UNIVERSITI PUTRA MALAYSIA

NON-LINEARITY IN MONETARY MODELS OF EXCHANGE RATE IN FIVE ASEAN COUNTRIES

LIEW KHIM SEN

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By

LIEW KHIM SEN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

February 2008

To

my mother Lai Hon Moi,

my wife Princess Joy Aguilar Tiamting,

my brothers and sisters,

for all their love, encouragement, help and support.

To

my nephews and nieces,

my sons Lorenz Phil Liew and Earl Justin Liew,

for all the joyful moment they have spent with me.

Abstract of thesis presented to the Senate of University Putra Malaysia
in the fulfilment of the requirement for the degree of Doctor of Philosophy

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LIEW KHIM SEN

February 2008

Chairman: Ahmad Zubaidi Baharumshah, PhD

Faculty: Economics and Management

This study is a part of the research endeavor since 1970s in searching for a satisfactory exchange rate forecasting model. The main objective is to evaluate the forecast performance of the relevant monetary exchange rate models, which are determined by the linear and non-linear approaches. Particularly, the long-run cointegration relationship between yen-based currencies of five major South East Asian countries including Indonesia, Malaysia, Singapore, Thailand and the Philippines (collectively known as ASEAN-5) and their fundamentals are investigated using the carefully designed testing procedures that include integration order, cointegration and exogeneity tests. The set of potential exchange rate determinants including domestic and Japanese money supplies, aggregate output levels, aggregate price levels and interest rates are included in this study. In this respect, several versions of monetary exchange rate models are considered. The lately developed non-linear stationary and non-linear cointegration tests are also employed aiming to provide complementary if not improvement to the robustness of

conventional tests. Towards the end of this study, the valid monetary exchange rate models are estimated for the ultimate purpose of forecast performance evaluation.

The major finding of this study is that both the purchasing power parity model and the reduced form forward-looking monetary model can have excellence predictive power for the dynamic behaviour of yen-based ASEAN-5 nominal exchange rates, over forecast horizon of 24 months or less, based non-linear smooth transition regression (STR) modeling procedures. Hence, this study is able to provide evidence to contradict the assertion that empirical exchange rate models have weak predictive power at horizons less than two years (Lycons, 2002). Importantly, the empirical forecasting performance of non-linear STR modeling procedures is for the first time revealed in this study.

Besides, this study identifies that, as far as ASEAN-5 is concern, current and past values domestic money supply, domestic aggregate output, Japan money supply, Japan aggregate output are the main driving forces of the current exchange rate dynamic, in addition to the past values of exchange rates. Furthermore, this study uncovers that rather than the long-perceived linear and symmetrical behavior, the nominal exchange rates adjust towards monetary fundamentals in a non-linear and asymmetrical fashions with respect to appreciation and depreciation of exchange rates, inflation and deflation, expansionary and contractionary monetary policy, as well as the economic cycles of both domestic and Japan countries. Taken together, these findings have important impacts on policy-decision and implementations as pointed out in the last chapter of this study.

Abstrak tesis yang dikemukakan kepada Senat University Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KETAKLINEARAN DALAM MODEL MONETARI UNTUK KADAR PERTUKARAN ASING DALAM LIMA NEGARA ASEAN

Oleh

LIEW KHIM SEN

February 2008

Pengerusi: Ahmad Zubaidi Baharumshah, PhD

Fakulti: Ekonomi dan Pengurusan

Kajian ini merupakan sebahagian daripada usaha penyelidikan di dalam pencarian model ramalan kadar pertukaran asing yang memuaskan semenjak 1970an. Objektif utama kajian ini adalah untuk menilai prestasi ramalan model-model monetari kadar pertukaran asing, yang ditentukan dari perspektif linear dan tak linear. Khususnya, hubungan kointegrasi jangka panjang antara kadar pertukaran asing berdasarkan yen dan penentu-penentunya untuk lima negara utama Asian Tenggara iaitu Indonesia, Malaysia, Singapura, Negara Thai and Filipina (digelar ASEAN-5 keseluruhannya) dikaji dengan kaedah pengujian terpilih yang meliputi ujian peringkat integrasi, kointegrasi dan keeksogenan. Penentu kadar pertukaran asing yang berpotensi seperti penawaran wang, keluaran agregat, paras harga agregat dan kadar bunga domestic mahupun Jepun. Dalam kajian ini beberapa bentuk model monetari kadar pertukaran asing dipertimbangkan. Kaedah pengujian kepegunan dan kointegrasi yang terkini diguna sebagai ujian tambahan kepada ujian konvensional. Pada akhir kajian ini, model monetari kadar pertukaran asing yang didapati sah akan dianggarkan untuk tujuan muktlamat iaitu penilaian prestasi ramalan.

