

Capital Controls during Financial Crises

The Cases of Malaysia and Thailand

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12.1 INTRODUCTION

In the 1990s, net capital inflows to developing countries grew substantially, particularly to those countries that had liberalized their capital accounts. As countries experienced surges in capital flows, the debate on how to manage these surges became a pressing policy topic. Capital controls, when they were discussed at all, were examined in the context of liberalizing restrictions on capital outflows, or in terms of which types of capital inflows should be taxed. However, with the most recent wave of financial market turbulence there has been a shift in the debate on capital controls. The types of controls that were contemplated or used during the recent crises were very different from the measures introduced during the inflow phase of the capital flow cycle (see Reinhart and Smith, 1998). These types of controls are applied mainly to outflows and are viewed as “last resort” measures as opposed to controls being applied to inflows which were interpreted as “prudential.”

Controls on capital outflows have been advocated as a way of dealing with financial and currency crises. These controls can take a number of forms: restrictions on capital account transactions including taxes on funds remitted abroad, outright prohibition of funds’ transfers, dual exchange rates, and outright prohibition of cross-border movement of funds.¹ The idea behind these measures is that they help slow down the

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¹ The measures may also be more subtle. For instance, in early 1999, Brazil increased the share of a local financial firm’s portfolio that must be held in domestic sovereign bonds (for details see Edison and Reinhart, 1999).

drainage of international reserves and capital outflows and give the authorities time to implement corrective policies. Paul Krugman (1998) has argued that countries facing major crisis might benefit from temporary imposition of controls on outflows, by giving the country the time to lower their domestic interest rates and put into place a pro-growth package.² Malaysia and, for a short while, Thailand followed this path in 1997–1999.

The initial reaction to the imposition of controls, especially for Malaysia, was quite negative. Subsequently, however, Malaysia seems to have fared reasonably well – although not as well as Korea, which did not introduce new restrictions on capital movements. Furthermore, institutional investors appear to have short memories, because Malaysia’s controls do not seem to have reduced investors’ appetite for returning to Malaysian capital markets once controls were eased. To quote a recent article on Malaysia:

Stocks of companies that were sold off two years ago and criticized for crony capitalist practices are being snapped up by foreign buyers at a fevered pace. Most companies have done little to address the flaws that foreign investors decried at the time. Almost all companies are under the same management as they were then.

Thomas Fuller, *International Herald Tribune*, Paris, January 18, 2000.

Not surprisingly, the use of such “market unfriendly” measures in times of stress is receiving considerable attention among academic and policy circles. The purpose of this study is to examine systematically two crisis-capital control episodes – Malaysia 1998–1999 and Thailand 1997 – in greater detail. We aim to assess the extent to which the capital controls were effective and successful in delivering some of the outcomes that motivated their inception in the first place.

For our case studies, we look at two types of data. First, we study monthly data. We focus on the movement of foreign exchange reserves and capital flows. In addition, we examine data from the United States International Capital Reports (TIC) to investigate how U.S. portfolio flows changed in the aftermath of controls. This data spans January 1988 to March 1999. Second, we examine daily data covering the period January 1996 through July 23, 1999 for key financial variables including: interest rates, equity market returns, exchange rate changes, domestic-foreign interest rate differentials, and bid-ask spreads on foreign exchange.

² For example, after the introduction of capital controls in Malaysia, other measures were introduced to stimulate the economy and reduce the burden of banks.

We employ a variety of empirical tests to attempt to examine the effectiveness of capital controls. For the monthly data, we test for differences in basic descriptive statistics in the capital control and no control periods. For the daily data, we also consider tests for the equality of moments and changes in persistence to address changes in behavior of key financial variables. In addition, we test for changes in cross-border volatility using GARCH tests for the effects of controls on volatility, as in Edwards (1998).

There are, of course, several limitations and concerns with the kind of analysis we undertake. First, results are episode-specific, not “stylized facts.” Second, given that these kinds of controls are introduced during periods of turbulence, it is particularly difficult to separate what is attributable to the controls and what is due to the financial crisis per se. For instance, a generalized withdrawal from risk-taking (as what followed the Russia/LTCM episode in the fall of 1998) can have similar implications and outcomes as the introduction of capital controls (see Kaminsky and Reinhart, 2000). Namely, international flows dry up, spreads widen, volatility in asset markets increases, and so on. In addition, our empirical methodology assumes linearities in relationships, which may break down during periods of extreme market stress – an issue that is highlighted in multiple-equilibria crises models. These caveats apply especially to analysis of the daily data but also to the monthly data we consider as well.

