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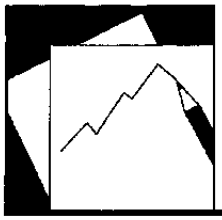

IMF Working Paper

Characterizing Exchange Rate Regimes in Post-Crisis East Asia

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Characterizing Exchange Rate Regimes in Post-Crisis East Asia

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Abstract

This paper examines the behavior of the exchange rates of selected emerging market East Asian economies in the aftermath of the Asian crisis. The results suggest that movements in the Asia-5 currencies (Indonesia, Korea, Malaysia, Philippines, and Thailand) were significantly influenced by the U.S. dollar's day-to-day movements before the crisis, and have indeed continued to do so post-crisis. However, comparisons with a range of other currencies suggest that this is a fairly common trait across various regimes. Moreover, results from the post-crisis data do not support the view that the Asia-5 currencies presently have the same characteristics as they did before the crisis.

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I. INTRODUCTION

More than four years after the onset of the Asian crisis, the characteristics of the exchange rate regimes of the Asia-5 (Indonesia, Malaysia, Korea, the Philippines, and Thailand) countries—before and after the crisis—remain a topic of considerable discussion. Recent recommendations have pointed toward a need for free floating rates in emerging market economies in general and in East Asia in particular. Mussa et. al. (2000), for example, argue that given the current international financial conditions, tight management of exchange rates that lead to limited exchange rate volatility in normal times can foster complacency with regards to exchange rate risk. They conclude—

> "Thus, for emerging market countries that cannot or choose not to undertake the very strict regimen necessary to sustain pegged exchange rate regimes in an environment of international capital mobility, it is essential that floating exchange rates really do float."[2]

After going through steep devaluations and high volatility in 1997–98, the currencies of the region have mostly stabilized over the past couple of years. Some observers, however, have interpreted this stability as evidence that the East Asian currencies are reverting back to *de facto* pegs against the U.S. dollar. In the context of the Asia-5, McKinnon (2000) argues that the so-called floating exchange regimes of the countries—barring Malaysia, which maintains a peg—are not really floating. Using a regression framework from Frankel and Wei (1994) on exchange rate data from January 1999 to May 2000, McKinnon argues that the evidence points toward a case of high-frequency pegging in Indonesia, Korea, the Philippines, and Thailand. He contends—

> "In the year 2000, both the crisis and non-crisis countries of East Asia (with Japan remaining the important exception) have returned to formal or informal dollar pegging, which is statistically indistinguishable from what they were doing before the crisis."

The prospect of a return of the dollar peg among the Asia-5 countries leads to concerns of fragility buildup through reduced incentive for exchange rate risk management, as well as real exchange rate misalignment. However, a critical and close scrutiny of the data is warranted before the characteristics of the exchange rate regimes in the concerned countries are branded as similar to that of pegged exchanged rates, especially the type that existed before the crisis. Hernández and Montiel (2001) examine the post-crisis exchange rate behavior of the Asia-5 currencies, and their results suggest that the currency regimes of

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[2] Empirical evidence, however, suggests that many countries that say they allow their exchange rates to float in fact intervene from time to time. Calvo and Reinhart (2000) find that among the countries that are classified as free floats, observed exchange rate variability is quite low relative to more committed floaters such as the U.S.

Korea and Thailand have moved in the direction of greater flexibility, but not to the extreme pole of clean floating. They assign lesser weight to their findings with respect to Indonesia and the Philippines, but nevertheless suggest that those two currencies have also become more flexible when compared to the pre-crisis period. With regard to policy implications, they conclude that countries that are not prepared to accept the constraints of a hard peg, a managed float designed to accumulate reserves and resist real appreciation could be preferable in some conditions over the polar extreme of free floating.

This paper is concerned with the questions regarding the methodology of characterizing exchange rate regimes in post-crisis East Asia. What are the appropriate benchmarks to compare the characteristics of exchange rates? What are the empirical pitfalls of dealing with the relevant data, especially given that exchange rate intervention can be unobservable and there can be considerable uncertainty about the authorities' reaction function? Are there any shortcomings in the standard statistical tests that are traditionally used to examine if an exchange rate is pegged? How can distinctions be made between pegging and "smoothing," and is such distinction meaningful?[3] And finally, is the post-crisis behavior of the exchange rates of the four countries concerned clearly indistinguishable from the pre-crisis behavior? Has there really been a return of the dollar standard in these countries?

The rest of the paper is organized as follows—Sections II and III describe the data and methodology. Section IV compares exchange rates, reserves, and interest rate volatility across the pre-crisis, crisis, and post-crisis periods of the selected East Asian exchange rates against a control group, representing various currency regimes from the industrial and emerging economies. Section V describes the construction of an indicator of exchange rate flexibility, which is examined across the three periods for the selected exchange rates. In Section VI, regressions are carried out across various data frequencies to test for the evidence of a dollar peg. Finally, in Section VII, properties of exchange rate data from the countries concerned are examined for evidence of pegging and/or smoothing. Section VIII contains some concluding remarks.

The results suggest that the Asia-5 currencies assigned statistically significant and large weights to the dollar on their day-to-day movements before the crisis, and have indeed continued to do so post-crisis. However, comparisons with a range of other currencies show that this is a fairly common trait across various regimes. Moreover, results from the post-crisis data do not support the view that the Asia-5 currencies have fully reverted to behavior that is statistically indistinguishable from pre-crisis characteristics.

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[3] Smoothing would entail the authorities displaying a tendency to resist large day-to-day movements, but at the same time allowing the exchange rate's trend movement over a medium-term horizon.

II. Data

The data requirements for this paper are simple. Four variables—exchange rate, interest rate (overnight money market rates), international reserves, and reserve/base money series—are used for the countries in the sample. The daily exchange rate data was extracted from Bloomberg, whereas the rest of the data (in monthly frequency) were obtained from the International Financial Statistics database. The sample includes the Asia-5 countries, ten selected countries with free floats, and nine other countries from emerging market economies with varying regime history.[4]

III. Methodology

In order to discern regime-specific behavior, the exchange rate characteristics of the Asia-5 countries are compared against the two control groups described above. Changes in the observations over time within the country in question are also analyzed to track regime switches. A similar exercise is carried out for interest rates and reserves. The exchange rate flexibility indicator, described in Section V, combines the information extracted from exchange rates, reserves, and base money, and is estimated for each year within the 1995–2000 sample. The results complement the ones obtained in Section IV, and allow for a better comparison across and within regimes.

The question of to what extent the Asia-5 countries have tracked the dollar through the sample period is explored in section VI through a country-by-country regression analysis and two hypothesis tests of coefficient stability. The approach involves using an independent currency as an arbitrary numéraire for measuring exchange rate variation against the U.S. dollar, Japanese yen, and German mark. The robustness of the results is tested by using two numéraires—the Swiss franc, which has been used in several recent studies, and the British pound. The coefficient tests are for the two hypotheses—if the dollar coefficient is statistically indistinguishable from one (implying a peg type behavior), and if the dollar coefficient in 1999 and 2000 for each currency is equal to the respective coefficient estimate in 1996.[5]

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[4] The group of rates that are under the sub-heading floating includes exchange rate regimes that have been classified by the IMF as being independent floats throughout the 1995–2000 sample period. They are: Australia, Canada, Germany, Japan, Mexico, New Zealand, South Africa, Sweden, Switzerland, and U.K. The group of emerging market economies with "other" regimes (during a portion of or throughout 1995–2000) include: Brazil, Chile, Czech Republic, Hungary, India, Israel, Poland, Singapore, and Turkey.

[5] The latter test examines if the currencies' behaviors are statistically differently from during the pre-Asia crisis period.

Section VII examines the exchange rate behavior of Indonesia, Korea, the Philippines, and Thailand by testing the currencies' respective residuals from a random walk regression. The residuals are tested for normality (which would tend to imply an exchange rate without any intervention), and their various properties are examined for the evidence of pegging or smoothing.

IV. Volatility Comparison

A. Exchange Rate Volatility

We begin by looking at the volatility of exchange rates, defined as the standard deviation of the percentage changes of the exchange rates against the U.S dollar. Using daily and monthly data respectively, Tables 1A and 1B illustrate annual estimates of exchange rate volatility between 1995 and 2000. For ease of exposition, the tables group the Asia-5, a selection of floating exchange rates (mostly from developed markets), and a selection other rates from emerging markets separately.

The extreme swings experienced by the Asia-5 countries during the 1997/98 crisis are clearly reflected in Tables 1A and 1B and Figure 1, with volatility jumping 10–20 times compared to the pre-crisis period of 1995/96. Of course, the very large increases in crisis period volatility estimates appear more dramatic due to the extremely low pre-crisis volatility among the concerned currencies, when they were all managed heavily to track the U.S. dollar—i.e. the exchange rates were pegged *de facto*. The spike in volatility in 1997/98 among the Asia-5, however, was not an isolated incident. The spillover from the Asian crisis (as well as the subsequent Russian crisis in 1998) is clearly evident among the estimates from the rest of the sample. Currencies with significant Asia-5 exposure, regardless of regime affiliation, also came under pressure, with volatility jumping in Australia, New Zealand, and Singapore.[6] Contagion from the crisis also spread, and was reflected in the exchange rate volatility of Mexico, South Africa, and the Czech Republic. Nevertheless, the magnitude of volatility of the Asia-5 was far above than those in the rest of the sample.

The volatility estimates for 1999 and 2000 highlight the key exchange related developments in Asia-5—Malaysia's nominal fixing of the rate against the U.S. dollar, continued turbulence with the Indonesian rupiah (at a somewhat lower level than in 1997/98, but still over 10 times than seen in 1995/96), and a marked return to stability for the currencies of Korea, the Philippines, and Thailand (although they remained substantially more volatile than during the pre-crisis period). Among the latter three countries, exchange rates of Korea and Thailand showed a further decline in volatility from 1999 to 2000, whereas the exchange rate of the Philippines became more volatile in 2000.

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[6] See Figures 2A, 2B, 3A, and 3B.

Table 1A. Exchange Rate Volatility: 1995-2000

Standard deviation of daily movements (percentage changes) against the U.S. dollar

	1995	1996	1997	1998	1999	2000
Asia 5						
Indonesia	0.15	0.15	2.49	4.86	1.88	1.05
Korea	0.25	0.23	2.65	1.75	0.48	0.42
Philippines	0.28	0.05	1.31	1.19	0.45	0.58
Thailand	0.12	0.08	1.71	1.58	0.56	0.45
Average	0.20	0.13	2.04	2.34	0.84	0.62
Malaysia	0.23	0.15	0.90	1.75	0.01	0.01
Independent Floats 1/						
Australia	0.53	0.40	0.60	0.84	0.58	0.76
Canada	0.35	0.20	0.27	0.38	0.35	0.33
Germany	0.79	0.41	0.62	0.56	0.60	0.77
Japan	0.90	0.48	0.75	1.08	0.83	0.63
Mexico	2.37	0.34	0.66	0.66	0.59	0.47
New Zealand	0.38	0.37	0.53	0.89	0.64	0.86
South Africa	0.27	0.69	0.31	1.14	0.63	0.60
Sweden	0.72	0.48	0.63	0.70	0.57	0.76
Switzerland	0.92	0.53	0.69	0.65	0.65	0.73
U.K.	0.57	0.38	0.52	0.46	0.44	0.57
Average	0.78	0.43	0.56	0.74	0.59	0.65
Others						
Brazil	0.40	0.09	0.09	0.08	1.72	0.48
Chile	0.48	0.19	0.24	0.44	0.38	0.37
Czech Rep.	0.59	0.35	0.96	0.88	0.63	0.74
Hungary	0.76	0.42	0.43	0.46	0.45	0.75
India	0.37	0.43	0.27	0.39	0.11	0.17
Israel	0.22	0.31	0.34	0.61	0.42	0.41
Poland	0.66	0.25	0.57	0.72	0.60	0.68
Singapore	0.32	0.18	0.42	0.81	0.30	0.23
Turkey	0.60	0.55	0.41	0.39	0.39	0.37

1/ Countries that have been classified by the IMF as having independently floating exchange rate regimes throughout the sample period.

Table 1B. Exchange Rate Volatility: 1995-2000

Standard deviation of monthly movements (percentage changes) against the U.S. dollar

	1995	1996	1997	1998	1999	2000
Asia 5						
Indonesia	0.51	0.65	11.25	32.66	10.25	3.85
Korea	1.06	0.93	10.06	7.49	2.86	2.44
Philippines	1.50	0.09	5.09	4.85	1.83	3.44
Thailand	0.59	0.34	8.45	8.93	3.08	2.18
Average	0.91	0.50	8.71	13.48	4.50	2.97
Malaysia	1.06	0.61	4.48	7.21	0.01	0.01
Independent Floats						
Australia	1.84	1.84	2.00	3.73	2.53	3.55
Canada	1.22	0.88	1.13	1.79	1.64	1.35
Germany	3.25	2.05	2.92	2.06	2.03	3.70
Japan	4.89	2.04	3.84	6.30	2.60	3.44
Mexico	6.93	2.49	2.66	3.56	2.71	2.44
New Zealand	1.73	0.97	2.13	2.95	2.44	4.35
South Africa	1.06	0.25	1.74	3.39	1.60	1.03
Sweden	2.34	1.97	2.89	2.25	2.47	2.97
Switzerland	3.72	2.76	3.33	2.58	2.16	3.61
U.K.	1.75	1.88	2.62	1.77	1.81	2.40
Average	2.87	1.71	2.53	3.04	2.20	2.89
Others						
Brazil	1.49	0.11	0.12	0.17	16.71	2.21
Chile	2.60	0.80	1.38	1.57	2.69	1.89
Czech Rep.	2.03	2.00	2.77	4.44	3.35	3.66
Hungary	2.14	1.43	2.07	2.01	1.81	3.69
India	1.81	1.99	2.08	1.53	0.47	0.77
Israel	1.09	1.81	2.01	3.26	1.67	1.77
Poland	1.84	1.14	2.02	3.92	2.88	3.91
Singapore	1.01	3.04	1.70	5.59	2.11	2.24
Turkey	2.75	1.52	1.33	1.79	1.46	1.62

Table 2. Interest Rate Volatility: 1995-2000 1/

	1995	1996	1997	1998	1999	2000
Asia 5						
Indonesia	1.28	1.17	15.60	14.75	4.06	0.88
Korea	1.16	1.30	2.27	1.99	0.29	0.08
Philippines	2.36	0.52	4.87	0.70	0.38	0.77
Thailand	2.53	1.84	5.54	4.76	0.35	0.41
Average	1.83	1.21	7.07	5.55	1.27	0.53
Malaysia	0.13	0.34	2.45	1.12	0.48	0.06
Independent Floats 1/						
Australia	0.16	0.20	0.16	0.07	0.07	0.16
Canada	0.63	0.21	0.24	0.37	0.10	0.16
Germany	0.10	0.15	0.10	0.10	0.17	0.11
Japan	0.20	0.02	0.03	0.05	0.04	0.05
Mexico	17.21	4.14	2.23	5.19	2.01	1.36
New Zealand	0.33	0.43	0.53	0.82	0.25	0.15
South Africa	0.29	0.72	0.42	1.59	0.40	0.19
Sweden	0.15	0.17	0.06	0.13	0.12	0.11
Switzerland	0.41	0.43	0.37	0.26	0.18	0.36
U.K.	0.49	0.22	0.19	0.37	0.82	0.91
Average	2.00	0.67	0.43	0.89	0.42	0.36
Others						
Brazil	6.80	1.27	6.26	6.20	4.55	0.34
Chile	3.40	2.30	3.35	6.35	2.42	1.74
Czech Rep.	NA	0.59	0.98	1.61	1.21	0.44
Hungary	0.87	0.56	0.33	0.40	0.45	0.56
India	8.57	6.75	3.00	5.55	1.92	1.72
Israel	0.62	0.73	0.42	1.18	0.24	0.16
Poland	1.78	1.56	2.60	1.68	2.14	0.81
Singapore	0.73	0.39	1.09	1.19	0.42	0.24
Turkey	13.15	8.41	5.18	8.70	2.10	32.93

1/ Standard deviation of differences in interest rates.

