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Exchange Rate Theory: A Review

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1. Introduction

Foreign exchange rates affects every walk of life, not just financial markets. Exchange rate movement can be significant for companies engaged in international trade, exposed to revenues and costs in foreign currency, or competing with foreign firms. After years of a relatively "fixed" exchange rate regime where the government would announce exchange rates daily, Asian countries, particularly Thailand, woke up one day and found their currency floating[1]. An end to the fixed currency regime disrupted capital flow and put up local interest rate in short run leading to full blow financial economic crisis, not only to Thailand, but also spillover throughout the region.

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[1] On July 2, 1997, Thai Baht currency for the first time was floated after months of speculations. A few weeks later, Philippines had proceeded to widen the band for its peso currency, while other Asian "fixed" exchange currencies are under the enormous pressure to change the exchange regime.

Most people are deeply shocked at the high volatility of floating exchange rates. The result was what began as turmoil in the currency market will have a serious impact on inflation, employment, investment and economic growth.[2] Many wonder how one can live with a floating currency regime. Some are concerned with what the foreign exchange rate fundamentally should be. Since the research in this area is vast and involves both theoretical as well as empirical investigations, any attempt to survey the exchange rate theory in its totality would be impossible. Consequently, this paper's objective is more moderate to provide a partial review on exchange rate determination theory and macroeconomics policy implications. Conceptual frameworks and its brief history are provided for the better understanding of currency movement. This is not equivalent to providing a unified approach to exchange rate theory. But the aim is to elucidate rather than advocate any particular theory.

Economist has long tried to explain the exchange rate movement for centuries with little success. Despite of its centuries old theory, Purchasing Power Parity (PPP) remains controversial as ever on the validity of exchange rate benchmark. Section 2 represents Cassel's absolute and relative PPP as a *flow model* for an exchange rate theory. The causes of deviation from PPP are examined in terms of "structural" as well as "transitory" effects. Only relative PPP seems to hold in the long run. Shifts in technology, tastes, commercial policies or labor force growth will structurally change national *productivity* and hence will permanently change the real exchange rate. Thus, PPP is usually a benchmark currency valuation though it offers no explanation for short-term exchange rate variation. Apart from reviewing recent empirical works on PPP, some policy implications are provided for fixed, flexible and managed floating exchange rate regimes in later section.

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[2] See more discussion by *Economist*, 6 September 1997, and Mendoza and Uribe [1999].

As the modern financial theory were developing in early 1970's, partial equilibrium based on *arbitrage argument* have gained popularity for short run exchange rate theory. Modern asset views on foreign exchange rate determination under an important assumption of a flexible exchange rate are pursued in both Sections 3 and 4. The asset model treats foreign exchange rates as assets traded in competitive markets; it is a *stock model* concept, viewing changes in stocks of assets at given time as the key determinants of the exchange rate. PPP and interest rate parity associations are explored in Section 3. Covered interest rate parity (CIRP), uncovered interest rate parity (UCIRP), the Fisher open theory, the unbiasedness hypothesis and relative PPP interdependent relationships are highlighted. The fundamental assumptions in this section are perfect capital mobility and perfect capital substitutability, along with rational expectations and informational efficiency in foreign exchange markets. Many empirical works are cited for reference, while some implications are given for consideration.

For the first half of this century, foreign exchange rate models are mostly based on then-reigning *IS/LM/Phillips curve* in general equilibrium paradigm. Until late 1970's, this basic paradigm was seriously challenged in term of variable identification, treatment of expectations and econometric methodology. Subsequently the next generation models in 1980's were designed to incorporate explicit specifications of *expectation* formation and *intertemporal* decision. Modern asset views on foreign exchange rate determination are again taken into account. The monetary approach and portfolio-balance approach are next surveyed in Section 4. Some assumptions of previous sections are relaxed. The "Overshooting" model, 'monetarist' model and small country model are among the specific models to be studied. Again some implications are provided. Section 5 would give extensive policy implication and discussion on various models in the light of the current Asian currency turmoil. Finally,

section 6 briefly summarizes the foreign exchange rate determination previously discussed herein.

2. Purchasing Power Parity (PPP)

The Purchasing Power Parity (PPP) theory, sometimes called the *"inflation theory of exchange rates"* can be traced back to the Salamanca school in sixteenth-century Spain, and to the writing of Gerard de Malynes appearing in 1601 in England. Though Keynes [1923, 1971: chapter 3] gave credit to David Ricardo for the concept of PPP, the Swedish economist Gustav Cassel [1918: 413] was first to name the theory PPP. After World War I, Cassel became the outstanding protagonist of the theory. Cassel once argued that without PPP, there would be no meaningful way of discussing over –or under – valuation of exchange rates. Basically, PPP relies on the *"law of one price"*[3] in an integrated, competitive "product" market with an implicit assumption of a risk-neutral world. The concept is based on a *flow* theory[4] –of exchange rates where the demand for currency is to pay for exports and the supply is to pay for imports. Despite the fact that the theory has been known for centuries, PPP remains as controversial as ever. Much of the theory is reviewed and discussed by Officer [1984], Dornbusch [1988], Levi [1990] and Levich [1998].

2.1 PPP Theory

Consider p_i and p_i^* to be the price of the *i* th commodity at home

[3] The law of one price states that when measured in a common currency, freely traded commodities should cost the same everywhere under perfect market setting (PMS) assumptions (that is, no transaction cost, no tax, homogeneous good and complete certainty). If the prices are deviate from each other, then commodity arbitragers would capitalize by buying in one market and selling in another until the profitable opportunities are ceased to exist.

[4] PPP is called the flow models since it traces the flow of goods and services through the current account to determine the exchange rate.

(e.g., Thailand) and abroad (e.g., the USA) stated in home and foreign currencies respectively. Aside from any friction in the "goods and services" trade, to prevent any profitable arbitrage, the price of the goods in each country should be the same, say, in Thai Baht: $p_i = e\, p_i^*$ where e = the exchange rate. Suppose now that the domestic price index, $P = f(p_1, p_2 \ldots p_n)$ and the foreign price index, $P^* = g(p_1^*, p_2^* \ldots p_n^*)$. If the prices of each good are equalized across countries, and if the same goods are in each country's market basket with the same weight[5], then the strong form or *absolute* PPP prevails. Mathematically, it is

$$e = \frac{P}{P^*} = \frac{\text{Baht price of a standard market basket of goods}}{\text{USD price of the same standard basket}} \quad (1)$$

Note that if the prices of perfectly homogeneous commodities are not at parity among countries at every point in time, it does not imply market failure. But it may simply reflect the inability to shift the commodities costlessly and instantaneously from one location to the other. Thereafter, the weak form or *relative* version (in log form) of PPP is developed as

$$\hat{e} = \hat{P} - \hat{P}^* \text{ where } \wedge \text{ denotes a percentage change.} \quad (2)$$

The absolute PPP in (1) shows comparative prices in different currencies and locations of a ***given*** and common basket of identical goods. As in Cassel [1918], the relative PPP in (2) restates that the rate of change of the exchange rate is equal to the difference

[5] This implies homogeneous-of-degree-one $g(\cdot)$ and $f(\cdot)$ functions are the same. Yet, in real world, different baskets are used for constructing price indexes in different currencies because their tastes and needs are different. Its implications would be discussed later.

between inflation rates. Going from (1) to (2) implies that one can circumvent any possible friction from transportation costs to tariff duties to trade. When the behavior of speculators[6] is taken into account, Roll [1979] suggests an alternative derivation of PPP in an expectation (log) form as follows :

$$E[P] = E[P^*] + E[e]$$
where $E[\,]$ = the mathematical expectation (3a)

Alternatively, the relative PPP or RPPP can be formulated in log form as:

$$\pi - \pi^* = E[s_{t+1} - s_t]$$
where $E[s_{t+1} - s_t]$ = expected changes in the future rate
π, π^* = inflation rate at home and abroad respectively (3b)

As in all PPP models, one major implicit assumption is that there are in a perfect market setting and/or a strong form of information efficiency[7] in both foreign exchange and goods markets. This assumption along with a risk aversion world will be discussed in later sections. Another implicit assumption is the constant equilibrium real exchange rate. There is no explanation concerning what determines the constant or why it should remain constant over a particular period of time. One final note is that PPP should be thought as an equilibrium condition in a long run (steady-state) equilibrium, NOT as a casual relationship.

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[6] This implies the departure from the risk neutral paradigm. Again its implications would be discussed in greater details subsequently.

[7] Note that a perfect market setting [PMS] will of course be efficient in the spirit of Fama [1970, 1991]. However the markets not satisfying PMS could also be efficient if equilibrium pricing obtains and no unusual profit opportunities are available as discussed by Levich [1998: chapters 4 and 7].

2.2 *Purchasing Power Disparity*

Theoretically, the PPP may have deviations in either the "structural" form or in a "transitory" fashion. First, the "structural" change may be a trend deviation from PPP. For example a *productivity* growth differential between countries leads to trend changes in the real exchange rate. If R is the relative consumer price levels in two countries measured in a common currency, the R = P/ eP*. As shown by Dornbusch, Fischer, and Samuelson [1977], the relative price level may account for productivity as follows:

$$R = R(h/h^*);\ R' > 0$$

where h, h* = the level of productivity at home and abroad respectively (4)

A general rise in the productivity rate at home would give a real appreciation of the home currency against a foreign currency. Shifts in technology, tastes, commercial policies or labor force growth will all change national productivity and hence will change the real exchange rate. Thus, as long recognized by Ricardo, *real factors* (e.g., real income, factor endowment, productivity levels, etc.) will introduce *systematic* departures from PPP. Second are the transitory deviations from PPP. These occur as a result of disturbances to which the economy adjusts with differential speeds in goods and asset markets. In the short run, the commodity price may be "sticky", the labor wages contract could be determined by long term contracts and the product market might have imperfect competition. In addition, capital flows induced by internationally divergent monetary-fiscal policies play an ever increasing pivotal role in foreign exchange determination. Some of PPP deviations will be explored (e.g. the Mundell-Fleming model and Dornbusch's "Overshooting" model, portfolio approach, etc.) in Sections 3 and 4.