With these caveats in mind, our key empirical findings are summarized below. First, the monthly data on foreign reserves and capital flows highlight some of the differences in the Malaysian and Thai experiences with capital controls. The monthly results suggest that in Malaysia, economic relationships changed, while in Thailand, things seemed to continue to get worse. For example, foreign exchange reserves continued to fall during the period of capital controls in Thailand, while they increased immediately following the imposition of controls in Malaysia.³

Second, we find that interest rates were less variable in both Malaysia and Thailand following the introduction of controls, but the level was lower only in Malaysia during the control period. Stock returns tended to be more variable following the introduction of capital controls – especially so in the case of Thailand – consistent with the view that more of the burden of adjustment falls on prices when the change in quantities is restricted. The exchange rate was more stable during the control period for Malaysia, while it was more variable for Thailand.

³ As shown in Kaminsky, Lyons, and Schmukler (2000) and reproduced here, however, mutual fund flows to Malaysia turn sharply negative after the introduction of capital controls.

Third, as to the side effects of capital controls, we find that foreign exchange bid–ask spreads were uniformly wider and more variable during the control periods. Also, onshore–offshore interest rate spreads widened and become more volatile following the introduction of controls.

Fourth, our results suggest that there is little evidence that capital controls were effective in reducing volatility spillovers. In the case of Malaysia, the results suggested that capital controls dampened the spillover, but it did not eliminate the spillover, although this result was not robust across all model specifications.

The remainder of the paper is organized as follows. The next section discusses the reasons why countries might apply controls and also discusses the theoretical predictions of the effects of those controls. Section 12.3 describes the measures and their chronology in Malaysia and Thailand. The following two sections examine the effectiveness of capital controls, describing empirical tests performed, their outcomes, and their implications. First, we focus on monthly data, examining capital flows and other macroeconomic indicators. Then we consider daily data, assessing financial variables including interest rates, equity returns, and exchange rate changes. The final section discusses possible extensions and policy implications of the analysis.

12.2 THEORETICAL PREDICTIONS OF THE EFFECTS OF CONTROLS

In this section we first review some of the reasons most often voiced by policy makers for resorting to capital controls during periods of turbulence. Knowing what the stated expectations from the policy change are in the first place is essential to assess whether the policy was “effective” or “successful.” Because many of these expectations are based on an implicit model, we then proceed to summarize the implications of capital controls for some of the variables of interest.

12.2.1 Reasons for Resorting to Capital Controls during Crisis Periods

The first line of defense by central banks dealing with speculative attacks on their currencies is usually to sell off their holdings of foreign exchange. However, central bank holdings of foreign exchange are often inadequate to support the currency; and even if the initial stock is high by international standards, recurring runs on the currency can quickly deplete the initial war chest. Not surprisingly, policymakers will often cite the need to stem the drain on foreign exchange reserves as a motivation for introducing capital controls during periods of extreme market stress.

Also central banks can (and often do) react to speculative pressures by raising interest rates, occasionally to prohibitively high levels. However, given the consequences of high interest rates on economic activity and debt servicing costs, this policy alternative is not particularly appealing either – especially if the pressures persist over an extended period and the domestic financial system is weak. Hence, capital controls are seen as a course of action that would enable the monetary authorities to maintain lower (and more stable) interest rates than would be the case under free capital mobility – especially if credibility has been lost. More generally, controls can (if they are effective) fulfill the authorities' desire to regain autonomy in monetary policy – without floating the exchange rate.

Because volatile international bond and equity portfolio flows are frequently viewed as a destabilizing force in asset markets and, more generally, in the financial system, another reason that is often cited for introducing controls is the desire to reduce the volatility in asset prices.