Table 3. Reserves Volatility. 1995-2000 1/

	1995	1996	1997	1998	1999	2000
Asia 5						
Indonesia	1.58	3.58	4.79	6.45	2.39	7.58
Korea	2.78	3.77	8.50	4.97	1.90	1.60
Philippines	5.57	3.69	7.53	6.13	3.16	4.62
Thailand	2.52	1.40	9.18	4.17	2.10	2.12
Average	3.11	3.11	7.50	5.43	2.39	3.98
Malaysia	2.64	2.72	6.06	4.55	3.36	2.82
Independent Floats 1/						
Australia	4.88	10.32	3.45	6.21	7.63	11.01
Canada	4.96	4.42	7.66	10.50	4.21	2.27
Germany	1.21	1.47	1.27	4.29	5.96	3.90
Japan	3.92	2.39	1.17	2.62	3.27	2.41
Mexico	30.40	4.12	3.91	3.65	1.18	4.31
New Zealand	4.78	7.94	8.68	3.68	7.45	3.97
South Africa	19.88	21.04	17.91	7.04	4.52	1.81
Sweden	4.45	9.39	10.12	10.42	5.77	4.16
Switzerland	6.21	5.90	4.08	5.15	3.53	4.62
U.K.	2.09	5.37	3.30	2.81	4.82	6.62
Average	8.28	7.24	6.16	5.64	4.83	4.51
Others						
Brazil	9.09	2.07	5.64	14.19	12.28	10.35
Chile	2.81	3.12	2.67	3.39	4.11	1.92
Czech Rep.	3.36	2.72	5.47	3.24	3.35	2.97
Hungary	9.58	4.70	4.28	5.03	4.18	4.21
India	3.11	3.49	4.92	3.63	1.87	4.23
Israel	7.11	6.17	4.05	2.36	2.14	2.35
Poland	4.22	3.14	2.36	4.45	2.94	1.71
Singapore	1.73	0.64	2.10	4.19	2.04	1.47
Turkey	11.39	5.37	5.66	7.53	3.45	7.17

1/ Standard deviation of percentage change in reserves.

The volatility of the floating exchange rates (in dollar terms), namely Japan and the countries in the sample outside of Asia (Germany, Sweden, Switzerland, and the U.K.), has been roughly unchanged or slightly decreasing since 1995, although a few countries with exposure to the financial crises in the late 1990s had sporadic episodes of increased volatility. While they were relatively stable, the magnitude of the floating currencies' volatility estimates were in general greater than the post-crisis Asia-5 estimates (with the exception of Indonesia).

B. Interest Rate Volatility

Exchange rate volatility alone may not be sufficient to characterize the exchange rate regime, as this statistic does not account for the extent to which the authorities have targeted the rate through monetary policy and intervention in the foreign exchange market. Thus, two currencies with comparable standard deviations could conceivably represent two contrasting regimes—one could be a stable free-float, the other a dirty float kept in check through interest rates changes or foreign exchange market transactions. Tables 2 and 3 address this issue by looking at the volatility of interest rates (standard deviation of interest rate differences) and reserves (standard deviation of monthly growth rates) during 1995–2000.

The interest rates of the Asia-5 countries, barring Malaysia, are seen to be substantially more volatile than the group of floating countries in the pre-crisis period. This is consistent with the experience of regimes with exchange rate as a nominal anchor, as capital flow related volatility is reflected somewhere else in the economy. Among other countries in the sample, as expected, interest rate volatility in the countries with managed floats or crawling pegs was comparable or more than the Asia-5 countries, which in turn was substantially more than the countries with floating rates.

Coinciding with the severe exchange rate pressure episodes in 1997/98, interest rate volatility is seen to have increased dramatically among the Asia-5, doubling in the case of Korea to over ten times in Indonesia. Among the floaters, New Zealand and South Africa, the countries that were impacted by the crises, show increases in interest volatility as well.[7] The same is seen in Brazil, Chile, Czech Republic, and Singapore.

The post-crisis estimates reveal a marked decrease in interest rate volatility in the Asia-5 economies. By 2000, for all of the Asia-5 countries, the standard deviations of interest rates were not only lower than the crises period, they were even lower than in 1995. Among the floating rate countries, virtually no change in interest rate behavior is noticeable, whereas in the other countries a clear pattern to reduced volatility is seen. Overall, across the time period

[7] Australia stands out as an exception, with no discernible changes in interest rate volatility, with the market pressure evidently passing through the exchange rate.

of 1995–2000, with the crises years as exceptions, a broad trend in declining interest rate volatility is seen for the entire sample.[8]

C. Reserves Volatility

With respect to reserves, the volatility for the Asia-5 jumped as expected during the crisis years as a result of the exchange rate defense and capital outflows (see Table 3). However, the crisis period volatility estimates are comparable or lower than the floating rate sample average. In the post-crisis period of 1999/2000, reserves volatility followed a declining pattern in Korea, Malaysia, and Thailand, whereas both Indonesia and the Philippines saw a decrease in volatility in 1999, only to have it reversed in 2000.[9] Among the Asia-5 countries, Korea's reserves volatility decreased the most.

Among the "other," nonfloating group in the sample, the volatility estimates illustrate the turbulence in Brazil and Turkey, as well as increasing stability seen in the economies of Chile, Czech Republic, Hungary, Israel, Poland, and Singapore in 1999/2000. These observations echo the interest rate volatility estimates.

The reserves figures presented are subject to two caveats. First, fluctuations in reserves can reflect valuation adjustments, debt repayments, and other factors that do not necessarily represent foreign exchange market intervention. Second, forward market intervention, which is common in some of the countries in the sample, is not fully captured by the gross reserves figures. Spot market interventions show up in the central bank's balance sheet immediately, whereas forward market interventions remain off-balance sheet, unless fully unwound at a future date.[10]

Notwithstanding the caveats, the results from this section suggest that while there has been a broad return to stability since the crises, not all Asia-5 countries have followed similar paths. Overall, Korea and Thailand appear to have normalized the most, with sharp reductions in interest rate and reserves volatility, although exchange rate volatility remains higher than in the pre-crisis period. The Philippines have also seen substantial relative change in the

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[8] A notable exception is of course Turkey, which was embroiled in a major—yet strikingly local in its fallout—financial crisis in 2000.

[9] In Indonesia's case in particular, the reserves volatility in 2000 was the highest in the 1995-2000 period.

[10] For example, Australia, which sometimes intervenes in the forward market to manage its exchange rate, comes across periodically with comparable or even less reserves volatility than New Zealand, which has not intervened in the foreign exchange market during this period. Forward market intervention was also common among the East Asian economies during the crisis, and continues to remain so in some cases.

volatility of the three variables in question, although there are indications of some increased turbulence by end-2000. Indonesia appears to be lagging in its path to stability, while Malaysia, by virtue of capital controls and a fixing of its exchange rate, appear to have tempered the market volatilities, at least by the benchmarks used in this section.

V. Exchange Rate Flexibility

Exchange rate or reserves movements, in isolation, offer a partial picture of an exchange rate regime. However, they can be combined to produce a more informative indicator of exchange rate flexibility to be used to analyze further exchange rate regime behavior. In this section, we follow the methodology used in Glick and Wihlborg (1997) and Bayoumi and Eichengreen (1998) to create an index of exchange market flexibility.

The flexibility index is constructed by dividing the standard deviation of exchange rate movements by a measure of exchange market pressure, which in turn is a function of reserves volatility, scaled by base money. The precise formula for the index is—

$$Index = \frac{SDEX}{(SDEX + SDREV)}$$

where,

SDEX: standard deviation of exchange rate changes (log difference),
SDREV: standard deviation of the ratio of changes in reserves, divided by lagged stock of base money.

By construction, the index ranges from 0.00 to 1.00, with the lower values indicating relative inflexibility of the exchange rate.

The index is calculated for each country for the years 1995–2000. For ease of exposition, Table 4A summarizes the Asia-5 results, and Table 4B breaks down the rest of the sample by the latest IMF classification of exchange rate regimes.

The index tracks the pre-crisis lack of exchange rate flexibility of the Asia-5 rather well, and the 1997/98 spike in the index illustrate the crisis-related developments. The post-crisis figures are broadly consistent with the findings in the pervious section—for Korea, the Philippines, and Thailand, the exchange rates have become somewhat less flexible from 1997/98 levels, but they remain consistently more flexible than during the pre-crisis years. Malaysia's regime has become completely inflexible, and Indonesia's exchange rate volatility is overwhelmed by its jump in reserves volatility in 2000, thus leading to a lower index value, indicating lower flexibility.

Table 4A. Exchange Rate Flexibility: 1995-2000 1/
Asia 5

	IMF Exchange Rate Regime Classification 2/	1995	1996	1997	1998	1999	2000
Indonesia 3/	*Independent float*	0.03	0.09	0.28	0.42	0.62	0.13
Korea 4/	*Independent float*	0.30	0.19	0.44	0.50	0.31	0.30
Malaysia 5/	*fixed peg*	0.22	0.16	0.49	0.49	0.00	0.00
Philippines	*Independent float*	0.26	0.03	0.42	0.42	0.31	0.33
Thailand 6/	*Independent float*	0.09	0.09	0.31	0.50	0.41	0.38

1/ Calculated as SDEX/(SDEX+SDREV), where SDEX is the standard deviation of log differences of exchange rate against the U.S. dollar, and SDREV is the standard deviation of the changes in the central bank's reserves divided by lagged stock of base money.
2/ Based on *International Financial Statistics,* International Monetary Fund, June 2001.
3/ Moved from managed float to independent float: August 1997.
4/ Moved from managed float to independent float: December 1997.
5/ Moved from managed float to fixed peg: September 1998.
6/ Moved from fixed peg to independent float: July 1997.

The results summarized in Table 4B reveal salient features of the other regimes. The floating rate regimes come across with relatively high flexibility in all periods, whereas the figures from the other regimes indicate a broad trend toward increased flexibility in recent years. While in general, during the post-crisis period, the Asia-5 currencies appear somewhat less flexible than the sample of other floating currencies, it is noteworthy that one cannot readily discern between various regimes using the above index alone. As evident from the index figures for the floating and other regimes, data and regime-specific idiosyncrasies can lead to difficulties in making cross-country comparisons. The index is susceptible to the same caveats raised about reserves figures in Section IV.C. This would partly explain why Australia and Canada score relatively low in the index, while India scores exceptionally high in 1995/96.

The index can however be additionally useful in within country analysis through examining the changes in the index over years. In this regard, the developments of the Asia-5 currencies can be followed readily, as described earlier. Moreover, the various regime switches that take place among some of the exchange rates in the sample are also picked by the index (Table 4B).

VI. Peg to the Dollar?

The analysis of the previous two sections suggest that there has been a post-crisis decrease in exchange rate volatility, as well as flexibility, among the Asia-5. However, the analysis also highlight that the greater relative stability of the regional currencies does not necessarily

Table 4B. Exchange Rate Flexibility: 1995-2000 1/

	IMF Exchange Rate Regime Classification 2/	1995	1996	1997	1998	1999	2000
Australia	*Independent float*	0.36	0.21	0.54	0.46	0.27	0.27
Canada	*Independent float*	0.27	0.22	0.15	0.16	0.28	0.34
Japan	*Independent float*	0.81	0.67	0.86	0.83	0.63	0.76
Mexico	*Independent float*	0.20	0.26	0.29	0.33	0.62	0.28
New Zealand	*Independent float*	0.19	0.05	0.12	0.40	0.25	0.61
S. Africa	*Independent float*	0.77	0.80	0.71	0.53	0.50	0.45
Sweden	*Independent float*	0.36	0.16	0.17	0.15	0.23	0.33
Switzerland	*Independent float*	0.36	0.28	0.36	0.27	0.30	0.39
U.K.	*Independent float*	0.37	0.40	0.50	0.39	0.36	0.44
Brazil 3/	*Independent float*	0.15	0.04	0.02	0.01	0.53	0.17
Chile 4/	*Independent float*	0.59	0.30	0.46	0.43	0.51	0.63
Czech Rep.	*Managed float*	0.38	0.40	0.33	0.61	0.50	0.55
Hungary 5/	*Crawling band*	0.20	0.11	0.14	0.17	0.21	0.31
India 6/	*Managed float*	0.61	0.62	0.49	0.47	0.33	0.24
Israel 7/	*Crawling band*	0.12	0.17	0.24	0.50	0.38	0.38
Poland 8/	*Independent float*	0.33	0.20	0.35	0.34	0.33	0.50
Singapore	*Managed float*	0.16	0.15	0.14	0.13	0.10	0.12
Turkey 9/	*Crawling peg*	0.14	0.13	0.10	0.09	0.17	0.12

1/ Calculated as SDEX/(SDEX+SDREV), where SDEX is the standard deviation of log differences of exchange rate against the U.S. dollar, and SDREV is the standard deviation of the changes in the central bank's reserves divided by lagged stock of base money.
2/ Based on *International Financial Statistics,* International Monetary Fund, June 2001.
3/ Moved from managed float to independent float: January 1999.
4/ Moved from crawling band to independent float: September 1999.
5/ Reclassified from managed float to crawling band: January 1998.
6/ Reclassified from independent float to managed float: December 2000.
7/ Reclassified from managed float to crawling band: August 1998.
8/ Moved from crawling band to independent float: April 2000.
9/ Moved from managed float to crawling band: June 1998.

imply a reversion to pre-crisis behavior. We continue our examination of post-crisis exchange rate characteristics in this section by addressing the question of whether the currencies have reverted back to their pre-crisis behavior of re-linking their currencies to the U.S. dollar, as claimed in some recent work.[11]

A test for high frequency pegging was developed by Frankel and Wei (1994), and it has been used subsequently by Ogawa (2001) and McKinnon (2000) in the context of post-crisis exchange rate behavior seen among the Asia-5. In this approach, an independent currency is chosen as an arbitrary numéraire for measuring the exchange rate variation. The goal here is to estimate the weight a currency assigns to another currency for a given frequency. The regression model, where the local currency's value against the independent currency is regressed against the major world currencies, is—

$$d\log\left(\frac{LC}{SF}\right) = \beta_1 + \beta_2 d\log\left(\frac{USD}{SF}\right) + \beta_3 d\log\left(\frac{JPY}{SF}\right) + \beta_4 d\log\left(\frac{DEM}{SF}\right) + \varepsilon$$

where,

LC: Local currency,
SF: Swiss franc,
USD: U.S. dollar,
JPY: Japanese yen,
DEM: German mark.

We begin by estimating annual regressions (using daily data for each year spanning 1995–2000) for the group of countries in the sample.

The regression framework helps in addressing two issues. First, the extent to which the coefficient of the U.S. dollar deviates from unity provides an indication of the flexibility of the currency against the dollar. Second, the pre and post-crisis results can be compared to test the hypothesis of a reversion to pre-crisis behavior.

To facilitate the exploration of the first issue, we apply the Wald coefficient test, for each regression, to test the null hypothesis that the dollar coefficient is equal to one. The second issue is probed by a test for coefficient equivalence, between the dollar estimates of the regressions for 1999 and 2000, against the estimates from the pre-crisis year of 1996.

[11] See, for example, Ogawa (2001) and McKinnon (2000).

In order to test the robustness of the results, the entire set of tests are then repeated by using a different numéraire—the British pound.[12] Tables 5A, 5B, 6A, and 6B summarize the results (the first two feature results using the franc as numéraire, and latter two feature the pound).