Empirically, there are conflicts of evidence supporting PPP

in the absolute or relative form caused bydue to statistical difficulties.[8] In fact, most evidence shows signs of large persistent deviations from PPP[9] for many reasons. First, it is difficult to find an accurate price index[10] to measure the inflation rate for the countries being studied. Frenkel [1978] asserts that *different commodity baskets* in different countries may cause PPP not to hold. Genberg [1978] indicates a bias in PPP calculations using the consumer price index (CPI). Perhaps, *"non-tradable" items:* (1) immovable property (e.g. land and buildings), (2) perishable goods (e.g. fresh milk, vegetable, etc.) and (3) services (e.g. the hospitality industry, tourism, etc.) can allow departures from PPP to persist when one measures inflation only from conventional market-bundle price indexes.[11] One implication is that given different economic structures, the essence of PPP could be vastly different. On one hand, the U.S. with its advanced economy, for instance, has transformed its economy from that of an industrialized nation to a knowledge and information based society. This implies a higher degree of flexible prices, intangible output and hard to measure productivity in its enormous service sectors.[12] As a result, PPP and inflation become less relevant in traditional macroeconomics including their ability to predict exchange rates

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[8] To test PPP or relative PPP, the data requirement usually is one time series of exchange rate and two series of price indexes from the corresponding country. See Appendix I for data source from webs.

[9] See discussion on long swing in foreign exchange rate fluctuation by Engle and Hamilton [1990].

[10] See "Virtual Price" discussion by Hausman [1997].

[11] Sercu [1989] applies option pricing theory to model foreign exchange rate. Given exchange rate as a right to buy foreign goods, as deviations from PPP increase, the option becomes in the money, which raises the likelihood of exercise and caps the deviations from PPP. See also Sercu et al. [1995].

[12] See more discussion on productivity improvement by Hoontrakul [1997].

as suggested by Thurow [1997][13]. On the other hand, in Asian countries, including Thailand, which rely heavily on "international trade", inflation and PPP are relevant to exchange rates, especially in the medium to long term.[14]

Second, Pippenger [1986] claims one obstacle to finding empirical support for PPP may be due to the statistical procedures. The problem of simultaneous determination of both price and the foreign exchange rate is noted by Levi [1976] and Hakkio [1984], while the errors in measuring the inflation differential were found by Levi [1977]. The main result from these studies is that PPP does *not hold in each and every period,* since adjustment time must be allowed.[15] Third, after using a co-integration test, Pippenger [1993] concludes that relative PPP holds in the long run and that nominal foreign exchange rates follow a random walk. And by using monthly data since the 1920's through four episodes of floating exchange rates and three episodes of fixed exchange rates, Becketti, Hakkio and Joneis [1995] conclude that PPP holds in the long run. For that reason, some like Frenkel [1978] may argue that PPP is not an exchange rate determination theory, particularly in the short to medium term run, but like Cassel, Dornbusch [1988] believes PPP remains an meaningful element of macroeconomics for an open

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[13] See more discussion on exchange rate regime matter with inflation by Gosh et al. [1995, 1996]. Gosh et al.'s strong result is pegged exchange rates are associated with significantly better inflation performance and high investment, but suffering from slower productivity growth. The two main reasons are (1) pegging the exchange rate provides a highly visible commitment to the government and thus raises the political costs of loose monetary and fiscal policy and (2) pegging the currency gives higher "confidence effect" than other regimes due to low currency volatility.

[14] See more discussion by Edward and Losada [1994] from the Latin American experiences.

[15] This can be done by simply fixing the exchange rate deliberately to depreciate below the prevailing rate of inflation in relative to other countries.

economy, at least as *a benchmark* for over or under valuation of a currency. *In short, neither form of PPP holds in the short run, while there is some evidence favoring (relative) PPP in the long run.*

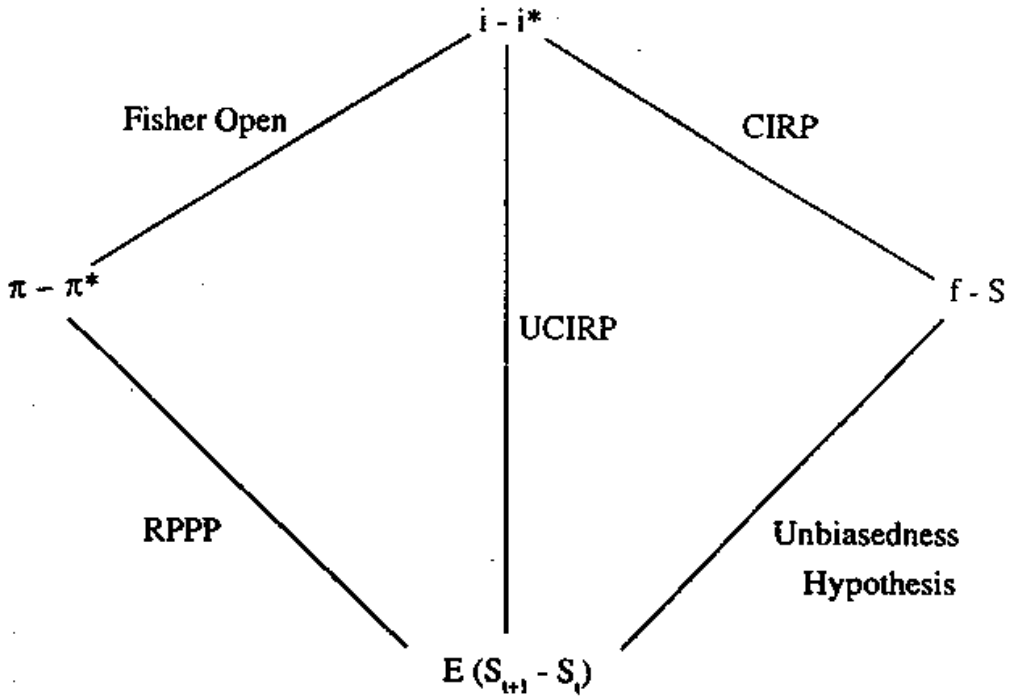
Sections 3 and 4 pursue some aspects of modern asset views of on foreign exchange rate theories developed mostly after the 1970's. The asset market views foreign exchange as assets traded in competitive markets depending on the expectation of fundamental changes. These sections incorporate increasingly the role of information and pricing models to explore the basis of PPP failure and to determine the resulting extent and persistence of policy effects under a flexible exchange rate regime. Section 3's main assumptions are concerned with perfect capital mobility and perfect capital substitution. Subsequently, Section 4 would relax some of these assumptions. Theoretical as well as empirical works are surveyed in both sections. This by no means exhausts the lists of exchange rate theories.

3. Modern asset view (I): PPP and interest parity

When an asset market is taken into account, an interest parity condition, like PPP, follows the essence of international manifestations of the law of one price. In the absence of friction[16], the dollar rate of return on security investments, or the dollar costs of borrowing, will be equal in different countries where there is *perfect capital mobility and perfect capital substitutability*. Thus, as illustrated in Figure 1, interest parity, exchange rates and inflation rates are interdependent as follows:

[16] The examples of the frictions in capital market are restrictions of the movement of capital, transaction cost, taxes and risks.

Figure 1 The Interdependence of Exchange Rates, Interest Rates, Inflation Rates and Purchasing Power Parity



Relative Purchasing Power Parity (RPPP) : $\pi - \pi^* = E(S_{t+1} - S_t)$ (3b)
Covered Interest Rate Parity (CIRP) : $i - i^* = f - S$ (5)
Uncovered Interest Rate Parity (UCIRP) : $i - i^* = E(S_{t+1} - S_t)$ (6)
Unbiasedness Hypothesis : $f - S = E[S_{t+1} - S_t)$ (7)
Fisher Open : $i - i^* = \pi - \pi^*$ (8)

Where i, i^* = Nominal Interest Rate at home, Abroad Respectively
$\pi - \pi^*$ = Inflation Rate at home, Abroad Respectively
f = Forward Foreign Exchange Rate
S = Spot Foreign Exchange Rate
$E(S_{t+1} - S_t)$ = The Difference Between the Expectation of Spot Rate at time t and t+1

Note : All Equations are Expressed in Log Normal Form.

3.1 Covered Interest Rate Parity (CIRP)

Under this belief, there will be no advantage to borrow or lend in one country's asset market rather in that of another country. If there is an advantage, then interest arbitrageurs will move the market toward covered interest rate parity. Mathematically, the partial equilibrium equation based on arbitrage or "law of one price" argument (in log form) is:

$$i - i^* = f - s \qquad (5)$$

where i, i^* = interest rate at home and abroad respectively
f = forward exchange rate and
s = spot exchange rate

Note that the condition in (5) is completely hedged or has covered interest rate parity because it involves the use of a forward rate[17]. Empirically, Frenkel and Levich [1975] using weekly observations from Jan. 1962 to Nov. 67 confirmed that CIRP held.[18] That is to say covered interest arbitrage does not seem to entail unexploited opportunities for profits. Later Frenkel and Levich [1977] extended their studies into three periods: 1962-67, the "tranquil peg"; 1968-69, the "turbulent peg"; and 1973-1975, the managed float confirmed their previous study that CIRP still holds during these periods even though the effect of transaction costs is taken into account. They

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[17] Two more interesting arbitrage based conditions for all major currency are (1) triangular arbitrage condition is $s_1(t) - s_2(t) = s_3(t)$ where $s_i(t)$ = spot rate for the i th currency and (2) with the existence of derivative market, put - call parity is $F(t) = X + [C(t) - P(t)][1 + i(t)]$ where $F(t)$ = forward rate, $C(t)$ = call, $P(t)$ = put and $i(t)$ = interest rate and all at time t. See more discussion by Vries [1994].