12.2.2 Theoretical Priors

The Mundellian trinity suggests that fixed (or quasi-fixed) exchange rates, independent monetary policy, and perfect capital mobility cannot be achieved simultaneously. Capital controls are a way of allowing the authorities to retain simultaneous control over the interest rate and the exchange rate. Capital controls may be particularly appealing when the authorities are reluctant to allow the exchange rate to float freely, which is the case in most emerging markets (EMs) (see Calvo and Reinhart, 1999). Fear of floating may arise for a variety of reasons, including the dollarization of liabilities – but for the purposes at hand, however, those reasons are not central to our analysis. The important point for our analysis is that controls introduce a systematic wedge between domestic and foreign interest rates. As uncovered interest rate parity breaks down, the domestic policy interest rate (from the vantage point of a small open economy) need not follow international interest rates.⁴ In principle, variation in that wedge can be introduced by the authorities to influence the exchange rate systematically. One example of this is the theoretical model of Reinhart and Reinhart (1998), who trace out the effects of one of the simplest forms of capital controls – a reserve requirement. Depending on the degree of competition among financial intermediaries, Reinhart and Reinhart show that the wedge between foreign and

⁴ Of course, imperfect asset substitutability and a time-varying risk premium are sufficient to explain a breakdown of uncovered interest parity – even in the absence of capital controls.

domestic interest rates induced by the reserve requirement influences the response of the exchange rate and the real economy to shocks.

The potential consequences of capital controls become even more pervasive in models that provide an important role for asset stocks in affecting an economy. The general mechanism at work is that, if the flow of capital is restricted in any way, then the burden of adjustment in asset markets falls more on prices. Calvo and Rodriguez (1979) first showed how sluggishness in the flow of international assets can generate overshooting of the exchange rate. Reinhart (2000) broadened that model by incorporating equity prices and introducing three different kinds of restrictions on capital flows. The implication in Reinhart's framework is that equity price volatility should increase with the imposition of controls. A shock to the desired portfolio allocation generally triggers adjustments to both asset quantities and prices. Capital controls shift more of that adjustment toward prices and, to the extent that they introduce interest rate wedges, may also alter the relationship between asset prices and the policy rate.

Edison and Reinhart (1999) provide details about the predictions of theory for a host of financial variables. Some of the key predictions are as follows:

- The declines in foreign exchange reserves and capital outflows should both either stop or reverse themselves.
- The level of domestic interest rates should decline as high interest rates are no longer necessary to prevent capital outflows. There should also be a decline in interest rate volatility.
- The implications of a decline in market liquidity – whether owing to a capital control or a generalized withdrawal from risk taking – are also straightforward. Bid–ask spreads in the market(s) where liquidity has diminished should widen and become more volatile.

12.3 THE CONTROL EPISODES

In this section we describe the timing and nature of the selected capital control episodes as well as some of the more relevant events surrounding the introduction and lifting of these measures.

12.3.1 The Policy Measures and Chronology of Events

The capital control episodes that we analyze are: Thailand (May 14, 1997–January 30, 1998) and Malaysia (September 1, 1998 to present). The chronology of the episodes and further details of the measures are summarized in Table 12.1. We briefly discuss these episodes below.

Table 12.1. A Chronology of Key Events

Episode and Country	Date	Key Events
Thailand, Asian crisis, 1997–1998	May 14, 1997	Bank of Thailand (BOT) introduces restrictions on capital account transactions.
	May 28	BOT limits outright forward transactions.
	June 2	BOT introduces additional measures to limit capital flows.
	June 10	Baht proceeds from sales of stocks required to be converted at the onshore exchange rate. Additional controls are introduced.
	June 18	The onshore–offshore interest rate differential hits a peak at 639 percent.
	July 2	BOT introduces a two-tier exchange rate. Thai baht is devalued.
	September 23	Additional controls on invisible and current account transactions are introduced.
	January 7, 1998	Proceeds on exports and invisible transactions and current account transfers must be surrendered after 7 days (instead of 15 days).
	January 30, 1998	BOT ends two-tier exchange rate.
	February 3, 1998	The stock market suffers its largest one-day decline (9.5 percent).
Malaysia, Asian crisis, 1997–1998	July 14, 1997	Interest rates peak.
	January 5, 1998	Ringgit suffers its largest daily decline (7.5 percent) against the dollar.
	September 1, 1998	Exchange controls introduced.
	September 2, 1998	Exchange rate is fixed.
	September 7, 1998	The stock market suffers its largest one-day decline (down 22 percent).
	February 4, 1999	Exchange controls modified. New rule introduced to replace one-year holding period rule for portfolio capital. Under the new rules, a declining scale of exit levies replaced the 12-month holding restriction on repatriation of portfolio capital.

Source: News and IMF reports.