Pre-crisis

Beginning with Tables 5A and 6A, the regression results show that in the pre-crisis years of 1995/96, for the Asia-5 currencies in the sample, the dollar coefficient is very large (ranging from 0.86 to 1.03) and in most cases statistically indistinguishable from being equal to one. Given that virtually all of the Asia 5 regressions feature large magnitude of the dollar coefficient estimates, accompanied by very small standard errors, and high goodness-of-fit results, it is clearly evident that the currencies maintained *de facto* pegs to the dollar in the pre-crisis years. The regressions also show very small effects of the Japanese yen and the German mark on the currencies, although the coefficient estimate on the yen is significant in a majority of the regressions.

The results from the floating and other regimes in the sample for the same period are interesting. Most of the floating rate regressions yield Asia-5 type large coefficient to the dollar, and high adjusted R-squared (e.g. Australia, Canada, Mexico, New Zealand, and South Africa), and in some cases the coefficient estimates are not statistically indistinguishable from one as well. Nevertheless, the floating rate results are not as consistently strong as the Asia 5 results.

The 1995/96 regression results for the other regimes, all of which were following a managed float or crawling peg during this period, show them to be broadly similar to that of the Asia-5, although the results weaken somewhat with the use of the pound as numéraire.

Crisis

The crisis period (1997/98) results for the Asia-5, in contrast, reflecting the large swings in the regional currencies, feature poor goodness-of-fit, as well relatively smaller estimates of the dollar coefficient. However, given the large standard error of the estimates, it is not possible to reject the null of the dollar coefficient equal to one in nine out of the ten regressions. The official classification of the three of the five regimes changed to independently floating during this period (see Table 4A), with Indonesia, Korea, and Thailand joining the Philippines. The dramatic fall in the goodness-of-fit measures from the regressions reflect these developments, and the initial exchange rate volatility following the regime switches.

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[12] Using the Swiss franc as an independent currency is somewhat problematic as the franc has tracked the German mark very closely in recent years. The correlation between the daily log differences of the two currencies is estimated to be 0.91 for the period 1995–2000. However, this problem should not affect the estimation of the dollar coefficient.

The floating rate regressions for the same period are not characterized by the same kind of instability as the Asia-5, with the results broadly carrying over from the 1995/96 period. The non-floating rates, on the other hand, show more volatility in regression results, reflecting some transmission of the crisis pressures.

Post-crisis

In the post-crisis (1999/2000) regressions, the coefficient estimates of the Asia-5 countries are seen to return close to their pre-crisis magnitudes, but the standard error of the estimates are uniformly much larger.[13] The larger standard errors, as well as substantially lower adjusted R-squared results, suggest that the degree to which the currencies are linked to the dollar is relatively less than in the pre-crisis period. However, in the case of Korea, the regression results look very similar to the pre-crisis results.

With respect to the floating regimes, the results once again reinforce that assigning a large weight to the dollar is hardly an exclusive feature of pegged rates. Moreover, in other regressions, for the exchange rates of Brazil and Chile, both of which moved to an independent float in the late 1990s, the results seem similar to that of the Asia-5. Thus the control group results tend to suggest that the above regression framework may not provide sufficient evidence of a dollar peg.

Tables 5B and 6B, presenting results of the coefficient equivalence tests, show that it is not possible to reject the hypothesis that Korea, Indonesia, and the Philippines assign a different weight to the dollar in 2000 than they did in 1996. However, these results are subject to the same caveat as above, as by the same measure, it is not possible to reject coefficient equivalence for Brazil and Chile, both of which had regime changes. More strikingly, according to this test, most of the floating rates also went through significant structural changes with respect to their weights to the dollar. Thus, once again, the tests used to make the case for a return of the dollar peg among the Asia 5 are susceptible to a great deal of noise when benchmarked against other floating rates.[14]

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[13] With the exception of estimates for the Malaysian ringitt, which has been virtually fixed in the post-crisis period, inducing very small standard errors.

[14] The coefficient equivalence test also suffers from low power when testing for volatile periods, as relatively large standard errors of the estimates push the test statistics down.

Table 5A. Exchange Rate Regressions: Comovement with the U.S. Dollar 1/
Numéraire : Swiss Franc

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Indonesia	dollar	1.03**	No	0.87	1.02**	No	0.93	1.11**	No	0.08	0.19	No	0.03	0.85**	No	0.13	0.98**	No	0.38
	yen	0.05			-0.04*			0.10			0.77**			0.32**			0.13		
	mark	-0.18*			-0.01			-0.22			1.62			0.06			0.36		
Korea	dollar	0.99**	No	0.94	0.99**	No	0.84	1.26**	No	0.07	0.95**	No	0.18	0.94**	No	0.67	0.99**	No	0.77
	yen	0.01			0.04			-0.04			0.21**			0.07*			0.06		
	mark	0.11			0.02			-0.45			0.64*			0.19*			-0.03		
Malaysia	dollar	0.88*	Yes	0.94	0.92**	Yes	0.93	0.90**	No	0.34	0.74**	No	0.14	1.00**	No	0.99	1.00**	No	0.99
	yen	0.07**			0.06**			-0.00			0.32**			0.00			0.00		
	mark	-0.01			0.03			0.31*			0.49			0.00			0.00		
Philippines	dollar	1.04**	No	0.91	1.01**	No	0.99	0.77**	Yes	0.20	0.92**	No	0.29	0.92**	No	0.67	1.01**	No	0.61
	yen	-0.03			-0.01			0.28**			0.29**			0.07**			-0.01		
	mark	-0.17**			-0.01			0.11			0.19			0.06			-0.16		
Thailand	dollar	0.94**	Yes	0.94	0.94**	Yes	0.98	0.74**	No	0.10	0.84**	No	0.17	0.85**	Yes	0.56	0.81**	Yes	0.71
	yen	0.05**			0.05**			0.10			0.27**			0.12**			0.13**		
	mark	0.02			-0.01			0.36			0.36			0.04			0.09		

1/ Regression Model: dlog(local currency/SF) = b1 + b2 dlog(USD/SF) + b3 dlog(JPY/SF) + b4 dlog(DEM/SF); where SF - Swiss Franc, USD - US Dollar, JPY - Japanese Yen, DEM - German Mark.
2/ Null hypothesis for Wald Coefficient test: coefficient estimate on the US dollar is equal to one.
** and * denote significance at 5 percent and 10 percent levels, respectively.

Table 5A (continued). Exchange Rate Regressions: Comovement with the U.S. Dollar 1/

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Australia	dollar	1.11**	Yes	0.78	1.27**	Yes	0.72	0.84**	Yes	0.56	0.51**	Yes	0.42	0.88**	Yes	0.53	0.62**	Yes	0.33
	yen	-0.17**			-0.20**			0.16**			0.38**			0.05			0.05		
	mark	0.09			0.01			0.16			0.43**			0.16			0.28*		
Canada	dollar	1.12**	Yes	0.91	1.04**	No	0.88	1.04**	No	0.87	0.93**	Yes	0.77	1.08**	Yes	0.81	0.95**	No	0.82
	yen	0.01			-0.01			-0.01			0.08**			-0.01			0.02		
	mark	-0.05			0.02			-0.07			0.23**			0.17**			0.10		
Mexico	dollar	1.20**	No	0.19	1.07**	No	0.74	1.17**	Yes	0.62	1.00**	No	0.56	1.17**	Yes	0.66	1.08**	No	0.73
	yen	0.17			0.01			0.10*			0.11**			0.05			-0.02		
	mark	-0.03			-0.03			-0.15			0.29**			0.11			0.04		
New Zealand	dollar	1.17**	Yes	0.90	0.93**	No	0.67	1.16**	Yes	0.67	1.51**	Yes	0.61	1.22**	Yes	0.58	1.44**	Yes	0.60
	yen	-0.11**			0.03			-0.20**			-0.47**			-0.06			-0.06		
	mark	0.07			0.11			-0.08			-0.60*			-0.42**			-0.16		
South Africa	dollar	0.83**	Yes	0.92	0.99**	No	0.36	0.98**	No	0.82	0.60**	Yes	0.20	1.05**	No	0.58	0.77**	Yes	0.49
	yen	0.01			-0.03			-0.03			0.27**			0.03			-0.04		
	mark	0.04			0.11			0.06			0.23			0.27**			0.41**		
Sweden	dollar	0.48**	Yes	0.43	0.36**	Yes	0.34	0.24**	Yes	0.38	0.11**	Yes	0.31	0.22**	Yes	0.46	0.07	Yes	0.30
	yen	-0.08			-0.05			0.03			0.09**			0.03			0.09**		
	mark	0.41**			0.58**			0.64**			0.85**			0.76**			0.82**		
UK	dollar	0.51**	Yes	0.63	0.66**	Yes	0.58	0.67**	Yes	0.51	0.53**	Yes	0.54	0.56**	Yes	0.55	0.54**	Yes	0.46
	yen	-0.01			-0.16**			0.03			0.01			0.02			0.06		
	mark	0.37**			0.51**			0.18*			0.33**			0.17**			0.26**		

Table 5A (continued): Exchange Rate Regressions: Comovement with the U.S. Dollar 1/

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Brazil	dollar	1.07**	Yes	0.87	0.99**	No	0.97	1.01**	No	0.98	0.99**	No	0.98	0.79**	No	0.17	1.10**	Yes	0.72
	yen	0.01			-0.01			0.01			0.00			0.43**			-0.05		
	mark	0.11			-0.01			-0.02			-0.01			-0.07			0.11		
Chile	dollar	0.97**	No	0.78	1.01**	No	0.88	0.98**	No	0.90	0.95**	No	0.68	0.98**	No	0.74	1.01**	No	0.78
	yen	0.02			0.01			0.03			0.05*			0.20			-0.05		
	mark	0.05			-0.04			0.11**			0.05			-0.03			0.14*		
Czech Rep.	dollar	0.93**	No	0.67	0.96**	No	0.66	0.56**	Yes	0.17	0.44**	Yes	0.18	0.22**	Yes	0.35	0.19**	Yes	0.42
	yen	0.01			-0.05			0.04			0.14**			0.03			-0.03		
	mark	-0.06			0.02			0.21			0.29			0.75**			0.94**		
Hungary	dollar	0.84**	Yes	0.55	0.81**	Yes	0.60	0.79**	Yes	0.65	0.74**	Yes	0.59	0.63**	Yes	0.63	0.17**	Yes	0.27
	yen	0.14*			0.11*			0.02			0.09**			0.01			-0.03		
	mark	0.11			0.29**			0.06			0.16			0.56**			0.71**		
India	dollar	1.03**	No	0.87	1.14**	Yes	0.65	0.99**	No	0.87	0.95**	No	0.72	1.01**	No	0.97	1.01**	No	0.95
	yen	0.05			-0.06			0.04*			0.01			-0.01			0.02		
	mark	-0.18*			-0.03			0.01			-0.01			0.01			0.04		
Israel	dollar	0.97**	No	0.95	0.96**	No	0.71	0.96**	No	0.79	0.96**	No	0.54	0.92**	Yes	0.69	0.91**	Yes	0.74
	yen	0.03			-0.06			0.01			-0.04			0.01			0.05		
	mark	0.01			-0.03			0.07			0.26**			0.18*			-0.05		
Poland	dollar	0.91**	No	0.61	0.87**	Yes	0.80	0.91**	No	0.58	0.86**	Yes	0.39	0.83**	Yes	0.49	0.80**	Yes	0.43
	yen	0.03			-0.02			0.06			0.09*			0.01			-0.04		
	mark	-0.23			0.15			0.13			-0.06			0.26**			0.41**		
Singapore	dollar	0.81**	Yes	0.83	0.83**	Yes	0.88	0.85**	Yes	0.70	0.68**	Yes	0.41	0.82**	Yes	0.82	0.83**	Yes	0.91
	yen	0.13**			0.09**			0.11**			0.31**			0.11**			0.12**		
	mark	-0.02			0.04			0.06			0.25			0.01			0.08**		
Turkey	dollar	1.04**	No	0.71	0.94**	No	0.44	0.88**	Yes	0.69	0.78**	Yes	0.69	0.72**	Yes	0.65	0.68**	Yes	0.76
	yen	0.09			0.11			-0.01			0.07**			-0.01			-0.01		
	mark	-0.37**			-0.21			0.08			0.09			0.08			0.31**		

Table 5B. Hypothesis Test of Coefficient Equivalence 1/
For the dollar coefficient of regressions; against 1996 estimates;
Null: coefficients are equal

	1999		2000	
	Statistic	Reject 2/	Statistic	Reject
Indonesia	-0.80	No	-0.29	No
Korea	-0.85	No	0.06	No
Malaysia	93.75	Yes	75.00	Yes
Philippines	-1.82	Yes	0.01	No
Thailand	-1.51	No	-2.45	Yes
Australia	-5.97	Yes	-7.35	Yes
Canada	0.97	No	-2.24	Yes
Mexico	1.47	No	0.25	No
New Zealand	4.08	Yes	5.06	Yes
South Africa	0.92	No	-3.11	Yes
Sweden	-3.48	Yes	-5.48	Yes
U.K.	-2.34	Yes	-1.98	Yes
Brazil	-1.08	No	1.73	Yes
Chile	-0.59	No	0.04	No
Czech Rep.	-14.82	Yes	-17.93	Yes
Hungary	-4.02	Yes	-13.68	Yes
India	-10.42	Yes	-6.19	Yes
Israel	-0.98	No	-0.98	No
Poland	-0.57	No	-0.94	No
Singapore	0.00	No	0.23	No
Turkey	-5.56	Yes	-7.76	Yes

1/ Test statistic = [estimate (t1)-estimate(t0)]/standard error of estimate (t1).

2/ 90 percent confidence level.

Table 6A. Exchange Rate Regressions: Comovement with the U.S. Dollar 1/
Numéraire : British Pound

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Indonesia	dollar	1.00**	No	0.94	1.01**	No	0.86	0.65**	No	0.01	0.53**	No	0.02	1.51**	Yes	0.18	0.83**	No	0.19
	yen	0.01			-0.04*			0.07			0.64**			0.35**			0.13		
	mark	0.02			0.02			-0.42			0.35			0.30			-0.13		
Korea	dollar	0.99**	No	0.83	0.96**	No	0.71	1.04**	No	0.02	0.97**	No	0.06	1.00**	No	0.49	1.00**	No	0.77
	yen	0.01			0.04			-0.04			0.17			0.07*			0.07		
	mark	-0.03			-0.06			-0.33			-0.15			0.04			-0.04		
Malaysia	dollar	0.86**	Yes	0.86	0.97**	No	0.88	0.87**	No	0.22	0.77**	No	0.07	0.99**	No	0.99	1.00**	No	0.99
	yen	0.08**			0.05**			-0.03			0.28**			0.00			0.00		
	mark	0.03			0.05			0.11			-0.03			0.00			0.00		
Philippines	dollar	1.03**	No	0.81	1.01**	No	0.98	0.68**	Yes	0.10	0.95**	No	0.17	0.97**	No	0.51	1.13**	No	0.55
	yen	-0.03			-0.01			0.27**			0.25**			0.08**			-0.01		
	mark	0.02			-0.01			-0.08			-0.18			0.03			0.03		
Thailand	dollar	0.97**	No	0.85	0.94**	Yes	0.96	0.77**	No	0.07	0.82**	No	0.07	0.99**	No	0.46	0.81**	Yes	0.60
	yen	0.05**			0.05**			0.08			0.23**			0.13**			0.13**		
	mark	0.03			0.01			0.18			-0.11			0.13*			0.07		

1/ Regression Model: dlog(local currency/BP) = b1 + b2 dlog(USD/BP) + b3 dlog(JPY/BP) + b4 dlog(DEM/BP); where BP - British Pound, USD - US Dollar, JPY - Japanese Yen, DEM - German Mark.
2/ Null hypothesis for Wald Coefficient test: coefficient estimate on the US dollar is equal to one.
** and * denote significance at 5 percent and 10 percent levels, respectively.

