sign of term of trade is negative. Hence an improvement in term of trade will lead to an appreciation in real exchange rate. Form the selected empirical works results, all paper works indicated increasing term of trade will lead to appreciation in real exchange rate.

Technological progress. Edwards' model suggest that technological progress will increase productivity in the economy, and lead to an appreciation of the real exchange rate. The selected paper works, almost paper works suggest that technological progress will appreciate in real exchange rate, but Edwards show the results contrast the theoretical. However, Tan explain that real exchange rate may depreciate due to technological progress may be boost the demand for non-tradable via a real income effect.

Ratio of government consumption on non-tradable to GDP. Edwards' model suggest that an increase in public consumption of non-tradable will lead to an appreciation of real exchange rate. the results in empirical works, all papers show the same results as the theoretical expected. Elbadawi explain the results that the government in Chile and India tend to devote more of their expenditure to

non-traded goods than private sectors. Excessive and unsustainable government expenditure leads to real exchange rate appreciation or overvaluation.

Import tariffs. The Edwards' model conclude that the tariff reduction will lead to depreciation in real exchange rate. Edwards, Shuji and Sukanda, and Tan are included this variable in the model. Their result showed correct sign. Shuji and Sukanda explained that when tariff rates are reduced, import of tradable goods will increase, requiring real exchange rate depreciation to maintain external balance. However, Shuji and Sukanda suggested that their results have a wrong sign and statistical significant. They explain that the real exchange rate may depreciate under trade liberalization, if income effect from lowering tariff can dominate substitution effects between tradable and non-tradable.

Capital inflows, when the controls on capital account are relaxed (increase in capital flow), real exchange rate tended to appreciate. Edwards, and Mongardini showed that the result consistent with the theoretical model, but in Shuji and Sukanda, the result has wrong sign and statistical significant.

From the selected empirical results, there are some variables that can be not explained in this thesis such as policy variables. This is due to the limitation of this thesis that consider only long run variables.

However, there are other works that modified the Edwards' model by using such as Lim and Stein,²⁶ and Baffes, Elbawawi, and O' Connell.²⁷ Lim and Stein examined NATREX for a small open economy in the case of Australia by using Edwards' model and Balassa framework. They included the capital stock and debt variables to the model. The fundamentals are thrift, productivity, the term of trade, and the world real rate of interest. The long-run real exchange rate is derived from non-tradable relative price that depend on the fundamental variables. The fundamentals which significantly affect the relative price of non-tradable affect the real exchange rate in a similar way. The results from NATREX model can be explained as the followings. However, before explaining the results, there are two effects that needed to be clear ; direct effect is the impact of fundamental variables directly to non-tradable market and indirect effect is the impact of fundamental variable to capital and debt then indirect to non-tradable market. The improvement in non-tradable productivity will lead to a depreciation in real exchange due to direct effect in non-tradable market and indirect effect which led to a depreciation in real exchange rate. The increase in thrift lead to an appreciation in real exchange rate since indirect effect is more than direct effect. An improvement in term of trade will lead to an appreciation in real exchange rate. The reason is that indirect effect is greater than direct effect. However, real

²⁶Guay C Lim and Jerome L Stein, "The Dynamics of the Real Exchange Rate and Current Account in a Small Open Economy: Australia," In Fundamental determinants of exchange rates. ed. Jerome L Stein, Polly Reynolds Allen, and associates, (New York: Oxford University Press , 1995), pp. 85-125.

²⁷John Baffes , Ibrahim A. Elbawawi, and Stephen A. O' Connell, " Single-Equation Estimation of the Equilibrium Real Exchange Rate," in Exchange Rate Misalignment: Concept and Measurement for Developing Countries. ed. Lawrence E Hinkle and Peter J. Montiel (New York : Oxford University Press. 1999), pp.405-464

exchange rate will depreciate when the world interest rate rises because direct effect and indirect effect produce real exchange rate depreciation.

The important feature of NATREX model that differed from Edwards' model is that it included the world interest rate and thrift (or saving) in the model. In addition to it also consider the role debt and capital in adjustment to steady state.

The final empirical work that I will review in this thesis, they used the concept of macroeconomic balance by setting the internal balanced and external balance. Then they find the equilibrium real exchange rate from the intersection in internal balance and external balance. This model is easier than Edwards' model and NATREX model. Baffes, Elbawawi, and O' Connell estimated the equilibrium value of the real exchange rate in case of Cote d' Ivoire and Burkina Faso by using annual data during 1970-1993 . The long run variables are term of trade, resource balance in GDP(sum of net transfer, net factor income, and net capital flow), index of open economy(import to GDP), investment in GDP, and the foreign price level converted to CFA francs(in case of Burkina Faso). The results suggested that an improvement in term of trade appreciates the real exchange rate. The estimated coefficients for the resource balance/ GDP ratio are negative, as expected. This suggested that a increase in capital flow rises domestic absorption and shifts the composition of potential output towards non-traded goods. The open economy index has negative coefficient in both countries. This supports the fact that trade-liberalizing reform would depreciate real exchange rate. The results of Baffes, Elbawawi, and O' Connell are consistent with Edwrads' model. In

addition to, in the model we can observe that there are some variables such as resource balance and the foreign price level are just introduced.