In the face of speculative attacks, the Thai authorities imposed capital controls in May 1997. The goal of these controls was to stabilize the foreign exchange market as speculative pressure continued to mount. The Bank of Thailand was concerned that using an interest rate defense as a means to defend the baht would have adverse effects on economic activity and the banking system. The capital control measures put in place were aimed at closing the channels for speculation, creating a two-tiered currency market. This system was aimed at denying speculators access to funds. The measures they used were not as sweeping as those that Malaysia subsequently put in place. However, the controls initially seemed to work as offshore interest rates rose above the domestic rates. The baht was floated on July 2, 1997, and controls were left in place until January 30, 1998.

In September 1998 the Malaysian authorities imposed a number of administrative exchange and capital control measures aimed at containing ringgit speculation and the outflow of capital. The measures sought to increase monetary independence and insulate the economy from potential shocks from the global economy, such as Russia and LTCM. The Malaysian authorities were concerned that domestic interest rates would have to be kept unusually high for long periods of time, producing unhelpful effects on economic activity and the banking system.⁵ Hence in September they closed all channels for the transfer of ringgit abroad and required repatriation of ringgit held abroad to Malaysia. In addition they blocked the repatriation of portfolio capital held by nonresidents for 12 months, and imposed restrictions on transfer of capital by residents. These controls were supported by additional measures to eliminate loopholes. On February 4, 1999, the 12-month holding restriction was replaced with a declining scale of exit levies.

There are two obvious differences between the Thai and Malaysian experience. The first difference is that Thailand was undergoing speculative attacks and tried to use capital controls as a defense mechanism. In contrast, Malaysia was not undergoing extreme speculative pressure when they applied their controls. The second difference is that the Malaysian controls were broad and attempted to eliminate all obvious loopholes. In contrast, the controls Thailand put into place, at least in hindsight, were not comprehensive enough to eliminate the speculative pressure on the baht.

⁵ It is important to consider the highly leveraged condition of the Malaysian economy at this time, with bank loan to GDP ratios of about 160 percent.

12.4 THE EFFECTIVENESS OF CONTROLS: IMPACT ON CAPITAL FLOWS

In this section we attempt to describe broadly the economic situation prior to the application of capital controls and the subsequent developments, considering data on economic activity, foreign exchange reserves, interest rates, and exchange rates. In addition, we examine monthly capital flow data, using data from the U.S. International Capital Transaction Report; these data capture bilateral U.S. capital flows with Malaysia and Thailand. The data on mutual fund flows are taken from a broader study of the patterns and determinants of these flows by Kaminsky, Lyons, and Schmukler (2000).

12.4.1 Economic Performance

There are a limited number of tests that one can use to analyze the monthly data because there are too few observations during the period of controls in both cases. However, a quick look at some graphs and descriptive statistics illustrates the vast differences in the results that capital controls appear to have yielded in Malaysia and Thailand.

Figure 12.1 shows plots of data on industrial production, foreign exchange reserves, interest rates, and the exchange rate for Malaysia. After September 1998, industrial production increased more than 8 percent, despite dropping significantly after controls were initially applied. Foreign exchange reserves rose steadily from \$20 billion in late August 1998 to \$27 billion in April 1999. Interest rates fell to below precrisis levels: In 1997, interest rates averaged just over 7 percent; in June 1999 these same 1-month interest rates were slightly more than 3 percent. In addition, the exchange rate that had started depreciating in July 1997 was stabilized by the authorities, pegging the rate against the dollar. Taken by themselves, these facts suggest that the capital controls may have helped Malaysia insulate its economy. Yet, the behavior of interest rates and economic activity of the other crisis-hit countries, Korea and Thailand, suggests that these countries also experienced improved economic performance around the same time as Malaysia. It is not clear whether capital controls contributed to improving Malaysia's performance. At a minimum, this finding suggests that capital controls did not harm Malaysia, as some critics of the measures feared. However, as Figure 12.2 (taken from Kaminsky, Lyons, and Schmukler, 2000) suggests, in the month of September 1998 (labeled "After the Russian Crisis," which began on August 17, 1998) Malaysia posted record outflows among the countries in the sample, casting a lukewarm reading on the success of the controls.