[18] To test IRP related research, one usually requires data on the forward and spot exchange rattes and interest rates on foreign currency and domestic currency denominated securites with comparable in all respects (e.g. credit risk, liquidity risk, etc). See Appendix I for data source from webs.

furthermore found that the cost of transactions (expressed in terms of widening bid and ask spreads) associated with CIRP increased dramatically during the managed float period compared to other periods. Clinton [1988] later examined CIRP and transaction costs with a similar conclusion. Yet Levi [1990] highlights that the deviation from CIRP may occur due to four main factors: (1) transaction costs, (2) political risk, (3) potential tax advantages and (4) liquidity preferences. Vries [1994: 353] contends that most of the time transaction costs, albeit small, prevent a profitable round-trip trade, but the discrepancy in CIRP is mainly due to the existence of political risk (e.g. capital controls, changes in regime policy, etc.). Employing six major cross currency swap rates from interest rate weekly data from 1985 to 1989, Fletcher and Sultan [1997] discovered that CIRP activities are associated with higher market volatility possibly caused by heterogeneous information or the trading itself. Moreover, one of Frenkel and Levich [1977]'s conclusion is that transactions costs play a similar role in accounting for deviations from parity during "quiet" periods, but not during "turbulent" periods. *In short, the partial equilibrium and arbitrage argument based CIRP model appears to hold in most cases.*

The major application for CIRP is as *a pricing model* for forward rates.[19] But one major implication for Asian countries, namely Thailand, is the political risk and market intervention apart from liquidity preferences. The more uncertainty in the political arena, the more costly is the capital inflow in term of country risk reflecting through money markets and forward markets. In addition, when the central bank has to intervene to stabilize its own currency, the bank has to take into consideration the interrelationship among foreign exchange markets, money markets and forward markets as

[19] The general form for pricing forward rate is $f = (1 + i)/(1 + i^*)$. See more discussion in Levi [1990].

described in CIRP. The mere intervention in the spot foreign exchange market alone may be ineffective. According to CIRP, this would surely cause high interest rates and high forward rates, hence increasing the cost of capital for all sectors : real as well as financial. One effective measure to solve his difficulty is for the central bank to intervene in all currency markets - spot and derivative simultaneously when CIRP does not hold perhaps due to market frictions or capital flow restrictions.[20]

3.2 Uncovered Interest Rate Parity (UCIRP)

Resembling to CIRP, it can be argued that an unhedged-interest-parity condition may hold in a rational expectation framework. The forward exchange rate may be strongly influenced by the market expectations about the future exchange rate, since participants' currency expectations change as the result of new information. The interest rate spread between two substitutable assets with different currency denominations is equal to the difference between the expected future (log) exchange rate and the current spot (log) exchange rate. Mathematically, UCIRP is (in log) at t = 0 :

$$i - i^* = E[s_{t+1} - s_t]$$

where $E[s_{t+1} - s_t]$ = expected changes in future rate and

i, i^* = interest rate at home and abroad between t to t+1 respectively (6)

Very little empirical evidence supports UCIRP consistent with stylized facts on nominal exchange rate return by Vries [1994: 361]. Originally using a k-step-ahead forecasting equation and overlapping techniques on seven major currencies weekly data during the 1970's

[20] See more discussion by Chaipravat [1997] and Levich [1998: Chapter 5: 133-37].

and 1920's, Hansen and Hodrick [1980] reject the simple market efficiency hypothesis for exchange; hence, UCIRP does not hold. Again Ito [1988] applies time-domain vector autoregression techniques and finds that UCIRP is rejected. Cumby [1988] later on asserts that the forward risk premiums are *time varying* with changing signs and question whether one should call it "risk" at all[21]. Finally, in the weak sense of UCIRP, expected changes in the nominal exchange rate should be positively related to the differences in the nominal interest rate across countries. But Adjaoute [1995] concludes that the risk premium arises in exchange because exchange risk is *not totally diversifiable*. From this cause, there are rewards for risk averse investors for open positions in assets denominated in currencies other than their home currency. Alternatively, Bansel [1997] still finds UCIRP is violated in the weekly data for the U.S., Germany and Japan from January 1981 - May 1995 by using a generalized method of moment on a term structure model.[22] Bansel claims one possible reason is each country may utilize *different monetary policies* over time.

3.3 Unbiasedness hypothesis

This is a direct fallout from CIRP and UCIRP. One can substitute (5) into (6) to derive the forward rate as an unbiasedness estimation of the expected future rate hypothesis or unbiasedness hypothesis. In other words, when the market uses all relevant information and uses this information correctly to determine exchange rates, this, in conjunction with risk neutrality, implies that the forward rate is an unbiased predictor of the future sport rate. While the exchange risk, $f_t - s_t$ can be observed in the market, the expectation of the future spot

[21] See more discussion of foreign exchange risk premium by Engel [1999] and Evans & Lyons [1999].

[22] See more discussion on forward exchange rate bias and risk premia in managed target zone by Nessen [1994].

rate can not be observed. Mathematically, the hypothesis is (in log) as:

$$f_t - s_t = E[s_{t+t} - s_t]$$

where f_t = forward exchange rate at t,

s_t = spot exchange rate at t,

$E[s_{t+t} - s_t]$ = expected changes in the future rate (7)

Subsequently, much empirical research has been done jointly on the risk premium for foreign exchange rates and the predictability of foreign exchange rates. Most of the empirical works that test the unbiasedness hypothesis *reject* it. Often cited is the study of Meese and Rogoff [1983] who find that a random walk model consistently forecasts a future spot rate better than the alternative models including the forward rate model. Investigations by Fama [1984] and Hodrick and Srivastava [1986] (FHS) further claim that the bias is not only evidence of a non-zero risk premia, but also as evidence that the expected depreciation is less variable than the exchange risk premium. Frenkel and Froot [1989] later infer from their studies that the systematic portion of forward discount prediction errors does not capture a time varying risk premium. But Frenkel and Froot reject the claim that the variance of the risk premium is greater than the variance of the expected depreciation like FHS. Using a cross currency swap examination, Levine [1991] subsequently documents that the forward premium/discount reflects not only CIRP, but also exchange rate expectations as also discussed by Takagi [1991].

3.4 Fisher Open Hypothesis [23]

This is the condition in which the expected real rates of interest are equal in different countries where the real interest rate is defined as the nominal interest rate minus the expected inflation rate. That is to say

[23] The hypothesis is popularized by Irving Fisher (1867-1947) and the word of "open" means the "open economy".

$$i - i^* = \pi - \pi^*$$

where i, i^* = interest rate at home and abroad respectively

π, π^* = inflation rate at home and abroad respectively (8)

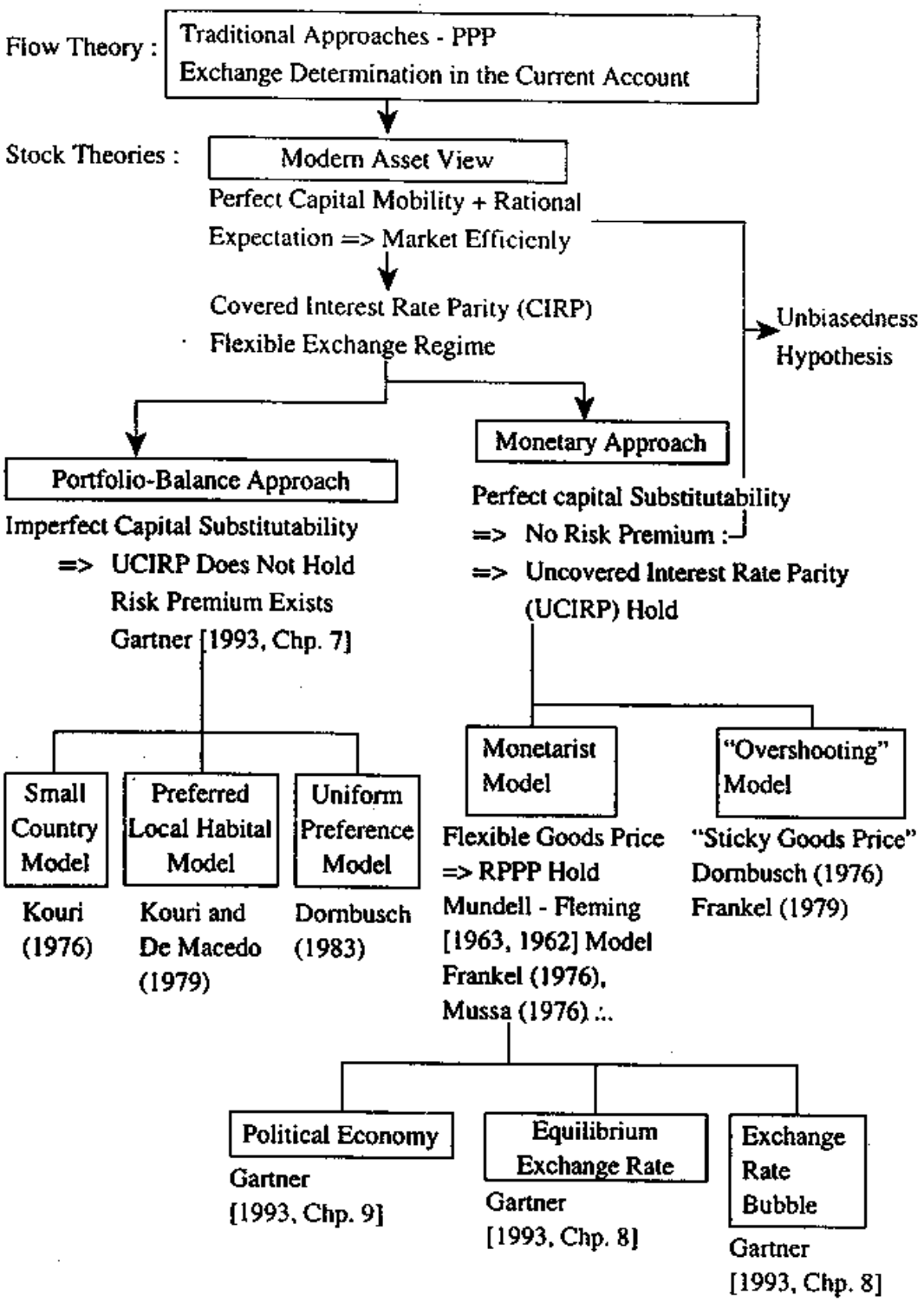
Empirically, little evidence supports the Fisher Open Hypothesis. Under a mean-variance theory of a capital asset pricing paradigm, Cumby and Obstfeld [1981] performed joint tests of the Fisher Open Hypothesis and a weak form of foreign exchange market information efficiency. They detected that the Fisher Open condition does not hold, and the deviation is highly correlated. Afterward, Cumby and Obstfeld [1984] uncovered evidence of heteroske-dasticity in the residual of the model, thus implying no justification for constant risk premia and the Fisher Open condition.