Table 6A (continued). Exchange Rate Regressions: Comovement with the U.S. Dollar 1/

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Australia	dollar	1.01**	No	0.55	1.17**	Yes	0.48	0.80**	Yes	0.40	0.42**	Yes	0.28	0.84**	Yes	0.31	0.55**	Yes	0.25
	yen	-0.16**			-0.18**			0.14**			0.35**			0.05			0.04		
	mark	0.00			-0.17**			-0.01			0.03			0.04			0.27**		
Canada	dollar	1.14**	Yes	0.79	1.06**	Yes	0.79	1.02**	No	0.79	0.96**	No	0.60	1.10**	Yes	0.65	0.96**	No	0.74
	yen	0.01			-0.01			-0.00			0.07**			-0.01			0.03		
	mark	-0.16**			-0.04			-0.06*			0.01			-0.03			0.04		
Mexico	dollar	1.63**	Yes	0.13	1.16**	No	0.62	1.24**	Yes	0.49	1.10**	No	0.39	1.21**	Yes	0.45	1.06**	No	0.61
	yen	0.14			-0.01			0.09			0.07*			0.05			-0.02		
	mark	0.01			-0.03			-0.24**			-0.01			-0.17**			-0.05		
New Zealand	dollar	1.23**	Yes	0.80	1.07**	No	0.58	1.30**	Yes	0.62	1.50**	Yes	0.49	1.27**	Yes	0.42	1.48**	Yes	0.48
	yen	-0.12**			0.00			-0.19**			-0.42**			-0.06			-0.05		
	mark	-0.01			0.11			0.08			-0.08			-0.14			-0.31**		
South Africa	dollar	0.78**	Yes	0.80	1.13**	No	0.28	0.92**	Yes	0.71	0.62**	Yes	0.14	1.06**	No	0.35	0.71**	Yes	0.39
	yen	0.01			-0.07			-0.03			0.26**			0.02			-0.04		
	mark	0.13**			0.013			0.02			0.13			-0.05			0.25**		
Sweden	dollar	0.34**	Yes	0.21	0.35**	Yes	0.44	0.17**	Yes	0.59	0.09	Yes	0.40	0.19**	Yes	0.55	0.05	Yes	0.65
	yen	-0.06			-0.04			0.04			0.03**			0.04			0.09**		
	mark	0.47**			0.71**			0.68**			0.76**			0.71**			0.80**		
Switzerland	dollar	-0.15**	Yes	0.86	-0.17**	Yes	0.79	-0.03	Yes	0.77	-0.09**	Yes	0.68	-0.06	Yes	0.70	0.10**	Yes	0.82
	yen	0.05**			0.08**			0.07			0.09**			0.01			-0.01		
	mark	1.04**			1.09**			0.90**			0.91**			0.89**			0.86**		

Table 6A (continued): Exchange Rate Regressions: Comovement with the U.S. Dollar 1/

		1995			1996			1997			1998			1999			2000		
		Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2	Coeff. Estimate	Reject Null 2/	Adj. R^2
Brazil	dollar	1.12**	Yes	0.72	1.00**	No	0.94	1.02**	No	0.97	1.00**	No	0.97	1.03**	No	0.13	1.06**	No	0.58
	yen	-0.01			-0.01			0.01			0.00			0.43**			-0.05		
	mark	-0.05			0.01			-0.02			0.00			-0.03			-0.04		
Chile	dollar	0.96**	No	0.56	0.97**	No	0.78	1.05**	Yes	0.85	0.96**	No	0.52	0.96**	No	0.55	0.98**	No	0.67
	yen	0.01			0.01			0.02			0.04			0.02			-0.05		
	mark	-0.03			-0.04			0.03			0.01			-0.02			0.04		
Czech Rep.	dollar	0.82**	Yes	0.38	0.87**	Yes	0.46	0.58**	Yes	0.22	0.36**	Yes	0.15	0.21**	Yes	0.46	0.17**	Yes	0.74
	yen	0.12			-0.02			0.06			0.16**			0.03			-0.03		
	mark	-0.03			0.03			0.39**			0.33**			0.73**			0.85**		
Hungary	dollar	0.90**	Yes	0.34	0.78**	Yes	0.40	0.79**	Yes	0.58	0.74**	Yes	0.46	0.62**	Yes	0.45	0.20**	Yes	0.72
	yen	0.14*			0.11*			0.03			0.09**			0.01			-0.03		
	mark	0.06			0.01			0.16**			0.16**			0.36**			0.85**		
India	dollar	0.97**	No	0.70	1.26**	Yes	0.52	1.00**	No	0.79	0.95**	No	0.57	0.99**	No	0.94	1.00**	No	0.92
	yen	0.05			-0.09			0.03			0.02			-0.01			0.02		
	mark	-0.13**			-0.01			-0.03			0.03			-0.03**			-0.02		
Israel	dollar	0.97**	No	0.86	0.93**	No	0.57	0.92**	Yes	0.67	1.03**	No	0.39	0.89**	Yes	0.47	0.90**	Yes	0.63
	yen	0.03			-0.05			0.01			-0.06			0.01			0.05		
	mark	-0.01			0.11*			0.01			0.14			0.06			0.01		
Poland	dollar	0.88**	Yes	0.38	0.83**	Yes	0.66	0.86**	Yes	0.41	0.89**	No	0.29	0.87**	No	0.32	0.73**	Yes	0.32
	yen	0.05			-0.02			0.05			0.09**			0.01			-0.04		
	mark	0.07			0.12**			0.01			0.07			0.19**			0.22**		
Singapore	dollar	0.78**	Yes	0.76	0.82**	Yes	0.82	0.81**	Yes	0.57	0.70**	Yes	0.29	0.87**	Yes	0.71	0.83**	Yes	0.87
	yen	0.13**			0.09**			0.11**			0.28**			0.12**			0.12**		
	mark	0.07*			0.09**			0.01			0.02			0.09**			0.05**		
Turkey	dollar	1.13**	Yes	0.55	0.80**	Yes	0.26	0.86**	Yes	0.59	0.79**	Yes	0.56	0.72**	Yes	0.52	0.67**	Yes	0.74
	yen	0.11**			0.14*			-0.01			0.07**			-0.01			-0.01		
	mark	-0.01			-0.12			0.12**			0.14**			0.26**			0.32**		

Table 6B. Hypothesis Test of Coefficient Equivalence 1/
For the dollar coefficient of regressions; against 1996 estimates;
Null: coefficients are equal

	1999		2000	
	Statistic	Reject 2/	Statistic	Reject
Indonesia	1.82	Yes	-1.19	No
Korea	0.70	No	0.78	No
Malaysia	20.00	Yes	30.00	Yes
Philippines	-0.61	No	1.40	No
Thailand	0.54	No	-2.18	Yes
Australia	-3.82	Yes	-6.07	Yes
Canada	0.83	No	-2.09	Yes
Mexico	0.52	No	-1.45	No
New Zealand	2.14	Yes	3.56	Yes
South Africa	-0.69	No	-5.16	Yes
Sweden	-3.19	Yes	-5.31	Yes
Switzerland	2.45	Yes	-11.71	Yes
Brazil	0.13	No	0.91	No
Chile	0.00	No	0.51	No
Czech Rep.	-10.20	Yes	-14.43	Yes
Hungary	-2.83	Yes	-11.09	Yes
India	-18.20	Yes	-10.53	Yes
Israel	-0.77	No	-0.55	No
Poland	0.48	No	-1.17	No
Singapore	1.19	No	0.27	No
Turkey	-1.42	No	-3.36	Yes

1/ Test statistic = [estimate (t1)-estimate(t0)]/standard error of estimate (t1).

2/ 90 percent confidence level.

The regression specification used in this section, while used in several papers in recent literature, has additional shortcomings as the variance distribution of the error term of the equation is likely to be non-normal due to the high frequency nature of the data used for estimation. Daily observations tend to display significant feedback from the previous day's observation, and thus the variance of the error term is prone to display conditional heteroskedasticity. Thus a better way to estimate the exchange rate regression would be to model the conditional variance. We estimate ARCH regressions with the same regressors as above, and do not find major changes in the estimated weights on the dollar. The results are therefore not reported. Additional ARCH regressions are estimated for the following section.

VII. SMOOTHING VERSUS PEGGING

As the results in the previous sections have shown, while there is some evidence of a reversion to assigning a large weight to the dollar among East Asian currencies, it is far from conclusive toward a return to the peg claim. The section tests if the East Asian currencies in discussion are indeed showing smoothing or pegging characteristics.

We use a random walk model for selected exchange rates (against the U.S. dollar), and incorporate a simple GARCH (1,1) specification to correct for the potential bias in the OLS setting. The residual of the regressions are then compared against various currencies and time periods. Examining the ARCH corrected residuals of the random walk regressions should provide further useful information in this regard. If the regression residuals for East Asian currencies seem to be similar between the pre and post-crisis periods, combined with the continued large weight to the dollar seen in the previous section, then the contention of a return of the dollar peg would gain ground. On the other hand, if the residuals are seen to be quite different between the pre and post-crisis period, then they can be compared to the residuals of other floating or managed float currencies for further analysis.

In addition to Indonesia, Korea, Thailand, and the Philippines, we pick five other countries for the control group—Australia, New Zealand, Singapore, Turkey, and the U.K. Singapore and Turkey represent managed float regimes, whereas the other three are free floats, with data from Australia and New Zealand likely to capture similar shocks as the East Asian countries.

Figures 4A–4I display year by year residual plots of country-wise random walk exchange regressions that incorporate conditional heteroskedasticity effects.[15] Strong ARCH and GARCH effects are evident in virtually all the variance regressions, with the sum of the estimated coefficients (which are statistically significant) very close to one. This finding is consistent with the literature of high frequency exchange rate dynamics.

[15] The plots are of standardized residuals, i.e. ε_t / σ_t.

The residual plots clearly show a major change in exchange rate behavior of the four East Asian countries in discussion. While the pre-crisis period was characterized by centrally clustered data with a few extreme outliers (typical of a heavily managed rate with few discrete adjustments), in the post-crisis period, by and large, the residuals are more dispersed, with noticeable reduction in the tendency for data points to cluster around the mean. Korea and Thailand, in particular, stand out with particularly well-behaved residuals in recent years, with the distributions in 1999 and 2000 appearing to represent well-dispersed day-to-day movements. However, the characteristics of the residuals from Indonesia and the Philippines reflect continued susceptibility of extreme swings of the exchange rate.

In overall comparison with the control group residuals, the East Asian residuals look closer to the managed rates' than the very well-dispersed and nearly-normal distributions of floating rates, which suggests that while the currencies are not being pegged, their movements are probably being smoothed by the authorities to some extent.

VIII. Conclusion

The analysis above suggests that Asia-5 exchanges rates have become less volatile than in the crisis period, but they are not as stable as in the pre-crisis period. Despite the sharp decrease from the 1997/98 period, volatility remains high relative to the pre-crisis period. Finally, the regressions and hypothesis tests do not support the view that East Asian currencies are increasingly being pegged to the dollar.

The analysis also suggests that it is difficult to generalize the behavior of East Asian exchange rates in the post-crisis period. Among the Asia-5, **Indonesia's** exchange rate and interest rate are the most volatile. The regression analysis shows that the rupiah assigns a large weight to the dollar, but it falls far short of explaining its sharp movements. **Korea** stands at the other end, characterized by sharply decreased volatility in its indicators, evidence of exchange rate inflexibility, and regression results indicating a return to a level of pre-crisis weight to the dollar. **Malaysia**, having fixed its rates in the aftermath of the crisis, is a fundamentally different case. **The Philippines'** rates show evidence of declining volatility, but when compared to the tranquil period, they continue to look more volatile. The **Thai baht** displays greater overall stability than in the crisis period, but the currency remains more flexible than observed during the pre-crisis period.

It may perhaps be premature to draw firm conclusions on whether East Asian economies have returned to a dollar standard. Testing for the nature of an exchange rate regime is inherently difficult, and the analysis performed above is only a first approximation at resolving this difficult question. The so called post-crisis period has only a few years' of data, thus limiting the depth of the analysis. The currency regimes in the East Asian economies could be some time away from establishing their identity as floating or pegged.

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Figure 1. Asia 5 Exchange Rates and Volatility; (1/1/1994-2/28/2001)

Right axis: exchange rate; national currency / U.S. dollar
Left Axis: log difference of daily exchange rate

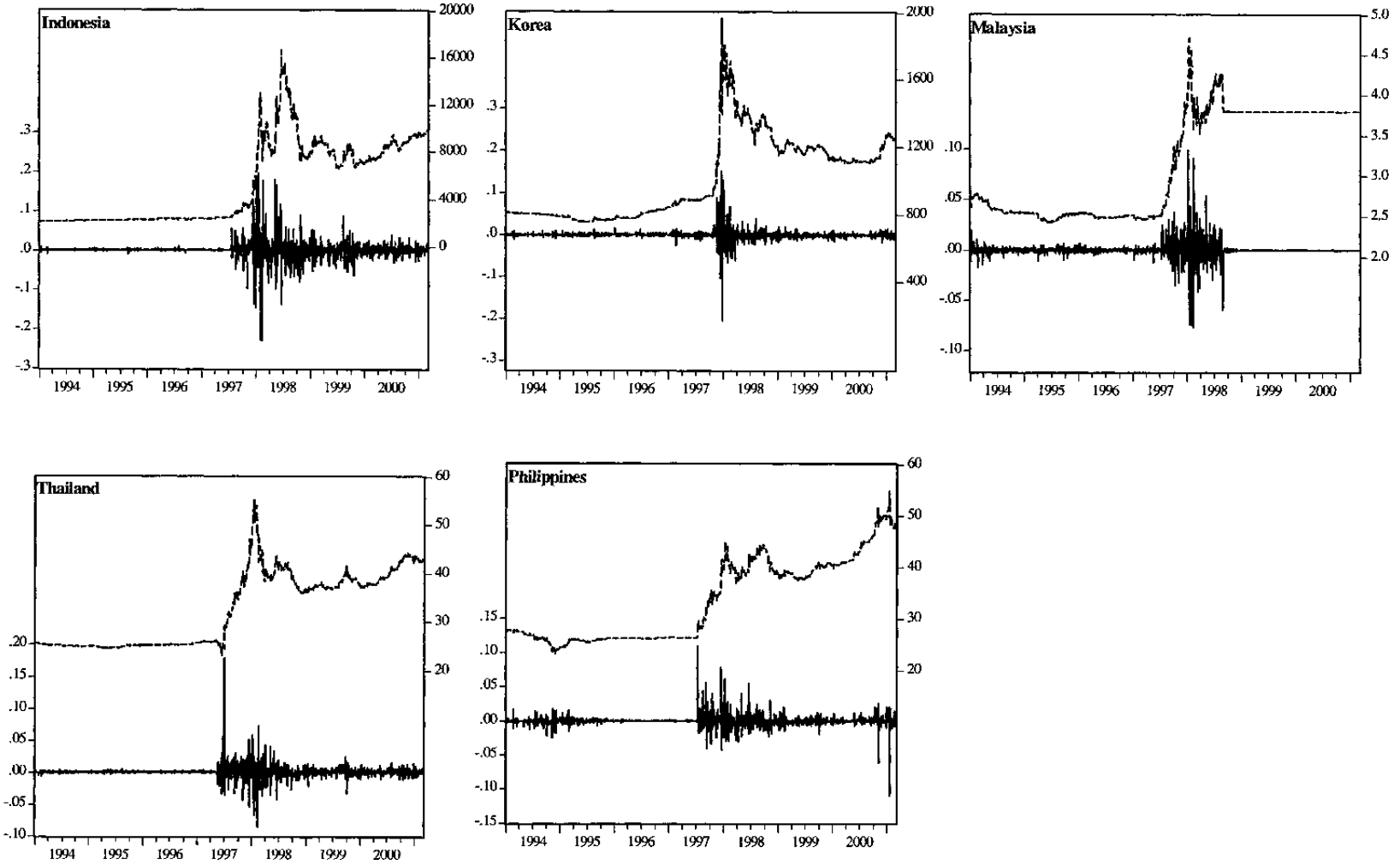
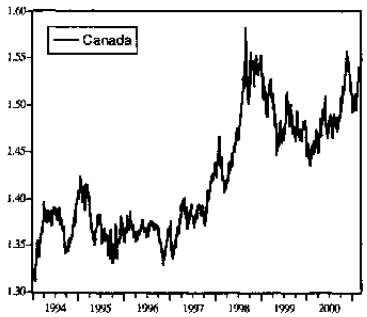
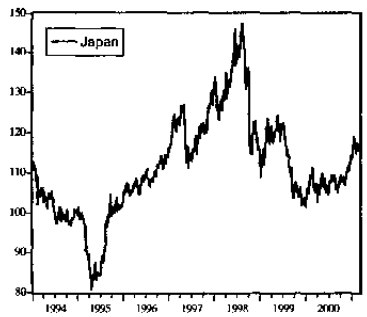
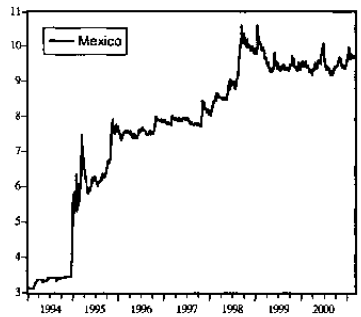
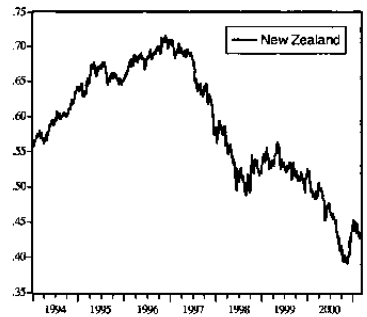