Penemuan utama kajian ini ialah model kuasa kesimbangan beli dan model monetary berpandangan hadapan berbentuk termudah mempunyai kuasa ramalan yang unggul untuk kelakuan dinamik kadar pertukaran asing ASEAN-5 berasaskan yen, untuk jangka ramalan selama 24 bulan atau kurang daripadanya, berdasarkan kepada kaedah tak linear iaitu regresi peralihan licin. Dengan itu, kajian ini dapat nmenunjukkan bukti untuk menafikan pendapat bahawa model empirik pertukaran asing tidak mempunyai kuasa ramalan sama sekali untuk jangka ramalan dua tahun atau kurang (Lycons, 2002). Pentingnya, prestasi ramalan bagi kaedah regresi peralihan licin adalah pada julung kalinya diketahui melalui kajian ini.

Selain daripada itu, kajian ini mengecamkan bahawa bagi ASEAN-5, nilai kini dan lepas untuk penawaran wang dan keluaran agregat domestik dan Jepun merupakan kuasa utama yang mempengaruhi pergerakan dinamik kadar pertukaran asing kini, selain daripada nilai lepas kadar pertukaran asing iti sendiri. Tambahan pula, kajian ini mendapati bahawa kadar pertukaran asing nominal menyeleras terhadap asas monetari secara tak linear dan tak simitri, bukannya linear dan simitri yang selama ini dijangkakan, terhadap penambahan dan kesusutan nilai kadar pertukaran asing, inflasi dan deflasi, polisi monetari yang mengembang dan menyusut, dan juga kitaran ekonomi negara domestik mahupun Jepun. Secara keseluruhan, penemuan-penemuan kajian in mendatangkan impak yang penting terhadap keputusan dan pelaksanaan polisi dan implementasi yang dikemukakan pada akhir bab kajian ini.

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Finally, this thesis would have never been completed if my late father, Liew Tou Ngam had not inculcated me the spirit of assiduousness ever since I was a school boy. I forever owe his soul a debt of gratitude.

I certify that an Examination Committee has met on February 29, 2008 to conduct the final examination of Liew Khim Sen on his Doctor of Philosophy thesis entitled "Non-Linearity in Monetary Models of Exchange Rate in Five ASEAN Countries" in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the degree of Doctor of Philosophy.

Members of the Examination Committee were as follows:

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Date: 28 April 2008

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Date: 8 May 2008

DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and it is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institution.

LIEW KHIM SEN

Date: 29 March 2008

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CHAPTER 1

INTRODUCTION

Exchange rate plays a very significant role in domestic and international economics. It serves as the key mechanism that links the macroeconomics of an open domestic economy to the rest of the world. In particular, international macroeconomic linkages take place through the goods and assets markets with exchange rates serving as the channel of transmissions. Besides, exchange rate also provides link to international microeconomics via resource allocation in the goods and assets markets. In the former case, allocation of resources in factor market occurs through trade competitiveness in which resources are drawn into traded goods sector from the non-traded goods sector. Conversely, international funds are channeled to economy which provides higher rate of return on foreign capital investment plus the percentage change in the exchange rate of the foreign currency as compared to other economies.

Due to the importance of exchange rates in the international linkages, it is not difficult to see that the microeconomic efficiency and the macroeconomic stability of an open market economy to a large extent rest on the movement of exchange rates. Movements or changes in exchange rates may, among others, affect an economy's balance of payments, net capital flow, foreign reserves and even the effectiveness of government policy. Certainly, being able to foresee future exchange rate movement can be of great help to the economic growth of an economy. Hence, forecasting and monitoring exchange rates are vital to central bankers and government policy decision makers. Besides, exchange

rate forecasting can be extremely useful and has been extensively used in financial decision-making. Multinational corporations, for instance, require exchange rates forecasts both in the short-tem and long-term because the sales, expenses, capital budgets, foreign investments, cash flows and the like for their operations in different countries, depend vitally on exchange rates. For international investors, the purchasing of foreign financial assets such as bonds and stocks involved foreign exchange risk as well since their net returns may shrink due to the downside exchange rate movement. For exporters and importers, international trade is very much dependent on exchange rates. Movements in exchange rates have significant impact on exports competitiveness. An appreciation of domestic currency or a depreciation of foreign currency may reduce export sales and therefore export revenue. For importers, depreciation in domestic currency or an appreciation in the foreign currency will increase the costs of imported goods and services. Sales may fall if they increase the selling prices, while profit margin may fall if they absorb the imported inflation. Thus, being able to forecast the exchange rates may help exporters and importers to enhance their trading activities and thereby profits. As for individuals, the budget for holiday of a traveler may vary when exchange rate changes. Even if you are staying at home, your choice of consumption and your living standard are very much affected by changes in exchange rates. Thus, understanding the past behavior of exchange rates and henceforth predicting the their future movements with satisfactory accuracy are crucial to international financial market participants such as central bankers, managers of multinational corporations and financial institutions, importers, exporters, foreign investors, speculators, arbitrageurs and even household units.