4. The modern asset view (II)

Basically, this section describes several *stock theories*[24] on exchange rates based on then the-reigning IS/LM/Phillip curve paradigm in 1960's and 1970's. While the flow theories like PPP take note of exports and imports per calendar quarter or a year as appearing in the balance-of-payments account, the stock theories are based on finding the exchange rate at which the available amount of currency, supply is equal to the demand to hold the currency. With different range of assets and assumptions, different stock theories on exchange rates as illustrated in Figure 2 are shown as follows :

[24] Stock models of the exchange rate postulate that the changes in the stock of assets, surveyed in the capital account, are the key determinant of the exchange rate.

Figure 2 Exchange Rate Models and Their Assumptions



Sources : Frankel [1993: 96] and Gartner [1993: 28].

4.1 Monetary approach [25]

Two essential elements into the monetary theory of exchange rates are (1) the ratio of the price levels in different countries to the countries' money supplies[26], and the (2) the relation between the price level and the exchange rate. Moreover, foreign exchange is viewed as a relative price between two currencies and money supply becomes an endogenous variable in the model.

4.1.1 Mundell-Fleming (Flexible Price) Model

Unlike Keynes who overlooks linkage between assets and money markets, the monetarist considers all three markets: money, assets and goods markets. And all three markets must be clearly in equilibrium under *perfect price flexibility* in long run. The monetarist exchange rate model contemplates flexible prices which keep the goods markets in permanent equilibrium since the employment is *not* fully utilized. Furthermore, the model assumes zero exchange risk premium, UCIRP holds, PPP holds and there is *perfect mobility of capital* in a risk neutral world. Still the money has no substitutability[27]. Hence, the neoclassical Mundell [1963]-Fleming [1962] model picks up on the classical Keynesian IS-LM models[28] for the closed economy, and adds those relationships considered relevant for an open economy, but has no role for rational expectations.

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[25] See more completed discussion by Gartner [1993].

[26] The money supply is the currency being held by the public and all or some subset of deposits at commercial banks.

[27] Note that perfect capital mobility is a necessary, but not a sufficient, condition for perfect substitutability.

[28] The Invest-saving or IS curve (with negative slop) is a the relationship between real GNP and the interest rate. In equilibrium, there exists an interest rate that makes sure that aggregate planned expenditure equals real GNP. The "Preferred" Liquidity Money or LM curve (with positive slope) is a relationship between the interest rate and real GNP such that the quantity of money demanded equals the quantity of money supply.

a) The Goods Market: IS curve

In equilibrium,

$$Y + RQ = C + I + G + X \tag{9.1}$$

where Y = domestic national income; Q = Q(Y,R) = imports; C = C(Y) = consumption; I = I(i) investment and i = interest rate; G = government spending; X = X(Y*R); P, P* = Price level for home, abroad respectively and R = real exchange rate (i.e. $R \equiv (E\ [P/P^*])$.

b) The Money Market: LM curve

$$M^d/P = L\ (Y, i) \tag{9.2}$$

In equilibrium,

$$M^d = M^s = M \tag{9.3}$$

where M^d = money demand, M^s = money supply, M = money, i = nominal interest rate

c) Foreign Exchange Market: FE schedule

Balance of Payment,[29]

$$BP = CA + CP = 0 \tag{9.4}$$

Current Account,

$$CA = PX - EP * Q \tag{9.5}$$

Capital Account,

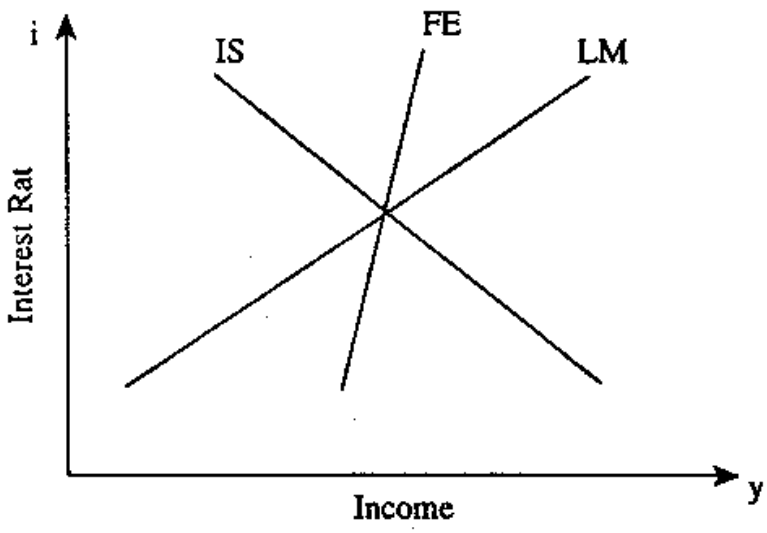
$$CP = K\ [I - i^* - E\ [e]]\ K_i \tag{9.6}$$

where BP = balance of payments, CA = current account, CP = capital account, I*= foreign interest rate, E[e] = expected depreciation and K, K_i = capital account for current, at the level of nominal interest rate respectively.

Figure 3 displays the equilibrium schedules for the three markets in the Mundell-Fleming model for an open economy in the i/Y plane. The IS curve has a *negative* slope, while both the LM and the FE schedules have *positive* slopes. The steepness of the slope is influenced

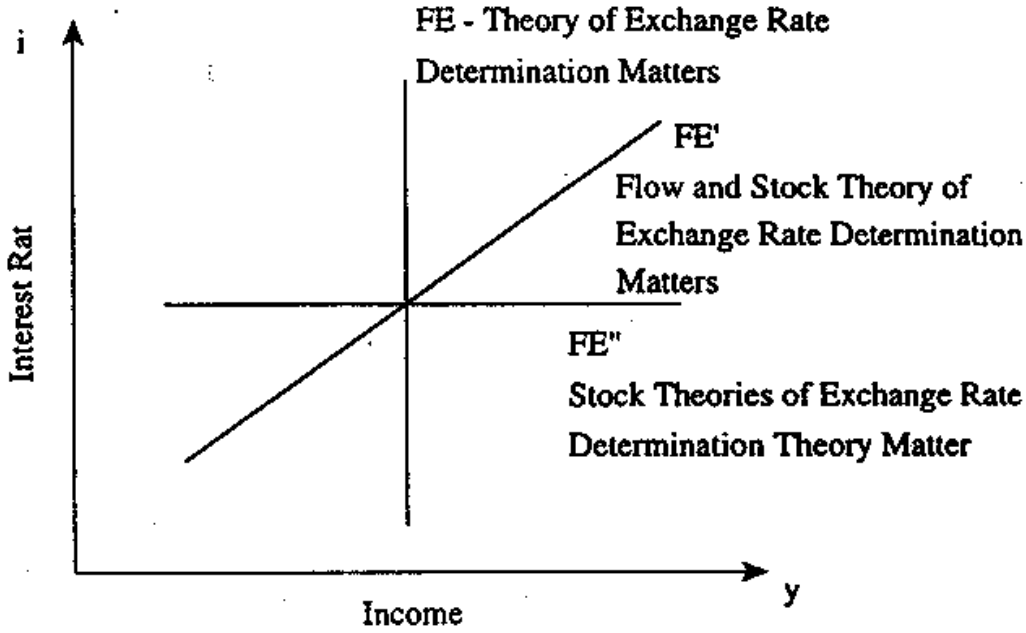
[29] The actual balance of payment, BP is consisted of (1) current account (CA) balance, (2) the capital account (CP) and (3) official reserve account (OR) balance. (i.e. BP = CA + CP + OR = 0) But in the current model, OR is assumed to be absent.

Figure 3 Market Equilibrium Schedules in the Mundell - Fleming Model when Capital Mobility is very Low



Sources : Gartner (1993 :10).

Figure 4 Equilibrium Schedules for the Foreign Exchange Market when Capital Mobility is Perfect (FE"), Imperfect (FE') and Absent (FE)



Sources : Gartner (1993:14).

by the mobility of capital across borders. On one hand, *under perfect capital mobility* and a flexible goods market assumption, in a flexible exchange rate regime, the FE schedule would be *horizontal* as in Figure 4 with monetary policy affecting the exchange rate and with fiscal stimulation not affecting aggregate income in the long run as noted by Fischer [1994: 55].[30] On the other hand, *if capital is completely immobile*, then the FE curve is *vertical* above the single aggregate income which equilibrates the balance of payments. If the balance of payment and/or current account tends to be in deficit, the exchange rate would depreciate. And the converse is true. Moreover, other parameters (e.g. imports, exports, etc.) vis-a-vis the current account affect the position of FE curve. Whether a devaluation shifts the FE curve upward or downward is determined by whether the current account improves or not.

4.1.2 Monetarist Model

This modelIt emphasizes those factors which affect the exchange rate via national money markets. The prices of goods are flexible and PPP holds by assumption. This implies that a goods market clears immediately after an exchange rate adjustment. Originally, Mussa [1976] simplified the frictionless world with his only one good, one bond world assumption. The basic building blocks are as follows:

a) Goods Market

In equilibrium,

$$p = e + p^* \qquad (11.1)$$

[30] Fisher [1994] states further that whereas, in a system of fixed exchange rates only fiscal policy would be, effective; hence the fixed regime greatly limits an independent central banks' room for manoeuvre in the conduct of monetary policy.

b) Money Market: LM Curve

In equilibrium,

$$m - p = \phi y + \lambda I \qquad (11.2)$$

c) Asset Market

In equilibrium,

$$i = i^* + E[e^\bullet] = \text{UCIRP hold} \qquad (11.3)$$

Notes: Lower case variables are in natural log, an exception being the interest rate. Greek letters denote a positive parameter. E[] = the expectation operators. Variables are defined as follows: p = domestic price level, e = exchange rate, i, i* = domestic, foreign interest rates respectively, m = domestic money, $e^\bullet$ = rate of exchange rate depreciation, m = domestic money supply (exogenous).