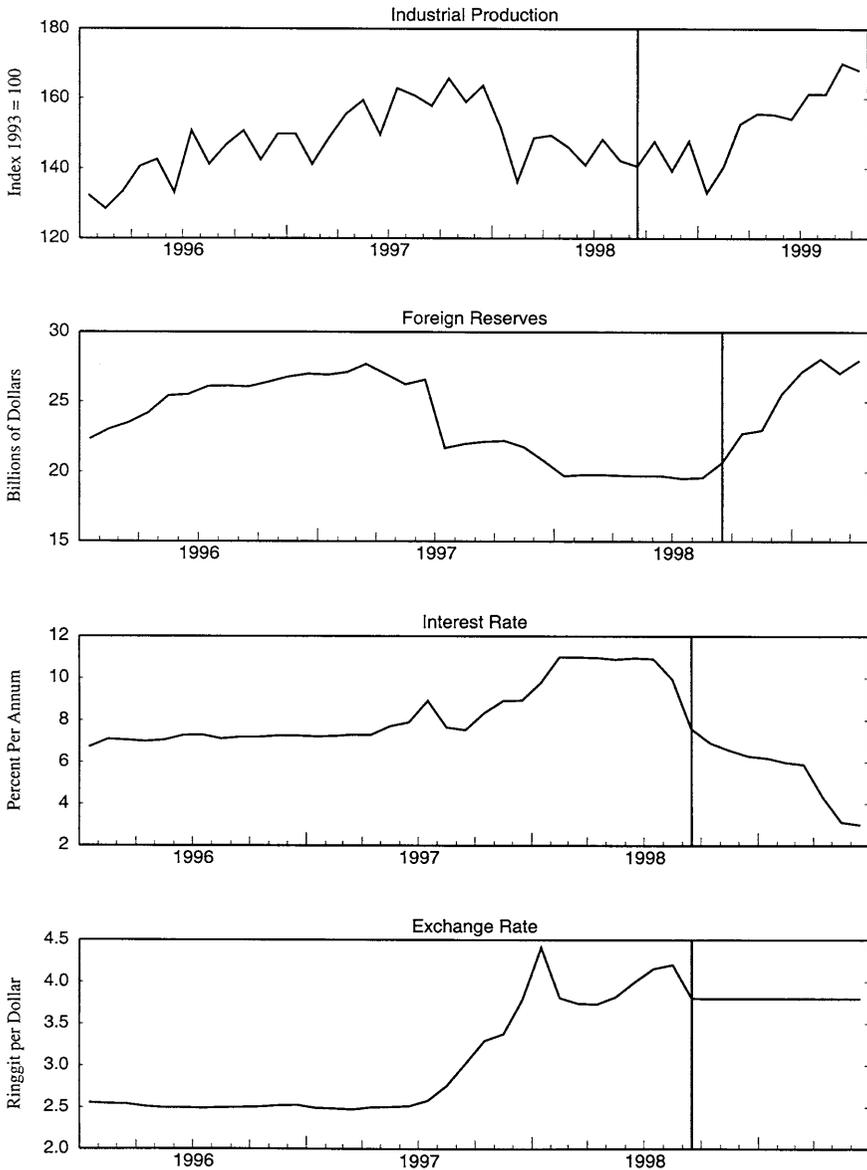


Figure 12.1. Malaysia: Selected indicators. (Source: Bank Negara Malaysia website.)