In general, it may be said that exchange rate forecasting is important because not only the current but also the future wealth of a nation, an organization or an individual will be affected by changes in exchange rates. Indeed, as a result of internationalization of business, liberalization of finance and trade as well as globalization of capital markets, coupled with the rapid advancement in the technology of money transfer, almost all issues on earth — the outlook of the world or domestic economy, the prospect of stock markets, the industrial competitiveness of a product or service, a firm or a country, the purchasing power of a consumer, the living standard of a citizen, …, and even the outcome of the next general election — have to revolve around the exchange rates. Therefore, there is no element of surprise in the fact that modeling and forecasting of exchange rates has received widespread attention in the literature ever since the collapse of the Bretton Woods fixed exchange rate system in March 1973. However, it is noteworthy that after many decades of research, there is a general consensus that reliable exchange rate forecasting model hardly exist to date. Motivated by the utmost importance of exchange rate forecasting and the urgently hunted satisfactory exchange rate forecasts, this study is devoted to the continuous effort in the literature in searching for reliable exchange rate forecasting procedures with enthusiastic spirit.

The rest of this chapter is outlined as follows: Sections 1.1 and 1.2 present the background of this study by offering a brief history of exchange rates development in general as well as an overview of the exchange rates of the countries undertaken by this study respectively[1]. Section 1.3 discusses the motivation of this study whereas the

[1] Understanding the history of these exchange rates may provide us some useful intuitive in the modeling and forecasting of exchange rates.

problem statement and objectives of this study are clarified in Section 1.4 and Section 1.5 respectively. Section 1.6 describes the importance of this study and a sketch on the plan of this study is provided in Section 1.7.

1.1 A Brief History of Exchange Rates Development[2]

Before the 20th century, most national currencies were backed by precious metal such as gold or silver although international transaction of currencies was not active yet. As transportation and storage technologies advanced resulting from industrial revolution, currencies transaction became more and more important because more and more transnational economic interactions and transactions were taking place. By 1930s, most major currencies had already been freely traded and were convertible into precious metal via the gold standard[3].

In 1933, U.S. abandoned the gold standard, and the convertibility of Dollars into gold was suspended as a consequent of the Great Depression[4]. Many large economic powers were also forced to abandon the gold standard (due to the depletion of gold reserves to shore up military expenses) soon after Europe entered World War II (1937 – 1945) in 1939.

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[2] This section is written based on Copeland (2005), Moosa (2005) and Weithers (2006), unless otherwise stated.

[3] Except Germany mark which was then no longer backed by gold. Mark had experienced tremendous depreciation (from 8 marks in 1919 fell to 4.2 trillion marks per USD in 1923) as a consequence of the hyperinflation (due to excessive expansion of money supply in Germany to consolidate reparations) resulting from World War I (1914 – 1919).

[4] With the world in the throe of the global depression, about one quarter of the U.S. work force was unemployed. In this period, money supply in U.S. fell significantly by one third from 1929 to 1933.

Towards the end of the war (July 1944), representatives from the Allied nations who gathered at Bretton Woods resolved to avoid the previous mistakes of past postwar settlements. Their main concerns were to reconstruct the European economies and prevent competitive devaluations and protectionism that had characterized the 1930s. The ultimate result of the meetings at the Bretton Woods Conference was the well-known Bretton Woods Agreement endorsed by the delegates of 44 countries. The most significant contribution of this agreement is the establishment of a fixed exchange rate system, known as the Bretton Woods System (1944 – 1968), in order to facilitate more stability to the new world economic order. Under this system, most of the major European currencies were pegged to the USD and the USD in turn was pegged to gold. The International Monetary Fund (IMF) was set up to police this fixed exchange rate system (and granting loans to deal with balance of payments difficulties), whereby the countries involved helped to maintain convertibility and to facilitate these pegs within a ± 1% bands. Periodic revaluations (new fixed rates or parities) were allowed with the permission of the IMF whenever obvious evidence of international trade imbalances appeared. The International Bank of Reconstruction and Development (later emerged as the World Bank), which specialized in granting loans for reconstruction and development and was also set up under this agreement.