In essence, a flexible exchange rate under a monetarist approach emphasizes those factors via national money markets. The level of the exchange rate is perfectly correlated with the level of the relative money supply. In a stationary world, the relative money growth rate would be zero and the exchange rate expectation would play a trivial role. *"Perfect foresight"* seems to be the most reasonable assumption in this *static* environment. Individuals will implicitly depend on the rules setting the path for future government variables. Substituting (11.1) into (11.2), the resulting exchange rate determination equation would be

$$e = m - \phi y + \lambda I - p^* \qquad (11.4)$$

This is to say that the exchange rate reflects the difference between home and abroad equilibrium price levels via money markets. Nevertheless, postulated in an inflationary and/or high growth economy, (11.4) simply implies why a foreign exchange rate market may be characterized by a self-fulfilling prophecy. In the short run, an erroneous expectation would trigger an initial exchange rate movement in the expected (wrong) direction. The *"overshooting"* in the rate would refer to a temporary overreaction of the nominal exchange

rate, but it is magnified by the effect of a perfectly flexible goods market. This is due to the *Fisher effect.* But in the long run, the expectation may be corrected and the exchange rate would return to equilibrium. Hence, government intervention in the market may be justified in this case. Furthermore, in the *hyperinflation economy,* the assumption of flexible goods prices is probably a better description of reality than a "sticky goods price" model. It is interesting to note that the starting point of hyperinflation is when *inertial inflation* occurs. That is when everyone believes inflation today is about equal to what it was yesterday. The public acts on these expectations and sets the prices and wages accordingly. Consequently, cyclical factors and supply shocks cause the inflation rate to explode.[31] Note that a related area is where models of exchange rates *bubble* and related approaches, such as the *peso problem,* where systematically biased forecasts *(ex post)* of the forward rate do not necessarily mean the expectations were irrational *ex ante.* More recent reviews can be found by Frenkel and Froot [1991] and Gartner [1993, chp. 8]

When the money supply becomes *stochastic, rational expectations* play an important role in *dynamic* analysis, given that the agents posses perfect information. If an individual can distinguish between shocks to money supply levels and shocks to the money growth target, then the change in the exchange rate would be a one-time response. But, if the information is *im*perfect, then the exchange rate reaction reflects a *magnification effect* whenever the market can not positively exclude the possibility of a deliberate change of monetary policy. If the information is asymmetric, the labor market, for example, may be cleared below the perfect information equilibrium as suggested by Lucas [1975]'s surprise supply curve. Subsequently, Lucas [1976] criticizes the use of an econometric model for evaluating the outcome of a policy decision based on the estimated parameters for unobservable expectations,

[31] More discussion by Dornbusch and Simonsen [1987].

because changing the policy instruments will also change the parameters of the model, either negating the effect of the policy or making its effect unpredictable.

4.1.3 The Dornbusch "Sticky Price" Model

The "overshooting" model in a small country with perfect capital mobility as originally studied by Dornbusch [1976] views in the macro economic disequilibrium approach where prices are to be fixed in short run, not in the long run. The interest rate becomes the endogenous variable in the model and the implicit assumption of PPP is relaxed. This is a spill off from the monetarist model in which the employment is full and goods prices become sticky rather than flexible. That is to say the price of "non-traded" goods change slowly toward their new equilibrium after a disturbance, while "traded" goods prices increase in proportion to the money supply. Hence, the overall price level increases less than the money supply, leaving the demand for money lower than the supply. In these circumstances, the exchange would go beyond its new equilibrium before returning to it. In the interim, the excess supply of money causes increased spending in goods and bonds. Eventually, the excess supply of money is eliminated via rising non-traded goods prices.

The simplified version of the Dornbusch "overshooting model" taken from Gartner [1993: chapter 2] can be described mathematically as follows:

a) Goods Market :

Phillips curve,[32]

[32] The curve is named after A.W. Phillips that uncovered the statistical observation that there was an inverse relationship between the rate of change of money, wage rates and the unemployment rate in U.K. This is certainly true for industry, but it remains to be seen in knowledge and service information based societies as discussed by Thurow [1997].

$$p = \pi (y^d - y) \quad (11.1)$$

Aggregate Demand

$$y^d = \delta (e-p) + \gamma y + g \quad (11.2)$$

b) Money Market :

Money Demand

$$m^d = p + \phi y + \lambda i \quad (11.3)$$

Money Market in equilibrium

$$m^d = m^s = m \quad (11.4)$$

c) International Asset Market :

Asset Market in Equilibrium,

$$i = i^* + E[e] \quad = \text{UCIRP hold} \quad (11.5)$$

Adaptive Expectation Formation,

$$E[e^\bullet] = \theta (e^* - e) \quad (11.6)$$

Notes: Lower case variables are in natural log, an exception being the interest rate. Greek letters denote positive parameters. E[] = the expectation operators. Variables are defined as follows: π = inflation rate at home, p = change in domestic inflation rate, p = domestic price level, y^d = aggregate demand for domestic goods, y = aggregated demand for domestic goods (exogenous), e = exchange rate, g = government expenditures, i, i^* = domestic, foreign interest rates respectively, m = domestic money, $e^\bullet$ = rate of currency depreciation, m^d = domestic money supply and m^s = domestic money demand.

The major assumptions are that there is full employment, goods prices are sticky, and interest rates and exchange rates are flexible. The main result confirms the link between interest rates and exchange rates that is emphasized in a foreign exchange event. A key role in the analysis is played by the sluggish adjustment of prices as compared to the asset market. In the short run, the effects of monetary expansion are entirely dominated by the asset market or by capital mobility and expectations. In the long run, the money supply determines the price level and PPP holds. When perfect foresight

is extended, the equation (11.6) becomes E [e•] = e• (11.7). Then, there exists only a line called a "streamline" along which the system would move towards equilibrium after a disturbance under perfect foresight. It is very important to distinguish between "adaptive expectations" and "perfect foresight". The former is based on a backward-looking weighted average of past informationin which is appropriate during times of policy stability. The latter is based on forward-looking in which an individual has a perfect knowledge of future government behavior and behaves accordingly and immediately.

4.2 Portfolio-Balance Approach (PBA)

In monetary approach to exchange rates, all economic agents are implicitly assumed to hold their own country currency, but not the foreign country's currency. But in the portfolio-balance approach (PBA), people may want to hold both moneys, although they might have a preference for one country's money, probably their home money. People will hold diversified portfolios of securities in all countries taking into account demand and supply equations for money and bonds in all countries. All the markets must clear with equations setting money and bond demands equaling supplies. Thus, the exchange rate is not determined primarily by the demand for foreign currency generated by trade in goods and services, but rather by decisions on how to spread wealth over different available assets. This argument holds for bonds also.

Basically, Kouri [1976] was the first to extend this PBA from the monetary approach to the balance of payments and devaluation under a flexible exchange rate regime. By construction, PPP holds in both the short and long run under full employment. As a rule, domestic and foreign bonds are perfect substitutes. The world is assumed to be a small country, like Thailand, and produces only internationally traded goods. Gartner [1993: chaps. 6-7] further

modified the PBA model to have risk-averse individuals maximize utility by first accumulating their wealth and then redistributing their wealth as follows:

4.2.1 The short run

The monetary sectors in PBA are the wealth constraint,

$$W = M + B + EF \tag{12.1}$$

the money market equilibrium,

$$M = m [\, i, i^* + E [e^{\bullet}], W \,] \tag{12.2}$$

the domestic bonds market equilibrium,

$$B = b [\, i, i^* + E [e^{\bullet}], W \,] \tag{12.3}$$

the foreign bonds market equilibrium,

$$EF = f [\, i, i^* + E [e^{\bullet}], W \,] \tag{12.4}$$

4.2.2 The medium to the long term

The model becomes as follows: the wealth constraint,

$$W = M + B + EF \tag{12.1a}$$

the money market equilibrium,

$$M = m [\, i, W \,] \tag{12.2a}$$

the domestic bonds market equilibrium,

$$B = b [\, i, W \,] \tag{12.3a}$$

the foreign bonds market equilibrium,

$$EF = f [\, i, W \,] \tag{12.4a}$$

The goods Markets for the medium to the long term becomes: in equilibrium,

$$Y = C + I + NX \tag{12.5}$$

consumption equilibrium,

$$C = C (W/P) \tag{12.6}$$

net export equilibrium,

$$NX = NX (E/P) \tag{12.7}$$

The balance of payments becomes for the medium to long term becomes

$$BP = 0 = P\, NX/E + i^*F - T - F^* \tag{12.8}$$

where M = domestic money supply, B = supply of domestic bonds, F = supply of foreign bonds (in foreign currency) on the domestic market, E = exchange rate, W = domestic wealth, Y = full employment income, P = price level, C = consumption, I = investment, T = transfer abroad (in foreign currency), NX = net exports (real, in domestic goods' equivalent, BP = balance of payment, I = interest rate, i* = foreign interest rate, E [e•] = expected currency deprecations.[33]

The essence of PBA is that the exchange rate, as a relative price of money, is viewed as one of the prices that equilibrates the international markets for various financial assets. The asset substitution effects and the nature of expectation formation are the critical determinants of stability rather than relative price elasticity of exports and imports. In general, the short run impact of policies can be quite different from the long run impact, depending on the nature of expectations. The short run comparative static effects of the PBA are summarized in Table 1. For example, if the domestic and foreign bonds or currencies are perfect substitutes, then government interventions in foreign exchange market by buying foreign bonds or currencies would cause domestic interest, exchange rates and wealth to rise. In contrast to open-market operations, a government buying domestic bonds would decrease interest rates and increase the exchange rate and wealth. However, in real life, such as for Asian currency and particularly the Thai Baht under turbulent conditions, domestic and foreign currencies are not perfectly substitutes. Hence, unobserved preference changes may move the exchange rate. Government intervention does not comply with PBA. The central message is that the exchange rates depend not only on the aggregate money supply, but also on the composition of home money in the government balance sheet.

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[33] Some partial derivatives' conditions must be applied for all equations. Please, consult Gartner [1993] for more details.

Table 1 Summary of short-run effects of portfolio balance approach

	Interest rate	Exchange rate	Wealth
Expansionary monetary policy			
open-market operations	falls	rises	rises
foreign exchange market intervention	falls	rises	rises
Foreign exchange market intervention			
sterilized	rises	rises	rises
Expansionary fiscal policy			
financed by issuing debt	rises	rises/falls	rises
financed by creating money	falls	rises	rises
Current-account surplus			
exogenous	unchanged	falls	unchanged

Sources : Gartner (1993:174).

In the medium to long term, under a flexible exchange regime, the supply of money is exogenous and the exchange rate is endogenous. When the goods market and balance of payments are taken into consideration, the Marshall-Lerner condition holds at all times, but J-curve effects are excluded. While the currency may be devalued in the short run, the currency may appreciate in the long run via the means of balance of trade. This is because under PBA, nominal shocks have lasting consequences for the real economy. If perfect foresight or rational expectations are assumed, then the short run devaluation effects are merely inferred as disturbances. Therefore, PBA offers to explain foreign exchange rate overshooting, not from the "sticky price" aspect, but from *the changes of wealth* via current-account surpluses or deficits over time. While being in disequilibrium initially, the balance of trade is brought into surplus in its new long-run equilibrium. This leads to permanently higher consumption being financed by higher wealth for domestic residents. What really matters is the speed of adjustment process at which assets are accumulated and the manner in which expectations are formed and revised. It is important to note that what emerges from PBA is that the exchange rate should implicitly behave as similarly to the behavior of asset prices in speculative markets such as stock markets.