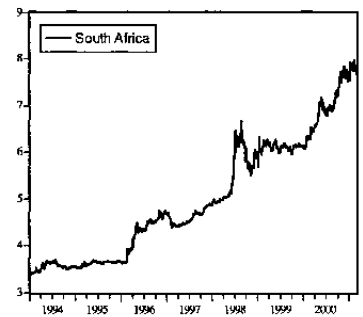
Figure 2A. Exchange Rates (against the U.S. dollar)

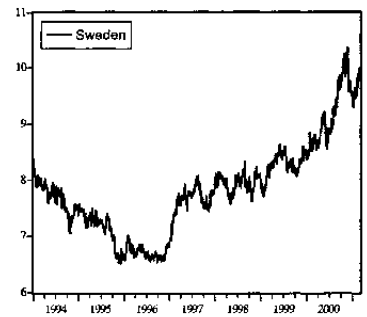












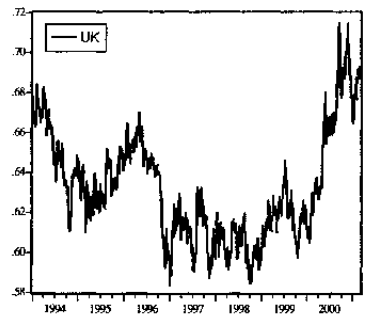


Figure 2B. Exchange Rate Volatility (log difference of daily data)

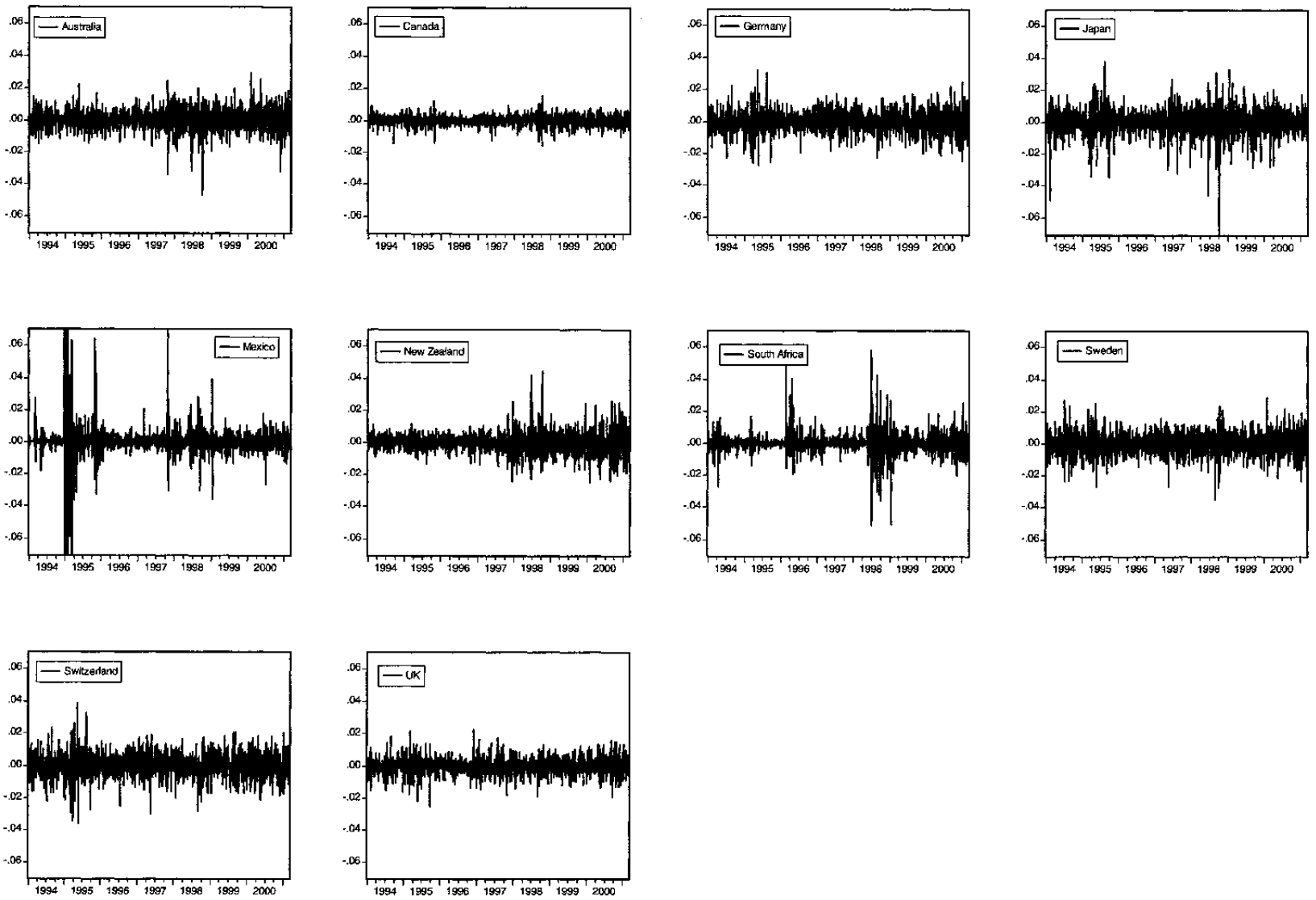
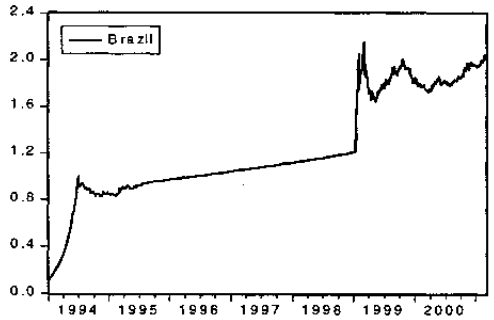
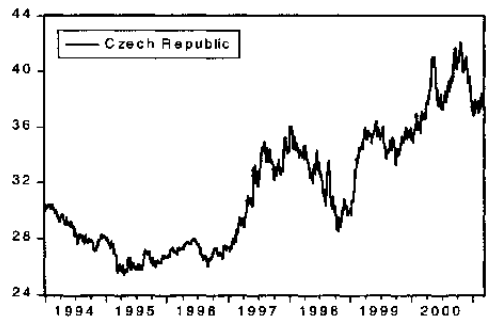
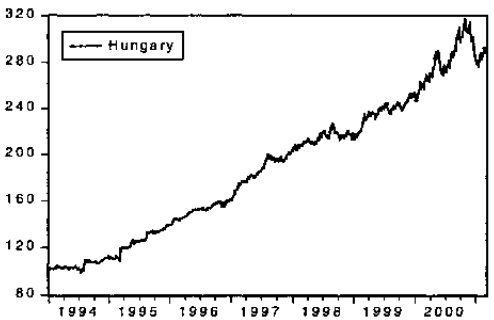
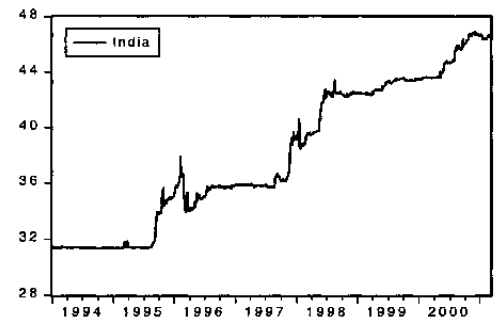


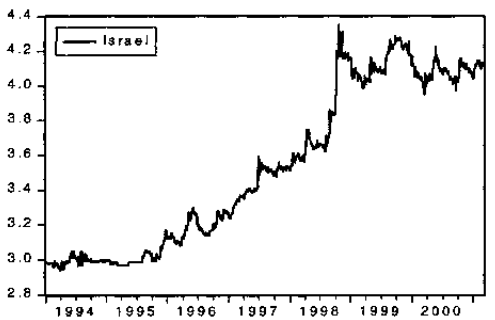
Figure 3A. Exchange Rates (against the U.S. dollar)

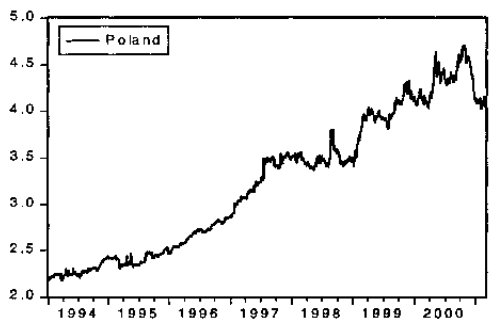


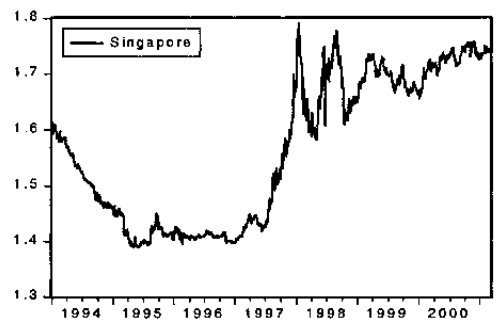












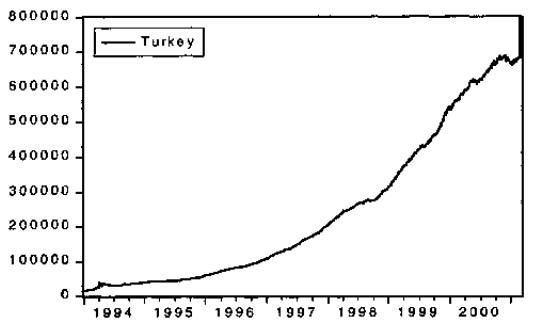


Figure 3B. Exchange Rate Volatility (log difference of daily data)

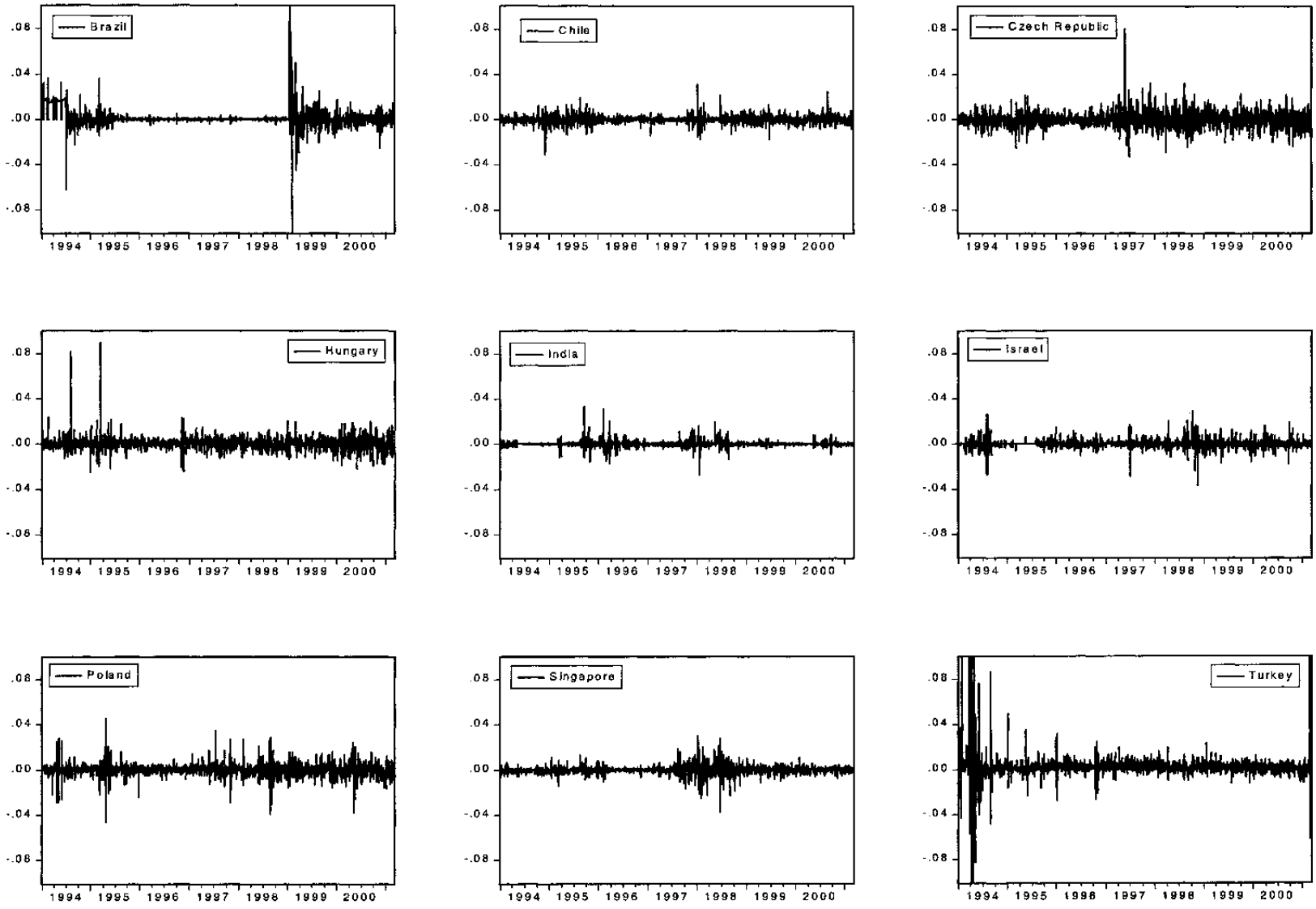
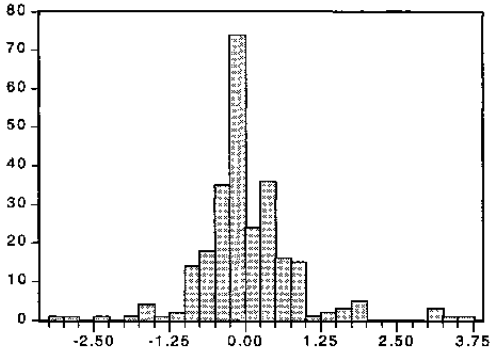
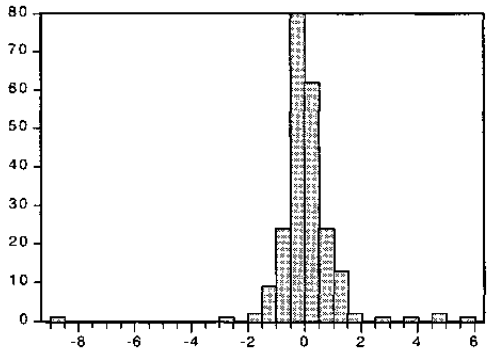