The Bretton Woods System worked quite well for more than 2 decades, before its credibility was seriously challenged in the late 1960s. During this era, changes in the major parities were very few and relatively small in scale. However, in 1967, the British pound was attacked and the central bank intervention through currency market operations

failed for the first time, leading to a decline in the value of British pound. More acutely, in the following year, the USD was also weakened relative to other currencies resulting from the increasing money supply through printing press, in order to finance the Vietnam War, in which the U.S. was deeply involved. As U.S. anchored the system as a whole, the declination of USD coupled with the falling competitiveness of U.S. trade and the rising of the deutschmark and yen due to the recovery of economy (Germany and Japan, as trade surplus countries, resisted to revalue their currencies) eventually insolvent the fixed exchange rate system. In the late 1960s, national inflation rates began to diverge and inconsistencies and incompatible macroeconomic policies in the major industrial countries became increasingly obvious. The option for floating exchange rate appeared to be more and more appealing. The system finally broke down on 15 August 1971 when U.S. suspended gold convertibility. In mid-1972, Britain ceased to support the fixed parity by allowing market forces to determine the pound exchange rates. This was followed by Japan and Italy which allowed their currency to float soon after the dollar was devalued by 10% in February 1973.

By 1973, floating exchange rate era had effectively begun, when foreign exchange markets opened on 19 March. The floating exchange rate era, however, was only stable for the beginning until the mid-1970s. After that, floating rates then became extremely volatile, with massive short-term fluctuations and obvious yet persistent longer run misalignment (relative to fundamentals) of all the major currencies including the USD. The major features of the floating exchange rate era include the U.S. twin deficits by the

end of 1980s, two massive OPEC oil price hikes[5], deepening of international debt crisis and global scale debt insolvency in the early 1980s, the world stock market clash in 1987, the rising of Japan in the mid-1980s as the world's largest trading nation and the declining role played by U.S. in the world markets, the rising of the other Asian economies[6] due to their spectacular blooming in the economic growth and overwhelming (overheated) stock market performance in the early to mid-1990s, and a series of exchange rate and stock market crashes in Asia in the1997 - 1998. All in all, these features sum up to reveal that floating exchange rates have failed to deliver tranquility but instead have brought intolerable levels of volatility.

The world of free international capital movements brought about by technology advancement in electronic trading systems (Electronic Brokering System, introduced in 1993) does not favor the fixed exchange rate regime either. This could be obviously observed from the failure of European Monetary System (EMS) (1979 – 1993). EMS was established by European Economic Community (EEC) which realized the need to maintain for some stability in the European currencies relative to one another then. The member countries arranged the Exchange Rate Mechanism (ERM), in which the values of their currencies were fixed against one another, along with tight bands ($\pm$ 2.25% range, except lira, $\pm$ 6%) of fluctuation, through the support of the European central banks. Effectively, the central exchange rate franc/deutschmark (other currencies were relatively minor) was kept stable by capital controls in France. ERM experienced few pressure

[5] One occurred in 1973-1974, which led to accelerated inflation, and another one happened in 1979, which led to a short sharp recession in U.S. and a more prolonged slump in Europe, and a steeply falling price in the 1980s.

[6] They were Hong Kong, Singapore, South Korea, Taiwan (collectively known as Asian Four Dragons), Malaysia, Indonesia, the Philippines, Thailand (Four Asian Tigers) and China.

since its establishment — worldwide recession that eventually led to the devaluations of franc from 1981 through 1983, the 25% devaluation of USD with respect to major European currencies in 1986, and the 1992 massive speculative pressure on (Quantum Fund of George Soros took a large short position in) the British pound and Italian lira[7], and the burden of high interest rates of EMS countries due to rapidly growing budget deficits of Germany in the early 1990s — until French eventually gave up in defending the depreciation of franc against the German mark[8], and henceforth the collapse of EMS in 1993. In 1993, the European Monetary Union (EMU), which had replaced EEC under the Maastricht Treaty in December 1991, widened the tight bands to ± 15%, rendering European currencies effectively floating.

Nevertheless, that was not the end of the story, because EMU was working towards transforming the European countries into a full monetary union with a single currency, since the 1991 Maastricht Treaty. Subsequently, the common currency, euro finally was introduced for trading (but not in physical form) on 1 January 1999 under the administration of the European Central Bank (ECB). Euro was introduced at a value of USD1.18 per euro and the other currencies[9, 10] were fixed irrevocably at one for one with respect to euro. Euro came into existence in physical from of notes and coins in January

[7] The attempt by Bank of England to defend the pound within the ERM prescribed band using, market intervention and interests was ineffective, lira suffered a similar fate.
[8] At that time, mark appreciated against other currencies due to upwards pressure on German interest rates to attract funds for reunification.
[9] Currencies of the 11 founding members: Germany, Italy, France, Spain, Portugal, Ireland, Belgium, Netherlands, Luxembourg, Austria and Finland.
[10] Greece, which was denied membership based on convergence criteria, later joint on the 1 January 2001. The other three EMU members, namely Denmark, Sweden and UK decided not to participate and were granted the right to temporally opt out of the union.