5. Policy implications

5.1 PPP, Currency Regime and Structural Change

Though PPP offers no explanation in short term foreign exchange rate determination, it remains an essential element of an open economy macroeconomics policy, notably in the long run. PPP becomes a linkage between the change in exchange rates and the differences between inflation rates. *A PPP-oriented exchange rate policy tends to maintain the real exchange rate constant and stabilize demand in the same direction as accommodating monetary policy.* In addition,

the structural changes in an economy such as improving *productivity*[34] would surely lead to changes of the real exchange rate and hence real income. Thus, one non-trivial implication for the government to improve real exchange in long run, hence improve standards of living is by structurally enhancing its economic competitiveness by raising productivity, shifting into new technology usage for higher efficiency, changing local tastes to accept local products, improving the quality of local products and upgrading the labor force, not just in quantity, but in quality in terms of education and training. Moreover, it is important to note that PPP is relevant for the exchange rate choice between fixed, floating and managed rates[35] as follows:

5.1.1 Fixed exchange rate

Under this regime, countries cannot afford high inflation because countries would lose their external competitiveness, which will lead to an excessive and growing trade deficit and high unemployment[36]. Perhaps a *crawling peg* and/or "triangular peg" may be the solution for Thailand or ASEAN as noted by Williamson [1982] and Hoontrakul [1998] respectively. In other words, the currency, by declaration, is to be re-valued into smaller parts spread over a certain

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[34] See more discussion on productivity improvement by Hoontrakul [1997a].

[35] See more discussion on exchange rate regime matter with inflation by Gosh et al. [1995, 1996]. Gosh et al.'s strong result is pegged exchange rates are associated with significantly better inflation performance and high investment, but suffering from slower productivity growth. The two main reasons are (1) pegging the exchange rate provides a highly visible commitment to the government and thus raises the political costs of loose monetary and fiscal policy and (2) pegging the currency gives higher "confidence effect" than other regimes due to low currency volatility. Also see Devereux and Engel [1998], Frenkel [1999] for more discussion; see Joa [1998] and Chan and Ngiam [1998], Chan and Chen [1999], Zarazaga [1999], for discussion on *currency board*.

[36] See more discussion by Edward and Losada [1994] from the Latin American experiences.

period of time. On the other hand, *appreciating real currency* to create a disinflation policy[37] as a deviation from PPP under a fixed exchange rate has been almost as disappointing as suggested by Fischer [1984]. The public has to fight the speculation against the overvalued currency by massive imports or capital flight, while the government finances the resulting deficits by external borrowing. In the end, such a scheme can collapse leaving both the public and private sectors a heavy external debt burden as witnessed in many countries in Latin America during the 1980's.

5.1.2 Floating exchange rate

If both structural trends and short-term capital movement are dynamic and the world exchange rate movement conforms strictly to PPP, then flexible exchange rates are preferable. But flexible rates suffer occasionally and often cause persistent disequilibrium of the real exchange rate away from the level warranted by the fundamentals of the goods market owing to *excessive capital flow* movement and speculation. A flexible exchange rate can be a real concern because disequiliberating capital flows can cause a large change in the rate of inflation. Therefore, government intervention is frequently needed to bring rates back to PPP "fundamentals".

5.1.3 Managed float rate

The system implicitly indicates the *target zones* of the exchange rate. This is to maintain the advantages of flexible rates within limits to preserve approximate PPP. One major implication is that there is a trade off between the stability of the real exchange rate and price stability.[38] These postulates either imported inflation from other

[37] This can be done by simply fixing the exchange rate deliberately to depreciate below the prevailing rate of inflation in relative to other countries.

[38] See more discussion on financial fragility, exchange rate regime and monetary policy in an open economy model by Chang and Velasco [1998] and managed float discussion by Chaipravat [1999].

countries or keep real exchange rate stable.

5.2 Credit-money creation, foreign exchange and asset price bubble

Most of macro-economic models (e.g. Keynesian, Mundell-Fleming, Dornbusch or Monetarist) rely on one core equation referred to as the "quantity theory of money" as originally found by Fisher [1911]. Mathematically, it is in some versions of

$$MV = PY \tag{13}$$

where M = supply of money or cash, Y= national output or income, P = price levels of goods and services and V = money velocity.

The equation (13) may be perceived as the effective purchasing power of economy is equal to what (e.g. goods and services) can be purchased in the economy. If V is relatively stable, then the relation between PY and M exists in the form of a money demand function. The stock of credit-money determines the nominal value of goods and services and hence the exchange rate. But if M is disaggregated into "real" and financial transactions as noted by Keynes [1930], then M become a dichotomous credit-money circulation as

$$C = C_R + C_F \tag{14}$$

Total loans by deposit-taking financial institutions, C is the sum of credit money used for both "real transactions", C_R and financial transactions, C_F. C_R is credit money used for *"real- transaction"* which are part of GDP such as investment and consumption; C_F is credit money used for *financial transaction* such as speculation real estate or stock purchases which are *not* part of GDP. From (13) and (14), national wealth may be thought

$$C_R V_R + C_F V_F = P_R Y + P_F Y \tag{15}$$

where P_R = price of "real" goods and services, P_F = price of "financial" assets.

The equation (15) implies that national wealth equal "cash money" and "credit" or total price of both real goods/services and

financial transactions. During the boom period[39], banks and/or other financial institutions lend aggressively for speculation purposes such as stock margin loan and real estate lending as studied by Werner [1997]. The financial transaction, C_F is increasingly channeled into the financial circulation determines the nominal value of assets and exchange rate (but not being accounted to real GDP). The assets (e.g. stock, real estate, etc.) price surges; domestic currency appreciates; and hence more international capital inflows rush in as evidences found by Werner [1994] in Japan. The ever-increasing asset values as collateral means higher the loan/valuation ratios. These provide banks' ability to extend further *asset-related loans* in C_F, but not in C_R for market share and profit since it is more difficult and time consuming to extend loan in real productive economy. Some banks may even give generous anticipation of future asset price rises in their current lending decision. There is an externality in the banks' behavior to driven up the asset price bubble by the banks. This seems to entail an underestimation of systemic credit risk. Still it is intriguing to note that the money velocity *declines* due to a disproportionate rise in C_F in which does not directly enter into the investment-wage-consumption cycle of the real economy. The decline is also due to the misspecification (i.e. $C = C_R$) in (13). Therefore, the traditional monetarist quantity theory does not hold in a financial boom period because the banks create a lot of money on the back of collateralised increasing value assets was not backed by *real* economic activity. Since consumer price inflation is trivial, monetary policy is considered appropriate. Nevertheless when asset price bubble bursts, excess asset-related credit creation must turn into bad debt that tends to cripple the banking system and create a credit crunch. Bank fragility

[39] These periods are the margin lending of the 1920's in the US, the property lending of the 1980's in Scandinavia and Japan and both margin lending and property lending during 1988-1994 in South East Asia, specifically Thailand. See more discussion on Asian Crisis by Corsetti et al. [1998a and b].

is imminent; the currency depreciates dramatically; and hence international capital outflow outburst. Real economic activity is reduced and a long, drawn-out recession is likely.

Few implications are worth mentioned here. First, it is imperative for the policy maker to *monitor the allocation of credit* and intervene, if credit creation is excessively used in speculative and unproductive fashion. Preventive measure is better than corrective measure in asset price bubble case. Second, to stimulate demand in post asset price bubble burst, the central bank should *create more money* or print money to increase money velocity and liquidity in the economy as suggested by Werner [1997]. If the real economy is *under*utilized like in Japan now, the inflation is unlikely to occur. But if the real economy is needed a major industrial restructure like at present in South East Asia, then inflation is likely to reign.[40] Third, *the money supply is increasingly difficult to be measured.*[41] The money, M is likely to be assumed incorrectly to be spent on transaction involving goods and service only represent by Y. The central banks should monitor use various deposit aggregates and variable money credit velocity with great care. For instance, the U.S. Federal Reserve de-emphasized M1 targeting in 1982 and abandoned formal targeting altogether in 1987. One implication is perhaps for the central banks to *target at the range of inflation* in goods, services and assets rather than the rate of growth of the money supply.[42] This

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[40] I would like to thank Dr. Supachai Panitchapaki to point this out to me.

[41] Tradition measures for money supply defined by the U.S. Federal Reserve Board (1980) are M1 = the sum of currency, demand deposits at the commercial bank and checkable deposits at all depository institutions, M2 = M1 plus small denomination savings, time deposit overnight repurchase agreement and money market mutual fund shares and M3 = M2 plus large-debinubatuib tune deoisuts and repurchase agreement with large financial institutions.

[42] See more discussion by Haldane [1996ed.], Federal Reserve Bank of New York [1997], Bernanke and Mishkin [1998].

would support price stability without penalizing economic growth. And more rigorous theoretical micro-foundation model for its macroeconomics policy decision may be evolved to include a wide range of quantitative monetary and fiscal policy analysis (see Brayton et al., 1997).

5.3 Asymmetric information, rational expectation and balance of payment crisis

Few models (e.g. Black [1973] and Mussa [1976]) are extended from Dornbusch [1976] to be stochastic in discrete time to allow for the possibility of random influences. An agent would optimize his utility and behave in a *rational expectation* framework. One inference is that monetary policy can have no systematic effect on the behavior of output unless the government has an information advantage so as to be able to *surprise* the market as discussed by Sargent and Wallace [1975]. Another implication can be in a *game-theoretic* perspective.[43] In a non-cooperative and uncoordi-nated game with many players, each individual player has little information on other players' payoffs. There is no reason to believe everyone would act together to reach the desired outcome in a single step. *Government coordination becomes essential to achieve effective monetary policy, particularly during high inflation and economic crisis period.* Then the government must ensure credibility of the aggregate demand policy consistent with disinflation and to coordinate the expectations and actions of individual wage and price setters in a few predetermined sequential moves. This is to stress to individual decision-makers how other actors will play and clear potential externalities in an imperfect information game.[44]

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[43] See discussion on managed float and game-theoretical approach for thinly traded and exotic foreign exchange market by Chaipravat [1999].