Figure 4A. Indonesia (Residual Distribution from Random Walk Regression)



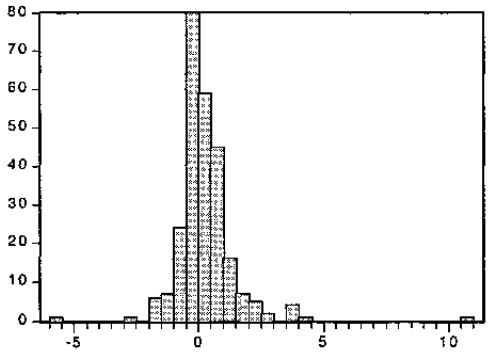
Series: RESIDI2
Sample 1/03/1995 12/29/1995
Observations 259

Mean	0.050628
Median	-0.046034
Maximum	3.629295
Minimum	-3.147856
Std. Dev.	0.821977
Skewness	0.756748
Kurtosis	7.993021
Jarque-Bera	293.7592
Probability	0.000000



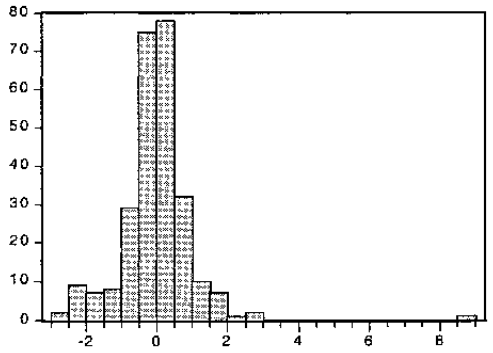
Series: RESIDI2
Sample 1/01/1996 12/31/1996
Observations 262

Mean	0.070240
Median	-0.039615
Maximum	5.695857
Minimum	-8.684552
Std. Dev.	0.998201
Skewness	-0.981838
Kurtosis	31.85351
Jarque-Bera	9130.492
Probability	0.000000



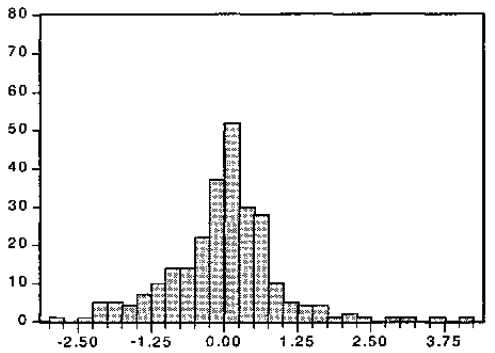
Series: RESIDI2
Sample 1/01/1997 12/31/1997
Observations 261

Mean	0.253338
Median	0.093847
Maximum	10.93891
Minimum	-5.686808
Std. Dev.	1.195693
Skewness	2.782616
Kurtosis	29.36303
Jarque-Bera	7895.042
Probability	0.000000



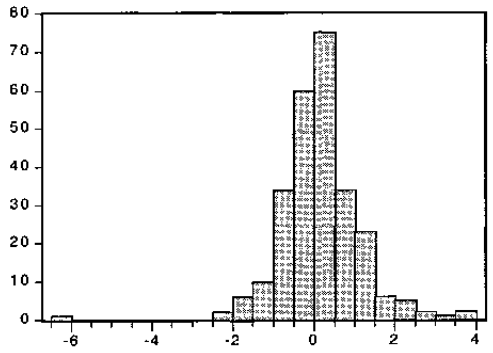
Series: RESIDI2
Sample 1/01/1998 12/31/1998
Observations 261

Mean	-0.006159
Median	0.001788
Maximum	8.595307
Minimum	-2.862826
Std. Dev.	1.002701
Skewness	2.218717
Kurtosis	23.30913
Jarque-Bera	4699.648
Probability	0.000000



Series: RESIDI2
Sample 1/01/1999 12/31/1999
Observations 261

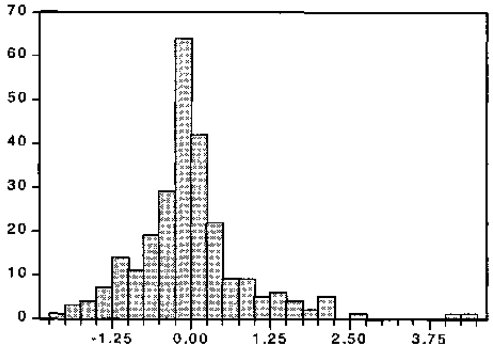
Mean	-0.004006
Median	0.074250
Maximum	4.046053
Minimum	-2.952929
Std. Dev.	0.930224
Skewness	0.400112
Kurtosis	5.867146
Jarque-Bera	96.36209
Probability	0.000000



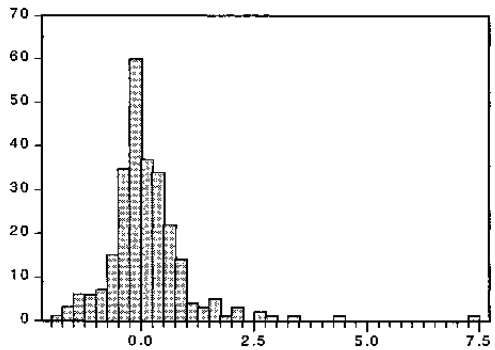
Series: RESIDI2
Sample 12/31/1999 12/29/2000
Observations 261

Mean	0.132804
Median	0.091837
Maximum	3.864235
Minimum	-6.040645
Std. Dev.	0.978669
Skewness	-0.329109
Kurtosis	9.836092
Jarque-Bera	512.9238
Probability	0.000000

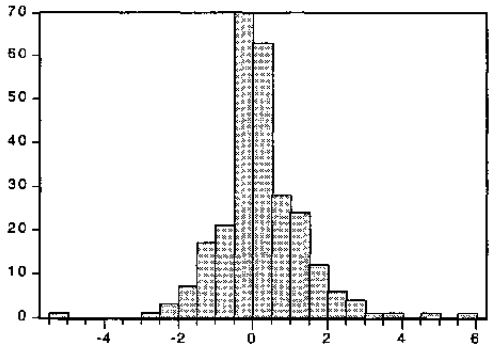
Figure 4B. Korea (Residual Distribution from Random Walk Regression)



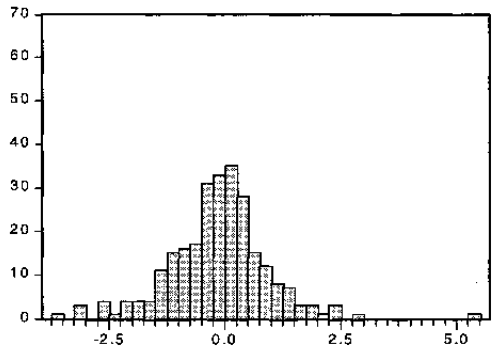
Series: RESIDKO	
Sample 1/03/1995 12/29/1995	
Observations 259	
Mean	-0.015011
Median	-0.025505
Maximum	4.378082
Minimum	-2.008230
Std. Dev.	0.853628
Skewness	1.219598
Kurtosis	7.480852
Jarque-Bera	280.8824
Probability	0.000000



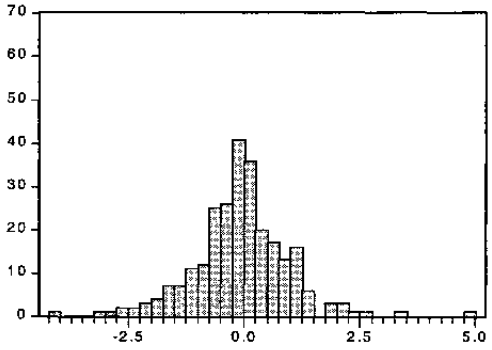
Series: RESIDKO	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	0.138881
Median	-0.012671
Maximum	7.448817
Minimum	-1.901383
Std. Dev.	0.909613
Skewness	2.748899
Kurtosis	20.54989
Jarque-Bera	3692.284
Probability	0.000000



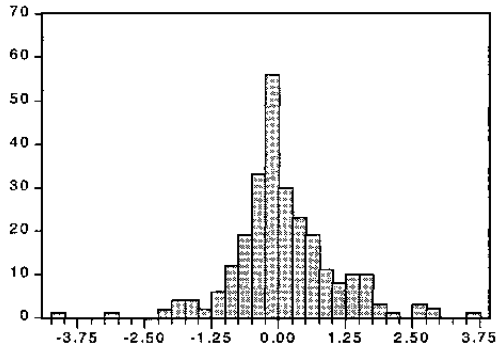
Series: RESIDKO	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.182704
Median	0.024393
Maximum	5.724087
Minimum	-5.340638
Std. Dev.	1.133218
Skewness	0.358892
Kurtosis	7.491386
Jarque-Bera	224.9794
Probability	0.000000



Series: RESIDKO	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.147673
Median	-0.092520
Maximum	5.426296
Minimum	-3.698706
Std. Dev.	1.061077
Skewness	0.197234
Kurtosis	6.302894
Jarque-Bera	120.3288
Probability	0.000000

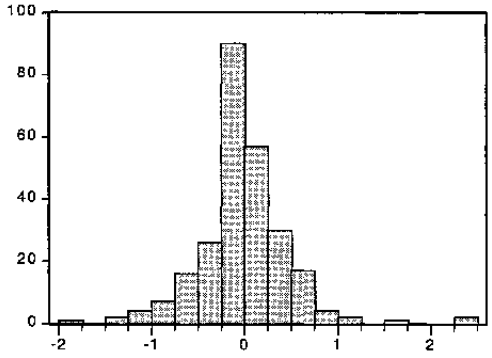


Series: RESIDKO	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	-0.086294
Median	-0.079153
Maximum	4.772716
Minimum	-4.087483
Std. Dev.	1.036468
Skewness	0.136749
Kurtosis	5.768935
Jarque-Bera	65.39489
Probability	0.000000

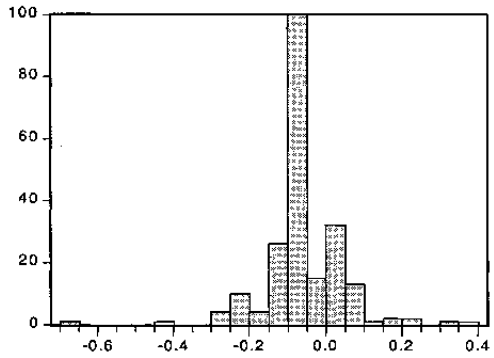


Series: RESIDKO	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	0.087791
Median	-0.032939
Maximum	3.720073
Minimum	-4.015373
Std. Dev.	0.940046
Skewness	0.132992
Kurtosis	5.583203
Jarque-Bera	73.33761
Probability	0.000000

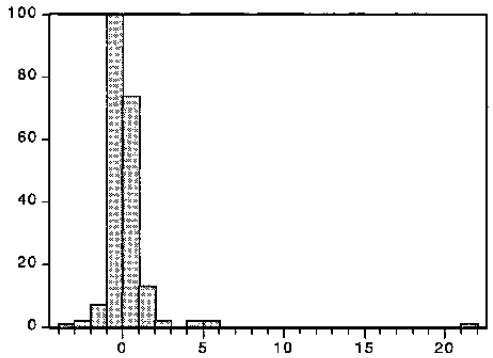
Figure 4C. Philippines (Residual Distritution from Random Walk Regression)



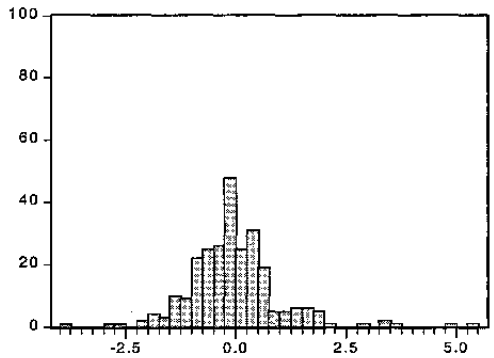
Series: RESDIPH	
Sample 1/03/1995 12/29/1995	
Observations 259	
Mean	-0.012482
Median	-0.053890
Maximum	2.419032
Minimum	-1.998589
Std. Dev.	0.479050
Skewness	0.560495
Kurtosis	8.730096
Jarque-Bera	367.8946
Probability	0.000000



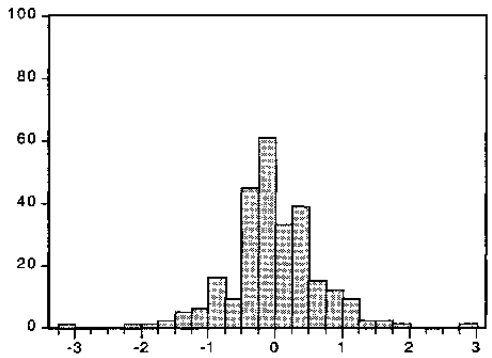
Series: RESDIPH	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	-0.054074
Median	-0.057616
Maximum	0.387995
Minimum	-0.650898
Std. Dev.	0.092498
Skewness	-0.479220
Kurtosis	12.91851
Jarque-Bera	1083.976
Probability	0.000000



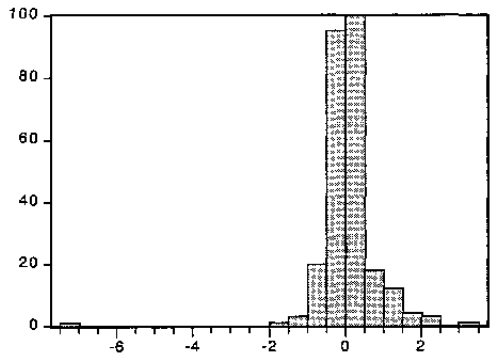
Series: RESDIPH	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.148593
Median	-0.055807
Maximum	21.17343
Minimum	-3.090135
Std. Dev.	1.560472
Skewness	9.843119
Kurtosis	129.0505
Jarque-Bera	177004.6
Probability	0.000000



Series: RESDIPH	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.038432
Median	-0.041076
Maximum	5.468965
Minimum	-3.916303
Std. Dev.	1.062477
Skewness	1.055206
Kurtosis	8.225695
Jarque-Bera	345.4087
Probability	0.000000

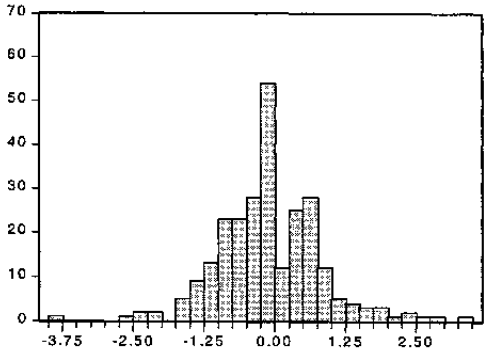


Series: RESDIPH	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	-0.028309
Median	-0.049677
Maximum	2.939584
Minimum	-3.080068
Std. Dev.	0.664060
Skewness	-0.099455
Kurtosis	6.032746
Jarque-Bera	100.4536
Probability	0.000000