After the Russian Crisis

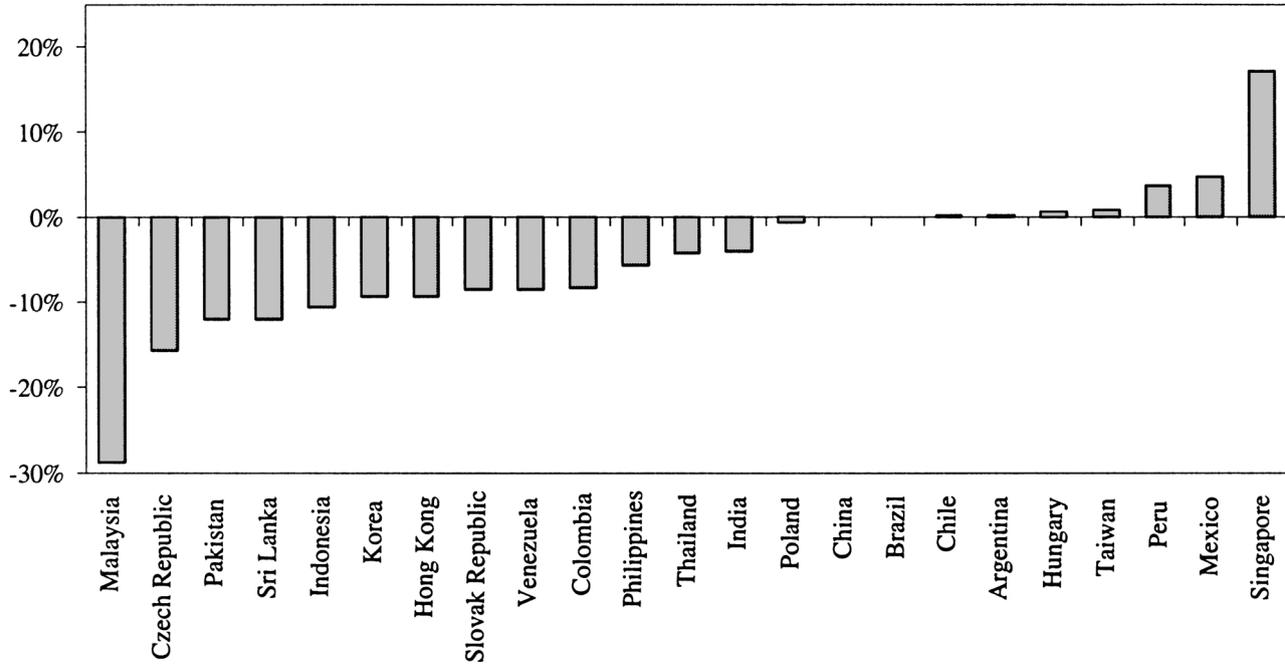


Figure 12.2. Mutual fund flows: Global spillovers. (Source: Kaminsky, Lyons, and Schmukler, 2000.) Note: The Russian crisis began August 1998. Mutual fund flows are the average net buying/selling (as percentage of the end of the preceding quarter holdings) in the two quarters following the outbreak of the crisis, relative to the sample average.

Figure 12.3 gives the same data for Thailand. A completely different story emerges when considering the economic performance of Thailand, following its use of capital controls. As noted earlier, Thailand applied capital controls in May 1997, hoping to prevent a full-blown currency crisis. In contrast to Malaysia, Thailand was not able to prevent the crisis and in fact some policymakers have argued that the capital controls may have exacerbated the problem for Thailand. Figure 12.3 shows that industrial output declined, foreign exchange reserves fell, interest rates rose, and the exchange rate lost half of its value against the dollar. These observations suggest that capital controls failed to stop the currency crisis. It is important to note, however, that while Thailand introduced the controls in the midst of crisis, Malaysia's controls were introduced at a time in which financial markets had begun to settle. This difference in timing may also be a key factor in explaining the difference between the two countries' outcomes.

The top rows of Tables 12.2 and 12.3 provide descriptive statistics (mean and standard deviations) for foreign exchange reserve levels in Malaysia and for foreign reserves as well as private capital flows in Thailand. The tables also report tests for the equality of first and second moments between period of capital control and free capital mobility. For Malaysia (Table 12.2) we find that the average level of foreign reserves is higher during the control episode, but this difference is not statistically significant. In Thailand (Table 12.3), we find that foreign reserves are, on average, lower during the capital controls period and that outflows are higher and more variable. The results for Thailand are statistically significant and are quite suggestive that controls did not insulate the Thai economy.

Figure 12.4 shows private capital flow data for Malaysia (upper panel) and Thailand (lower panel). Both figures are plotted in local currency: ringgit for Malaysia and baht for Thailand. Unfortunately, the data for Malaysia are quarterly and end with the fourth quarter of 1998, owing to long reporting lags. It appears that the large capital outflows stopped following the application of capital controls. Note that there was also a huge capital outflow the third quarter of 1997, owing to the general crisis in Asia. The lower panel, which shows capital flows for Thailand, suggests that Thailand's capital controls were not effective in preventing outflows of capital. From May 1997 through the crisis, capital outflows increased despite the use of capital controls.