[44] See more discussion by Dornbusch and Simonsen [1987], Evans and Lyons [1999] and Dominguez [1999].

Many overshooting models have been developed in recent years. Krugman [1979], Flood and Garber [1984], Agenor et al. [1991] and Mendoza and Uribe [1999] are, for instance, Dornbusch-type invariant models. These study *balance of payments crises* which may be relevant to the current Asian economic debacle coupled with shortage of *skilled* labor. The central theme is that balance of payment crises are often the equilibrium outcome of maximizing behavior by rational agents faced with a fundamental *in*consistency between monetary and exchange rate policies. Afterwards, Krugman [1991] adopted the "barrier" option theory to reexamine the balance of payments crises for policy target variables. The basic ideas are unchanged and the speculators' reactions are profit seekers as before. But the important insight is that a credible zone would stabilize the exchange rate inside the zone, the so-called "honeymoon effect." This may suggest that widening the trading band in foreign currency in Asian countries may be more suitable than a free float. Moreover, recent developments in macroeconomics studies have again emphasized the *game-theoretical* approach, namely *the role of creditability*. The government must, for example, ensure the consistent aggregate demand policy consistent with disinflation and coordinate the expectations and action of individual wage and price setter. Blackburn and Christensen [1989] and Andersen and Risager [1991] contend that a lack of credibility can therefore be self-fulfilling. One simple solution may be the appointment of a "conservative central banker" or reputable person may alleviate the creditability problem appropriately, as studied by Wood [1991].

5.4 Currency devaluation and its effects

In the early (prior 1970's) models the current account (or equivalently the trade balance) was a function of output, foreign output and the relative price of the domestic good. The export and import effects

based on relative price of these items are overemphasized. In a *static* world, the exact condition in which devaluation improves the current account and the exchange rate is known as *the Marshall-Lerner conditions*.[45] First, if depreciation makes domestic goods cheaper abroad, then the current account improves, given a relatively constant domestic price. Second, if depreciation makes imported goods more expensive at home, then the current account improves ceteris paribus. Finally, if depreciation makes the home country pay more for any remaining imports or debts, then the current account deteriorates and currency may depreciate further. Note that initially, following devaluation, the current account may worsen considerably before the effects stressed by the Marshall-Lerner conditions become strong enough to improve the current account. This phenomenon is called the *J-curve effect.*

By contrast, the next generation (post 1980's) model is based on the basic relationships from microeconomics foundation while continuing to assume perfect foresight or rational expectation in open economy macroeconomics.[46] The essential ingredient is the identification of national income as the saving of the households and government, investment and the current account surplus. For example, the simplest dynamic problem for the consumer is to maximizes a time separable utility function subject to an intertemporal budget constraint in two-period problem as follows:

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[45] Marshall-Lerner condition is the common link between trade theory and international macroeconomics in a static world. It states that the condition for stability of the foreign exchange market depends directly in terms of the import and export elasticities of demand. These elasticities would determine the slopes of the currency supply and demand curves. See more discussion by Levi [1990: 118-20].

[46] The selective list of works are Lucas [1984], Frenkel and Razin [1987] for discussion, Sen and Turnovsky [1989], Sen [1991], Kozicki et al. [1996], Levin [1996], Reifshneider et al. [1997] and Brayton et al. [1997].

$$\text{Max. } V(C_0, C_1) = u(C_0) + (1-\delta)^{-1} u(C_1) \qquad (16.1)$$
$$C_0, C_1$$
Subjected to
$$C_0 + (1-r)^{-1} C(1) = W \equiv (y_0 + (1+r)^{-1} y_1 \qquad (16.2)$$

where C_i ($i = 0, 1$) denotes the consumption in period i, Y_i ($i = 0,1$) denotes the wage income in period i, δ stands for the fixed discount rate or the rate of time preference, r is the interest rate, V is assumed to be increasing and strictly concave in its arguments, and W denotes the given lifetime wealth of the consumer (see Ploeg, ed. 1994: chap. 5).

When the world is *dynamic* and stochastic, trade and relative price may lead to different views of the factors. For example, an anticipated depreciation would cause an immediate depreciation, which could improve the trade balance through the relative price effect and raise private sector saving by lowering real wealth. Obstfeld [1982], for instance, analyzes that the central insight of the *Harberger-Laursen-Metzler (HLM) effect* is that the trade imbalance reflects differences between expenditures and saving (Ploeg, ed. 1994: 520-4). A worsening the terms of trade would lower its real income in a steady state. Hence, consumption is reduced drastically. In the absence of investment, this saving is equal to the current account surplus. As the result, Obstfeld's finding in *dynamic* world may lead to the exact *opposite* of HLM claim in *static* world. But employing the utility maximization agent approach with resource constraints, Backus [1992] contents that the *income effect* plays the crucial role in the HLM effect. The relation between the trade balance and the terms of trade is also determined by the elasticity of substitution. Furthermore, asset price dynamics play an important role. Massive currency devaluation naturally causes the nation to adopt strict austerity. A surplus in the current account is followed for foreign asset accumulation in which affects individual behavior in the future.

There are at least four implications from the above analysis

First, a devaluation is likely to be ineffective if it is accompanied by a monetary expansion and wage increases as in (9.1), thus eliminating any real effects as claimed by Dornbusch [1988]. Thus, devaluation may lead to further devaluation if fiscal discipline is not exercised, if inflation is not controlled and if the balance of payments is not well managed. Second, poor, but abundant in unskilled labor, countries (e.g. Asian reexport processing countries, like Thailand) normally produce export goods with a relatively low local content or high import content. Devaluation may not significantly improve the current account because the import and export levels are highly correlated apart from inducing competitive devaluation from neighbour countries.[47] The net effect on (9.1) would virtually nullify each other. The higher the degree of a nation's reexport processing industry, the lower would be the impact of devaluation for current account improvement. Third, most evidence as gathered by Vries [1994] shows that a central bank's intervention in foreign exchange markets results in only temporary effects on the exchange rate as evidenced by the simultaneous equilibrium in (9.1), (9.2) and (9.3). The real effects may come from the central banks revealing its intended target concerning foreign exchange and other variables including interest rates. Notwithstanding, again the *creditability* of the central bank is the key factor of success in market intervention for currency stabilization. And a traditional IMF-style program would certainly enhance the credibility in time of economic crisis, but it does not guarantee the success. Finally, in intertemporal rational expectation world, the affect of austerity measures over economic agents behavior in future can not be overlooked. To redeploy resources for productivity enhancement and to ensure industrial

[47] Thank you Dr. Olarn Chaipravat very much for pointing this out to me. The high import content (i.e. about 70% of total sale) of high growth export items such as electronics, computer peripherals, electrical appliances, etc. are accounted more than half of total export in 1996 for Thailand.

restructure are very critical in South East Asian Countries, specifically Thailand after recent currency turmoil. This requires microeconomics measures (Hoontrakul 1997a, 1997b, Chaipravat and Hoontrakul 1999) rather than mere macroeconomics stability. These measures may, for instance, be to increase efficiency in market for corporate control, to provide incentive compatibility for industrialist, to avoid adverse selection for risk taking investors and to eliminate free rider problems for mismanagement.

5.5 Currency overshooting : fundamental or speculation

As stated previously, the "overshooting" in the exchange rate refers to a temporary overreaction of the nominal exchange rate before moving back toward the equilibrium value in the long run. There are at least three fundamental economic reasons for currency overshooting. First, in noisy rational expectation monetarist model in flexible goods price, economic agents who may possess *imperfect information* about *shocks* to money supply levels and *shocks* to the money growth target, may overreact in the currency market. Systematically biased forecast (ex post) of the forward exchange rate in post de facto devaluation currency after changing regime from fixed to float, for example, becomes a self-fulfilling prophecy for further devaluation. The obvious solution is for the central bank to provide more appropriate information and signal to the market in consistent manner. Second, the currency may be overshoot after it is first floated as the result of the *"sticky price"* of goods markets combined with instantaneous adjustment in asset market. The overall price level increases less than the money supply, leaving the demand for money lower than the supply. Consequently, the exchange would depreciate beyond its new equilibrium before returning to it. Third, after a long period of high inflation, when central bank can not consistently pursue corrective economic program, confusions are reigned in the financial market. The lack of sustain-

ability, *credibility* and confidence in government causes the political support to inevitably fall off. Thus, the currency chaos can be resulted in self-fulfilling perpetual currency depreciation belief resulting in hyperinflation period. Unless the credibility of the government can be found by perhaps strict fiscal austerity and remonetizated income policy, stabilization will not be found. The income policy may first to include temporary wage, price and even exchange rate freezing to focus on the supply side of inflation to complement the fiscal stabilization though this would be politically unpopular. In other words, to stop inflation someone must start offering cuts in either profit margin or real wages and protracted recession is inevitably. Then aggregate demand discipline should be followed by "monetary reform". Liberalizing financial market, privatizing state-owed enterprises, widening tax based collection and ending all the subsidies are among fine examples of monetary reform.

On the other hand, Shiller [1990] believes all economic models mentioned above have one major flaw - a gross oversimplification model. The key reason is all economic models assume that economic agents know the true state of economic structure and make rational decision for their consumption and investment. Shiller believes that the asset prices are speculative due to investor psychology; hence only *popular models*[48] are relevant. Moreover, the related papers by Welch [1992] and Banerjee [1992] assess rational herding, sequential decision and so-called *information cascades* where each investors takes into account the decision of previous decision makers

[48] Popular models are the models that used by the broad masses of economic actors to form their expectation. These are not systems of equations, as are economist's models. Popular models consists of qualitative descriptions of causes, anecdotes as suggestions of what may happen, and presumed correlations, cycles, or other simple patterns of variation of economic variables apart from influences in communications patterns, reactions lags, habits and social norms. See more discussion by Shiller [1991].

in his or her own choices, ignoring private information. These in turn create institutional herding similar to Froot et al. [1992] in short time horizon information acquisition. Nevertheless, Dornbusch [1997] contents currency speculation attack *per se* is *not* the cause of the currency crisis. It is the economic fundamental underlining the currency that causes the currency to depreciate or appreciate. Speculation is just an accelerator to the currency realignment at the faster rate to reach its fundamental equilibrium value[49]. The problem of Thailand currency debacle, Dornbusch adds, is *vulnerability*. Asset bubble and bust, very large current deficit, massive short term dollar debts and illusion of a strong reserve position are among the fine examples of preconditions for the speculative attack. This leads to full-scale financial crisis and forced "de facto" devaluation by changing currency regime from fixed to float. One lesson from this episode is to avoid vulnerability in the first place. This can only be done by having good macroeconomics management including financial deregulation and supervision, avoiding overvalue real exchange rate to achieve disinflation, lengthening the foreign capital maturity and plenty of transparency.