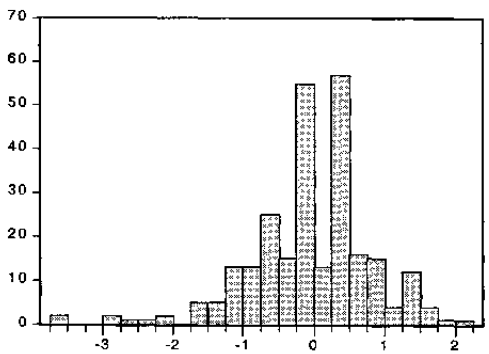


Series: RESDIPH	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	0.084999
Median	0.034840
Maximum	3.129858
Minimum	-7.243640
Std. Dev.	0.737851
Skewness	-3.044407
Kurtosis	40.62063
Jarque-Bera	15794.69
Probability	0.000000

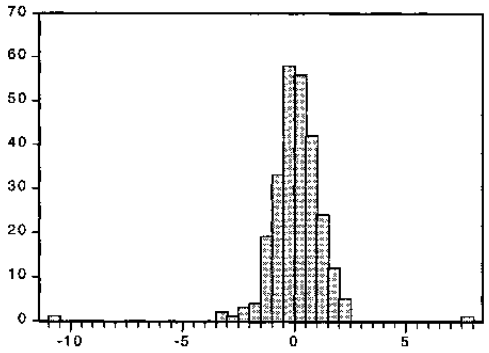
Figure 4D. Thailand (Residual Distribution of the Random Walk Regression)



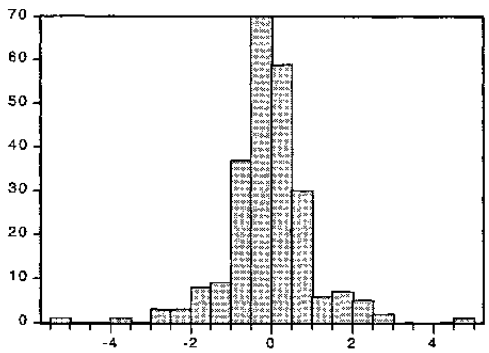
Series: RESIDTH	
Sample 1/03/1995 12/29/1995	
Observations 259	
Mean	-0.098963
Median	-0.116375
Maximum	3.363647
Minimum	-3.999973
Std. Dev.	0.912306
Skewness	0.141348
Kurtosis	5.131638
Jarque-Bera	49.89849
Probability	0.000000



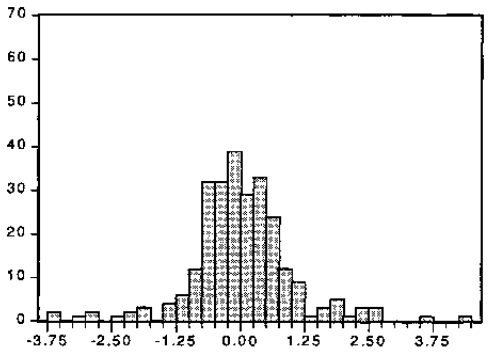
Series: RESIDTH	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	-0.052154
Median	-0.074026
Maximum	2.076021
Minimum	-3.736997
Std. Dev.	0.868041
Skewness	-0.839507
Kurtosis	5.172289
Jarque-Bera	82.28899
Probability	0.000000



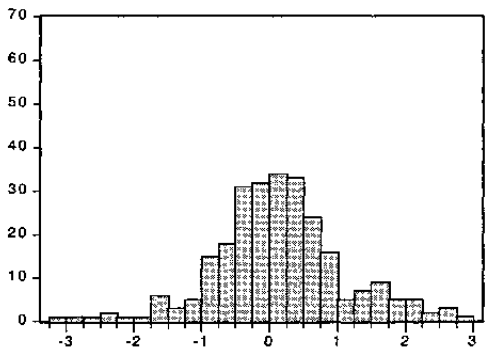
Series: RESIDTH	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.071042
Median	0.069068
Maximum	7.699756
Minimum	-10.93227
Std. Dev.	1.241632
Skewness	-1.903190
Kurtosis	30.44033
Jarque-Bera	8346.130
Probability	0.000000



Series: RESIDTH	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.074660
Median	-0.111213
Maximum	4.911248
Minimum	-5.275975
Std. Dev.	0.986837
Skewness	-0.114244
Kurtosis	9.078837
Jarque-Bera	402.4236
Probability	0.000000

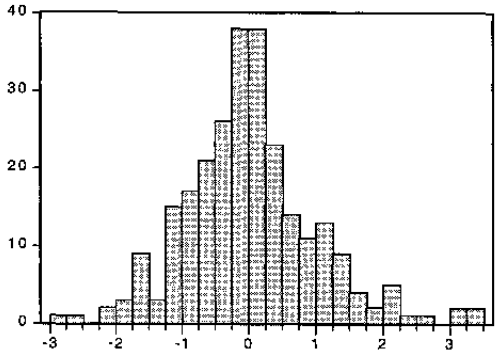


Series: RESIDTH	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	0.018082
Median	-0.016055
Maximum	4.337980
Minimum	-3.630292
Std. Dev.	0.984799
Skewness	0.124283
Kurtosis	6.423113
Jarque-Bera	128.1019
Probability	0.000000



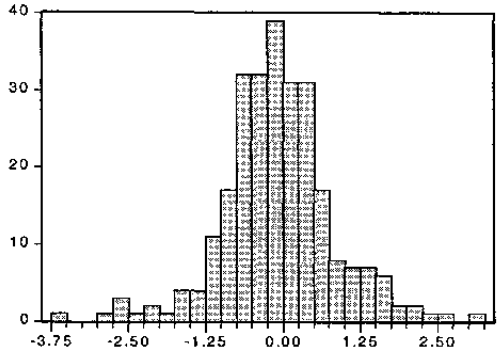
Series: RESIDTH	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	0.132865
Median	0.108627
Maximum	2.826717
Minimum	-3.178835
Std. Dev.	0.953883
Skewness	-0.022715
Kurtosis	4.084031
Jarque-Bera	12.80191
Probability	0.001660

Figure 4E. Australia (Residual Distribution from Random Walk Regression)



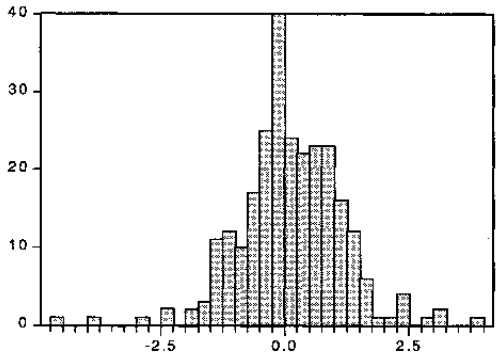
Series: RESIDAU
Sample 12/30/1994 12/29/1995
Observations 261

Mean	0.018552
Median	-0.022314
Maximum	3.431590
Minimum	-2.866408
Std. Dev.	0.990826
Skewness	0.477859
Kurtosis	4.124819
Jarque-Bera	23.69246
Probability	0.000007



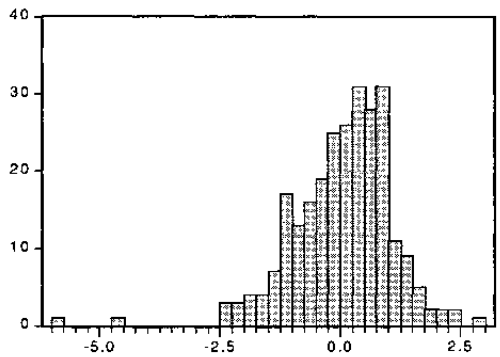
Series: RESIDAU
Sample 1/01/1996 12/31/1996
Observations 262

Mean	-0.086074
Median	-0.115959
Maximum	3.145824
Minimum	-3.603626
Std. Dev.	0.902310
Skewness	-0.067299
Kurtosis	4.897897
Jarque-Bera	39.51975
Probability	0.000000



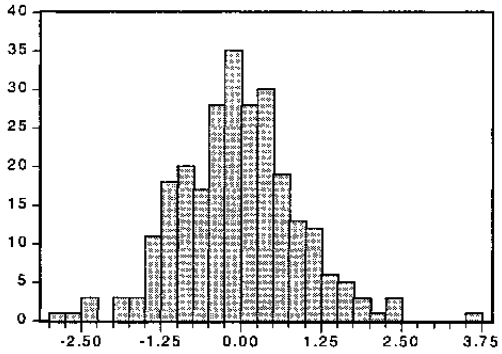
Series: RESIDAU
Sample 1/01/1997 12/31/1997
Observations 261

Mean	0.107274
Median	0.033883
Maximum	3.905256
Minimum	-4.620351
Std. Dev.	1.032095
Skewness	-0.241238
Kurtosis	5.674586
Jarque-Bera	80.32488
Probability	0.000000



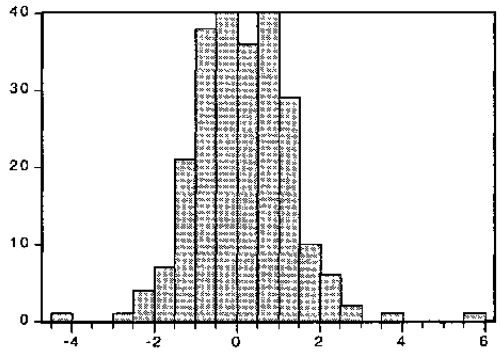
Series: RESIDAU
Sample 1/01/1998 12/31/1998
Observations 261

Mean	0.035256
Median	0.169596
Maximum	2.754563
Minimum	-5.776909
Std. Dev.	1.039197
Skewness	-1.091223
Kurtosis	7.248660
Jarque-Bera	248.1043
Probability	0.000000



Series: RESIDAU
Sample 1/01/1999 12/31/1999
Observations 261

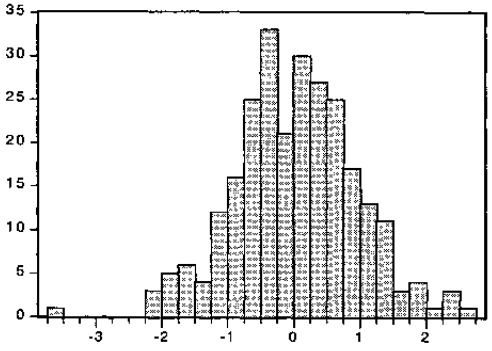
Mean	-0.062095
Median	-0.066620
Maximum	3.572363
Minimum	-2.780184
Std. Dev.	0.931988
Skewness	0.193175
Kurtosis	3.837164
Jarque-Bera	9.244957
Probability	0.009828



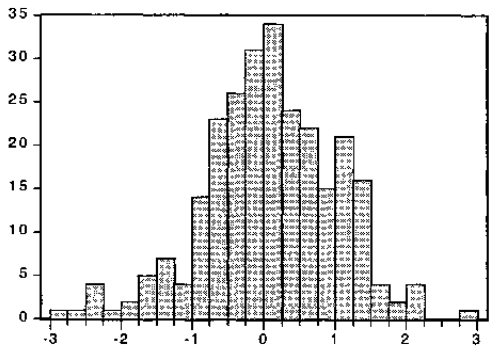
Series: RESIDAU
Sample 12/31/1999 12/29/2000
Observations 261

Mean	0.089292
Median	-0.026912
Maximum	5.551869
Minimum	-4.487360
Std. Dev.	1.095748
Skewness	0.361768
Kurtosis	6.045064
Jarque-Bera	106.5306
Probability	0.000000

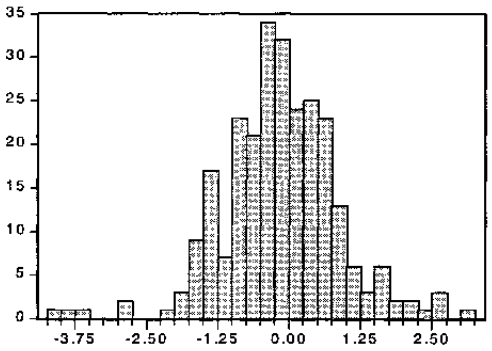
Figure 4F. New Zealand (Residual Distribution from Random Walk Regression)



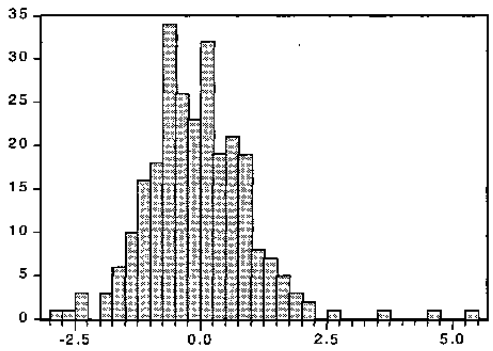
Series: RESIDNZ	
Sample 12/30/1994 12/29/1995	
Observations 251	
Mean	0.018120
Median	0.017999
Maximum	2.700967
Minimum	-3.702063
Std. Dev.	0.926385
Skewness	-0.111636
Kurtosis	3.665205
Jarque-Bera	5.354284
Probability	0.068759



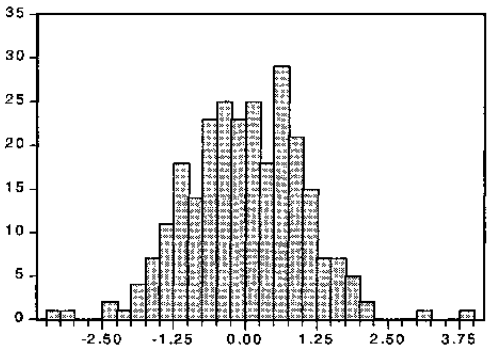
Series: RESIDNZ	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	0.091628
Median	0.095576
Maximum	2.883409
Minimum	-2.833836
Std. Dev.	0.928804
Skewness	-0.292644
Kurtosis	3.482208
Jarque-Bera	6.278035
Probability	0.043325



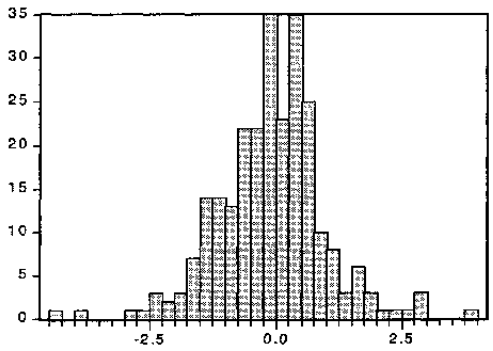
Series: RESIDNZ	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	-0.155743
Median	-0.172568
Maximum	3.070416
Minimum	-4.159961
Std. Dev.	1.014474
Skewness	-0.214304
Kurtosis	4.964837
Jarque-Bera	43.98167
Probability	0.000000



Series: RESIDNZ	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.056442
Median	-0.135382
Maximum	5.352036
Minimum	-2.905420
Std. Dev.	1.034466
Skewness	1.014906
Kurtosis	7.122268
Jarque-Bera	229.6064
Probability	0.000000

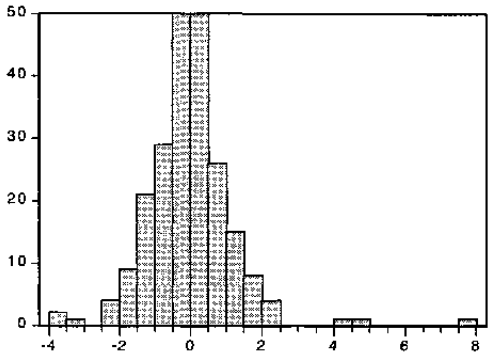


Series: RESIDNZ	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	-0.004132
Median	0.007730
Maximum	3.771434
Minimum	-3.293348
Std. Dev.	1.017013
Skewness	-0.002380
Kurtosis	3.603494
Jarque-Bera	3.960975
Probability	0.138002