The group of Macroeconomic balance that use the reduced form to find the equilibrium RER are not set the target values. The fundamental variables that in developed countries and developing countries are different as follows. In Industrial countries case, the productivity differential, interest rate differentials and net debt are the fundamental variables, in the case of developing countries the fundamental variables are term of trade, productivity, real long term interest rate, government spending, capital inflow, the openness, and tariff tax. The good point of reduced form estimation are that they are simplify to calculate and does not set the targeting value of the variables. The methods of reduced form may be called positive economic. The weak point is that the equilibrium RER does not at the desired values.

In this thesis, I will test the validity of equilibrium real exchange rate in case of Thailand by adapting the NATREX model from version of developing countries. The hypothesis of the productivity, thrift, term of trade will effect the equilibrium real exchange rate in whether a positive way or a negative way. The foreign real long term interest rate will effect the equilibrium value in a negative way (in detail will explain in chapter 3). Although the theoretical framework is the same as NATREX in the case of Australia, but the econometric methods will not be the same. in this thesis, I will use the Johansen method. The methodology is that to test the long-run relationship of the equilibrium real exchange rate model and to confirm the speed of adjustment by the error-correction model.

Table 2.2 Selected Empirical studies of macroeconomic balance (Macroeconomic Models)

| AUTHOR | COUNTRIES/PERIOD | FUNDAMENTALS | TECHNIQUE |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Williamson(1985) | real effective exchange rate, USA, Japan, Germany, France, UK 1983.1 | choose the base period that no pressures in demand and set external target by saving, investment, capital flow | MERM model |
| Williamson(1994) | real effective exchange rate, US dollar, Japanese yen, Deutsche mark, French franc, Pound sterling, Italian lira, Canadian dollar 1981.1-1990.1 | choose the base period that no pressure in demand and set external target by life cycle and demographic factor | six macro models; EAG, GEM, Interlink, intermod, Mimosa, MSG |
| Bayoumi and other (1994) | real effective exchange rate, Canada, France, Germany, Italy, Japan, UK ,USA 1971-1975 | use three elasticities to set sustainable external balance and choose 1970 as the base period | Multimod model |

Table 2.3 Selected Empirical studies of macroeconomic balance : reduced single equation and industrial countries

| AUTHOR | COUNTRIES/PERIOD | FUNDAMENTALS | TECHNIQUE |
|----------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Faruqee (1994) | real effective exchange rate; USA, Japan 1950-1990 | term of trade, productivity, net foreign asset, non-tradable relative price | Co-integration and error-correction (Johansen) |
| Stein (1995) | real effective exchange rate; US dollar against G-10 Feb. 1975 - Apr. 1989 | productivity, foreign productivity, thrift | Cc-integration (Engle and Granger) |
| Clark and MacDonald (1999) | real effective exchange rate; USA, Germany, Japan | term of trade, non-tradable relative price, net foreign asset, relative stock of government debt, differential of real long term interest rate | Co-integration (Johansen) |

Table 2.4 Selected Empirical studies of macroeconomic balance: reduced single equation cases and developing countries

| AUTHOR | COUNTRIES/PERIOD | FUNDAMENTALS | TECHNIQUE |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Edward (1988) | Twelve countries Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, Philippines, South Africa, Sri Lanka, Thailand, Yugoslavia. 1962-84 | Term of trade, capital flows, import tariffs, government spending, productivity differentials (trend), excess domestic credit, nominal devaluation | Panel data; fixed effect instrument variables Dynamic adjustment equation that allows short run effects of nominal, including the rate of devaluation. |
| Edwabadi (1994) | real effective exchange rate; Chile, Ghana, India 1965-1990 | term of trade, openness, net capital inflow, government spending | Co-integration and error-correction (Engle and Granger) |
| Mongardini (1998) | real effective exchange rate; weighted average exchange rate of Egypt 1987-1997 | term of trade, government consumption, capital account, technical progress, gulf war dummy, debt service ratio | augmented autoregressive distribution lag |
| Shuji and Sukanda (1998) | real effective exchange rate; Thailand against major trading partner | term of trade, technological progress, capital accumulation, government consumption, tariff, capital flow | Co-integration and error-correction (Johansen) |
| Tan (1999) | real effective exchange rate; Malaysia against major trading partner 1975Q4-1987Q4 | term of trade, technology progress, capital inflow, government consumption, Tariff, capital accumulation | Co-integration and error-correction (Johansen) |

Table 2.4 Selected Empirical studies of macroeconomic balance: reduced single equation cases and developing countries (continued)

| AUTHOR | COUNTRIES/PERIOD | FUNDAMENTALS | TECHNIQUE |
|--------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Lim and Stein (1995) | bilateral exchange rate; Australia against USA 1975.4 - 1991.3 | productivity, thrift, term of trade, world interest rate | Co-integration and error-correction (Engle and Granger) |
| Baffes and others (1999) | Two countries Cote d' Ivoire, Burkina Faso 1970-1993 | term of trade, openness, resource balance to GDP, investment share, foreign price level, Harrod-Balassa- Samuelson Proxy | Co-integration and error-correction (Engle and Granger) |