6. Conclusion

The objective of the paper is to provide a partial review on exchange rate theories and their macroeconomics policy implications. Conceptual frameworks and its brief history are presented for the better understanding of current foreign exchange movement. The aim is to elucidate rather than advocate any particular theory since no single theory explains conclusively how all possible factors can impact on foreign exchange rates.

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[49] I would like to thank Dr. Supachai Panitchapaki, Prof. Perrakis for the discussion on this point.

Purchasing Power Parity (PPP) is covered in the first section. Based on no arbitrage argument, PPP is *a flow model* of the "inflation theory of exchange rates" *vis-a-vis* the balance of trade. PPP becomes a linkage between the change in exchange rate and the differences between inflation rates. Despite of some difficulties (e.g. accurate price index, composite of goods basket, statistical procedures, etc.) in empirical testing on PPP, only relative PPP seems to hold in the long run. Shifts in technology, tastes, commercial policies or labor force growth will structurally change national *productivity* and hence will permanently change the real exchange rate. As the result, PPP is usually a benchmark currency valuation though PPP offers no explanation in short-term foreign exchange rate determination. Note that PPP is relevant to all exchange rate regimes. Under a *fixed* exchange rate countries cannot afford high inflation. While a "crawling" peg is suggested for gradual devaluation, it would have to be tried and evaluated to determine its real world impacts. Under a *floating* exchange rate excessive capital flow movement and speculation cause disequilibrium resulting in vast changes in inflation and frequent government intervention, rather than the desired stability based on fundamentals. And under a managed floating currency rate system much stability is sacrificed both in the exchange rates of currency and the prices of goods and services among countries.

As the modern financial theory were developing in early 1970's, partial equilibrium based on *arbitrage argument* have gained popularity for short run exchange rate theory. Modern asset views on foreign exchange rate determination under an important assumption of a flexible exchange rate are pursued in both Sections 3 and 4. Interested rate parity related theories are given in Section 3. Again the theories are based on partial equilibrium or no arbitrage argument. The covered interested rate parity (CIRP) states there will be no advantage to borrow or lend in one country's asset market rather in

that of another country. Many evidences support CIRP. CIRP becomes a major application for forward exchange rate pricing model. But different monetary policy, degree of risk aversion, political risks, barriers to capital mobility and market microstructure variations may cause persistent varying risk premia over time. Though uncovered interest parity, Fisher open and unbiasedness hypothesis are covered, these theories are not extensively emphasized because the lack of empirical evidences.

In Section 4, the first three monetary models are based on general IS/LM/Philip Curve type equilibrium which essentially assume a model of short run dynamic with a long run anchor of PPP. First, the Mundell-Fleming theory considers three markets: money, asset and goods markets under perfect *price flexibility* in long run. Marshall-Lerner conditions, J-curve effect and Harberger-Laursen-Metzler effect are presented. One implication is devaluation may lead to further devaluation if fiscal discipline, inflation and balance of payments are not well managed. Another is that the higher the degree of reexport processing industry the country has, the lower the impact of devaluation for current account improvement. Second, monetarist model concept implies that the exchange rate level is perfectly correlated with the level of the *relative money supply* in long run. In a *stationary,* economy, the relative money growth rate would be zero and the exchange rate expectation would play a trivial role. Postulated in an *inflationary and/or high growth* economy, this model explains why a foreign exchange rate market may be characterized by a *self-fulfilling prophecy.* When the money supply becomes *stochastic, rational expectation* and accuracy of market *information* play an important role in *intertemporal* analysis. Third is the Dornbusch's original "overshooting" or "sticky price" model. When a currency is devalued and the price of goods remains fixed for short run, but not in the long run, the currency value may "overshoot". *A balance of payment crisis,* extended from the model,

is the equilibrium outcome of maximizing behavior by rational agents faced with a fundamental *in*consistency between monetary and exchange rate policies. One implication can be in a *game-theoretic* perspective in policy implementation. In a non-cooperative and uncoordinated game with many players, each individual player has little information on other players' payoffs. There is no reason to believe everyone would act together to reach the desired outcome in a single step. Good government coordination as a signal to the financial market, becomes essential to achieve effective monetary policy for currency stabilization.

Portfolio-Balance approach is last examined in the third section of modern asset view on foreign exchange. This theory determines the exchange rate as *the relative price of money* in short run. The asset substitution effects and the nature of expectations formation places more emphasis on short run capital flows rather than the trade balance. In general, the short run impact of policies can be quite different from the long run impact, depending on the nature of the expectations. Exchange rates should implicitly behave like the behavior of asset prices in speculative markets.

The current thinking in post 1990's is on microeconomics foundation model paradigm in a highly idealized economy. These models are generally based on individual optimization problem with constraints under rational expectation model in open economy macroeconomics. The essential ingredient is the identification of national income as the saving of the households and government, investment and the current account surplus. When the world is *dynamic* and *stochastic,* individual rational expectation decision making may lead trade and relative price to different conclusion than the above models. It should be noted that this microeconomic model is a complement of, and not a substitute for the Monetary model as concluded by Stein and Paladino [1998].

Though none of the structural standard models is able to explain the short run dynamics of nominal exchange rate, some policy implications may be provided at the fourth sections. First, a *PPP-oriented exchange rate policy* tends to maintain the real exchange rate constant and stabilize demand in the same direction as obliging monetary policy. Since the quantity of money supply is increasingly difficult to measure, the policy makers are recommended to target the inflation rate of goods, services and asset prices rather than money supply. Second, excess asset-related credit creation in the *financial circulation* is shown to be responsible for asset prices boom (bust) and currency appreciation (depreciation). When asset price bubble bursts, excess asset-related credit creation must turn into bad debt that tends to cripple the banking system and create a credit crunch. Bank fragility is imminent; the currency depreciates dramatically; and hence international capital outflow outburst. Real economic activity is reduced and a long, drawn-out recession is likely. Third, Currency devaluation may lead to further devaluation if fiscal discipline is not exercised, if inflation is not controlled and if the balance of payments is not well managed. It is particularly noteworthy that the monetary model still dominates the empirical world, but the macro-structural models like Mundell-Fleming are still of interests in policy literatures despite of many deficiencies in theories.

Finally, Currency may temporarily *overshoot* its long run equilibrium value for at least three reasons. Foremost, it is due to *imperfect information* on the shock of money supply levels. The currency may next be overshoot after it is first floated as the result of the *"sticky price"* of goods markets combined with instantaneous adjustment in asset market. Last, but not least, the lack of sustainability, *credibility* and confidence in government causes the political support to inevitably fall off and rise the country risk premium. Thus, the currency chaos can be resulted in self-fulfilling perpetual currency depreciation belief resulting into hyperinflation period.

Appendix

WWW sites for a wealth of information and data

The WWW sites listed here offer a wealth of information about current international financial market conditions; recent data on exchange rates, interest rates, volatility and so forth;

Name of Website	WWW Address (http://)
Part 1. The International Financial System	
International Monetary Fund	www.imf.org
Organization for Economic Cooperation and Development	www.oecd.org
World Bank	www.worldbank.org
Bank of Canada	www.bank-banque-canada.ca
Bank of England	www.bankofengland.co.th
Bank of Japan	www.boj.go.jp
Bundesbank	www.bundesbank.de
Federal Reserve Board of Governors	www.bog.frb.fed.us
Links to central banks	www.bis.org/cbanks.htm
European Union	www.europa.eu.int/en/index.html
European Monetary Institute	www.europa.eu.int/emi/general

Part 2. Foreign Exchange Markets

Olsen and Associates	www.olsen.ch
Morgan Stanley & Co. Inc.	www.ms.com
Bloomberg Business News	www.bloomberg.com/bbn/index.html
Bloomberg Radio Feed	www.bloomberg.com/wbbr/index.html
Reuters Business Headlines on Yahoo	www.yahoo.com/headlines/business
Links to Governments' Statistical Servers	www.isds.duke.edu/sites/archive.html
European Economic Data from Europages	www.europages.com/business-into-en.html
Financial Time	www.ft.com
The Economist	www.economist.com
National Bureau of Economic Research	www.nber.org

Part 3. Offshore Markets

Euromoney World Link	www.emwl.com

Part 4. Derivatives: Futures, Options, and Swaps

Chicago Mercantile Exchange	www.cme.com
London Int'l Financial Future Exchange	www.liffe.com
MATIF	www.matif.fr
Singapore Int'l Financial Future Exchange	www.simex.com
Int'l Swap Dealers Association	www.isda.com

Part 5. International Asset Portfolios

Int'l Finance Corporation	www.ifc.org
IFC links to Emerging Markets Database	www.ifc.org/EMDB/EMDBHOME.htm
Links to International Stock Exchange	www.ft.com/hippocampus/c18e.htm
The Bank of New York Global Investing	www.bankofny.com/adr
BradyNet Home Page	www.bradynet.com

Part 6. Thailand and International Regulatory Issues

Bank for Int'l Settlements	www.bis.org
U.S. Securities and Exchange Commission	www.sec.gov
Financial Accounting Standards Board	www.fasb.org
Int'l Organization of Securities Commission	www.iosco.org
Bank of Thailand	www.bot.or.th
Security Exchange Commission of Thailand	www.sec.or.th
Security Exchange of Thailand	www.set.or.th

Other Address

Int'l Business Resources on the Web	www.ciber.bus.msu.edu/busres/statinfo.html
Economagic Database	www.economagic.com
Financial Data Finder	www.cob.ohio.state.edu/dept/finosudata.htm
Richard Levich, Stern School of Business	www.stern.nyu.edu/~rlevich
Ted Bos, Univ. of Alabama	www.bos.business.uab.edu

Source : Mostly from International Financial Markets: Price and Policies by Richard M. Levich (1999).

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