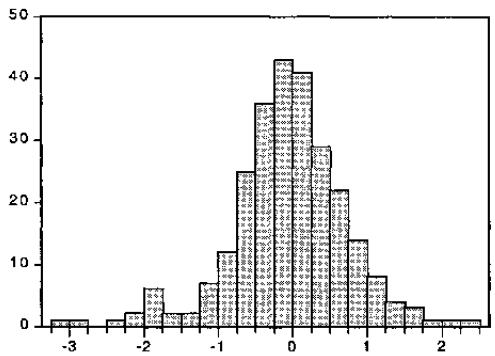


Series: RESIDNZ	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	-0.096179
Median	-0.074833
Maximum	3.970019
Minimum	-4.434795
Std. Dev.	1.056225
Skewness	-0.099306
Kurtosis	5.181240
Jarque-Bera	52.17016
Probability	0.000000

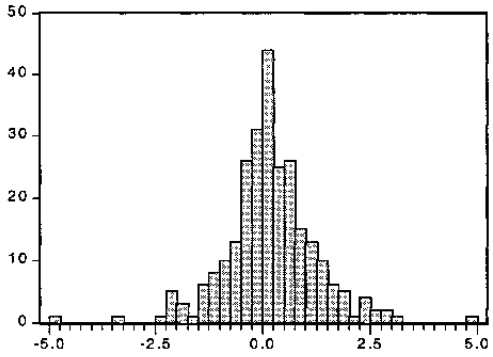
Figure 4G. Singapore (Residual Distribution from Random Walk Regression)



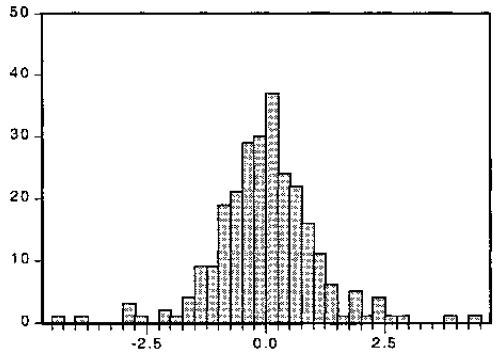
Series: RESIDSG	
Sample 12/30/1994 12/29/1995	
Observations 261	
Mean	-0.034907
Median	-0.106004
Maximum	7.910030
Minimum	-3.960811
Std. Dev.	1.112240
Skewness	1.515829
Kurtosis	14.65124
Jarque-Bera	1576.249
Probability	0.000000



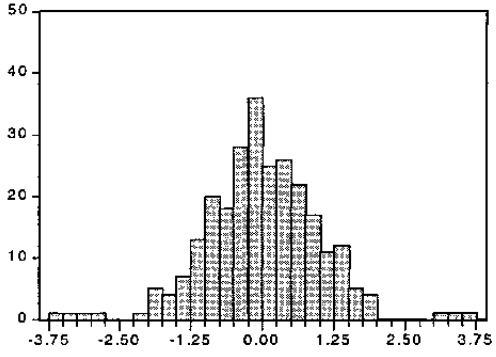
Series: RESIDSG	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	-0.057465
Median	-0.032380
Maximum	2.434458
Minimum	-3.215965
Std. Dev.	0.777920
Skewness	-0.421272
Kurtosis	4.878017
Jarque-Bera	46.25204
Probability	0.000000



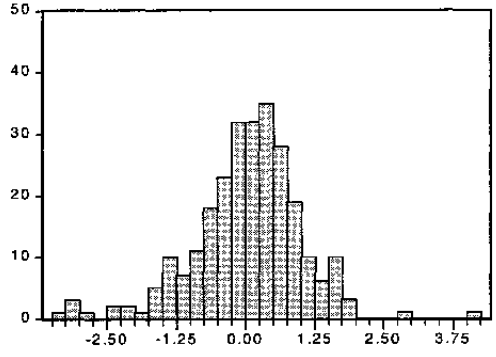
Series: RESIDSG	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.175812
Median	0.154723
Maximum	4.797088
Minimum	-4.792673
Std. Dev.	1.053811
Skewness	-0.050874
Kurtosis	6.301837
Jarque-Bera	118.6732
Probability	0.000000



Series: RESIDSG	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	0.000520
Median	0.006434
Maximum	4.491123
Minimum	-4.486412
Std. Dev.	1.059245
Skewness	-0.031810
Kurtosis	6.308948
Jarque-Bera	119.1159
Probability	0.000000

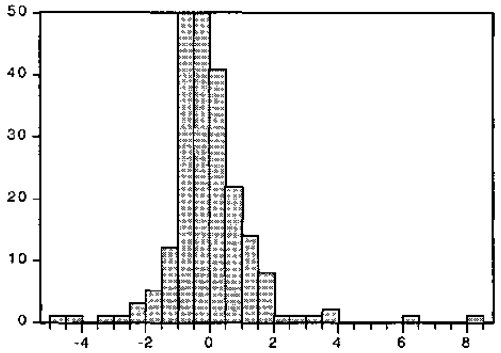


Series: RESIDSG	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	-0.007632
Median	-0.081276
Maximum	3.553047
Minimum	-3.681822
Std. Dev.	0.992639
Skewness	-0.066640
Kurtosis	4.801833
Jarque-Bera	35.49998
Probability	0.000000

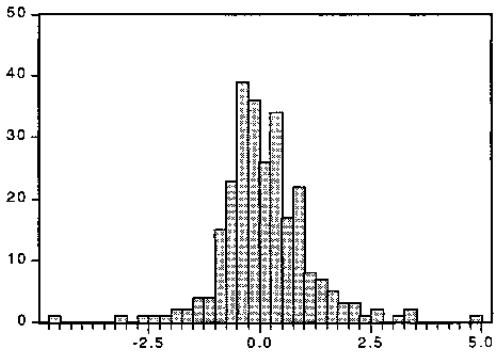


Series: RESIDSG	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	0.037141
Median	0.119414
Maximum	4.080428
Minimum	-3.353377
Std. Dev.	0.972811
Skewness	-0.396214
Kurtosis	5.076256
Jarque-Bera	53.70924
Probability	0.000000

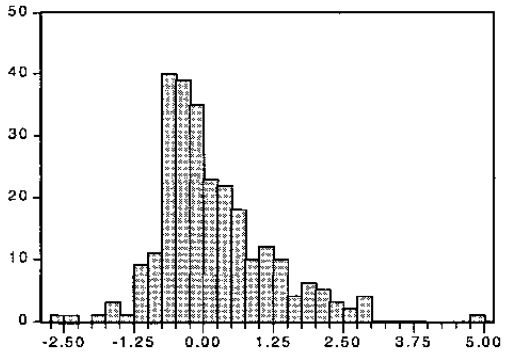
Figure 4H: Turkey (Residual Distribution from Random Walk Regression)



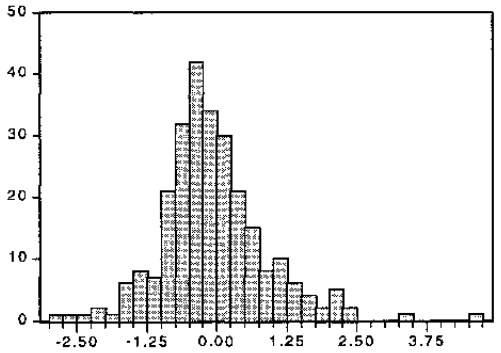
Series: RESIDTK	
Sample 12/30/1994 12/29/1995	
Observations 261	
Mean	-0.063710
Median	-0.204763
Maximum	8.306227
Minimum	-4.762612
Std. Dev.	1.173022
Skewness	1.914743
Kurtosis	17.16369
Jarque-Bera	2347.282
Probability	0.000000



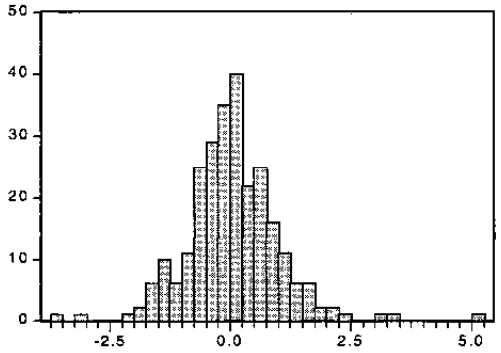
Series: RESIDTK	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	0.103005
Median	0.013415
Maximum	4.774133
Minimum	-4.551140
Std. Dev.	0.996629
Skewness	0.303448
Kurtosis	7.179460
Jarque-Bera	194.7119
Probability	0.000000



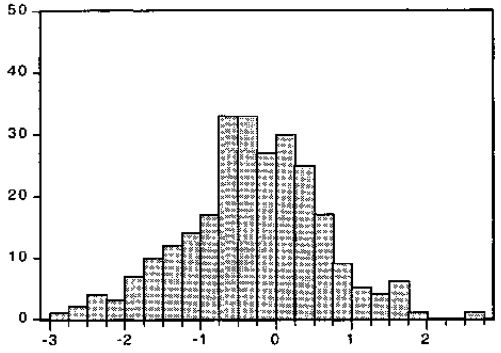
Series: RESIDTK	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.148020
Median	-0.090339
Maximum	4.790174
Minimum	-2.718913
Std. Dev.	0.981394
Skewness	0.968203
Kurtosis	5.063630
Jarque-Bera	88.79167
Probability	0.000000



Series: RESIDTK	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.075799
Median	-0.150453
Maximum	4.670086
Minimum	-2.964729
Std. Dev.	0.937571
Skewness	0.776659
Kurtosis	5.953332
Jarque-Bera	121.0927
Probability	0.000000

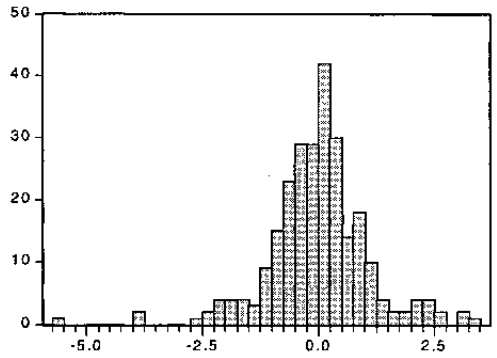


Series: RESIDTK	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	0.045284
Median	0.016811
Maximum	5.232961
Minimum	-3.506182
Std. Dev.	0.940382
Skewness	0.575267
Kurtosis	7.332800
Jarque-Bera	218.5536
Probability	0.000000

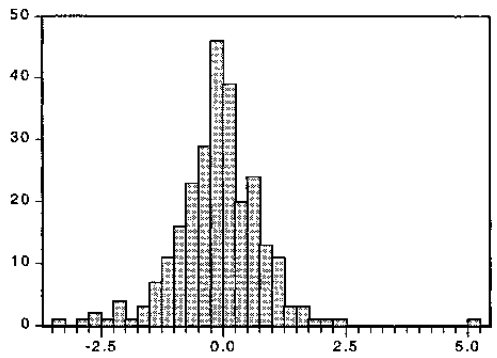


Series: RESIDTK	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	-0.304326
Median	-0.284558
Maximum	2.693594
Minimum	-2.925398
Std. Dev.	0.903937
Skewness	-0.104501
Kurtosis	3.381434
Jarque-Bera	1.895695
Probability	0.387574

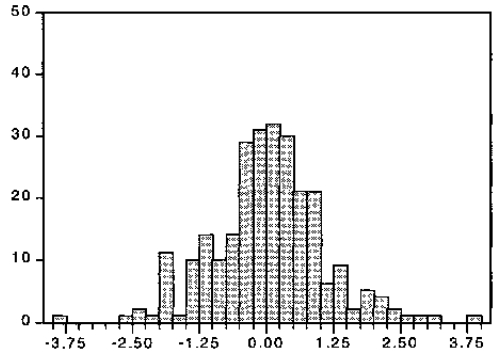
Figure 4I. UK (Residual Distribution from Random Walk Regression)



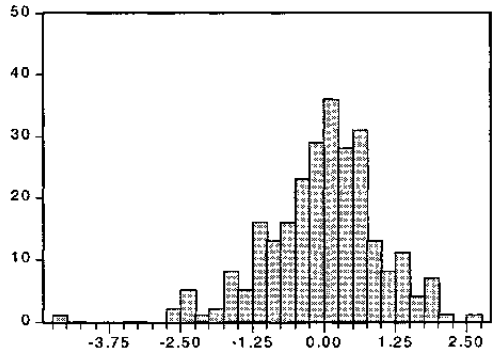
Series: RESIDUK	
Sample 12/30/1994 12/29/1995	
Observations 261	
Mean	-0.001541
Median	0.052795
Maximum	3.433003
Minimum	-5.681845
Std. Dev.	1.082800
Skewness	-0.516250
Kurtosis	6.970184
Jarque-Bera	183.0090
Probability	0.000000



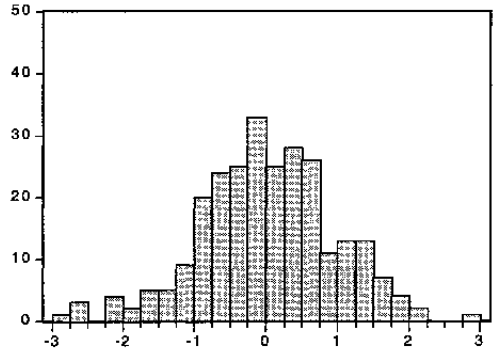
Series: RESIDUK	
Sample 1/01/1996 12/31/1996	
Observations 262	
Mean	-0.093377
Median	-0.077815
Maximum	5.245051
Minimum	-3.408745
Std. Dev.	0.894950
Skewness	0.357500
Kurtosis	8.284014
Jarque-Bera	310.3829
Probability	0.000000



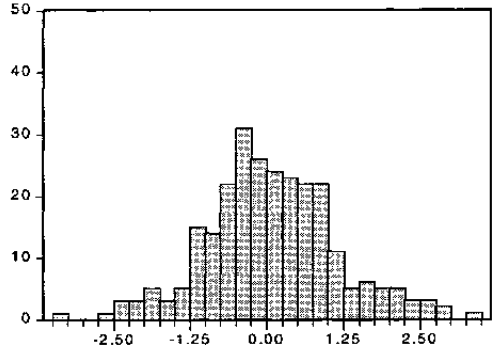
Series: RESIDUK	
Sample 1/01/1997 12/31/1997	
Observations 261	
Mean	0.027532
Median	0.026540
Maximum	3.970366
Minimum	-3.869072
Std. Dev.	1.032512
Skewness	0.097640
Kurtosis	4.381428
Jarque-Bera	21.16793
Probability	0.000025



Series: RESIDUK	
Sample 1/01/1998 12/31/1998	
Observations 261	
Mean	-0.015342
Median	0.064753
Maximum	2.611113
Minimum	-4.570958
Std. Dev.	0.975191
Skewness	-0.605856
Kurtosis	4.598651
Jarque-Bera	43.76027
Probability	0.000000



Series: RESIDUK	
Sample 1/01/1999 12/31/1999	
Observations 261	
Mean	0.021554
Median	-0.016704
Maximum	2.791230
Minimum	-2.888779
Std. Dev.	0.945533
Skewness	-0.180897
Kurtosis	3.390706
Jarque-Bera	3.083565
Probability	0.213999



Series: RESIDUK	
Sample 12/31/1999 12/29/2000	
Observations 261	
Mean	0.075214
Median	0.031323
Maximum	3.364765
Minimum	-3.399783
Std. Dev.	1.070113
Skewness	0.175058
Kurtosis	3.562500
Jarque-Bera	4.773990
Probability	0.091905