12.4.2 Capital Flows to and from the United States: The TIC Data

In this section we employ a database on U.S. capital flows to and from Malaysia and Thailand, starting in January 1988 and ending in March

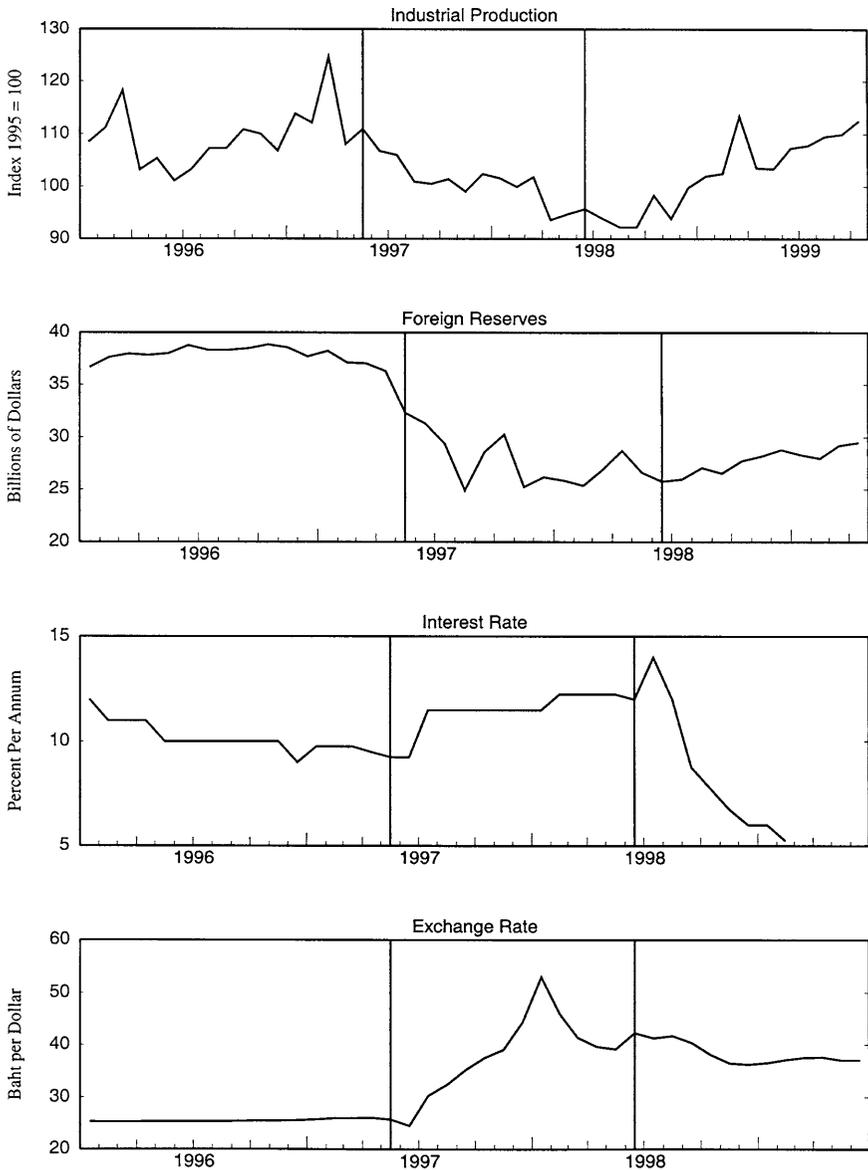


Figure 12.3. Thailand: Selected indicators. (Source: Bank of Thailand website.)

Table 12.2. Malaysia, January 1988 to March 1999: Descriptive Statistics for Monthly Data (in millions US \$)

Variable	Mean, No Controls	Mean, Control Period	Equality of Means <i>t</i> -Test Probability	Standard Deviation, No Controls	Standard Deviation, Controls	Equality of Variance Test ^a
Foreign reserve level ^b	23.5	24.9	0.26	2.9	2.7	0.85
Private capital inflows	NA	NA	NA	NA	NA	NA
U.S. TIC Bilateral Capital Flows:						
<i>Gross Flows</i>						
All	2,144.5	508	0.05*	2,214.6	242.5	0.003*
All bonds	1,838.9	430.9	0.07**	2,054.3	212.2	0.03*
U.S. private and foreign bonds	142.3	49.1	0.29	227.4	49.5	0.23
Equity	327.8	124.3	0.1**	325.0	51.7	0.08**
<i>Net Flows</i>						
All	-58.8	99.2	0.3	393.2	234.8	0.9
All bonds	-45.9	74.0	0.4	395.2	193.4	0.9
U.S. private and foreign bonds	-37.5	-6.6	0.7	211.9	38.2	0.7
Equity	-17.5	19.4	0.2	66.4	62.7	0.4
<i>Malaysian Equity Outflow</i>						
Equity	155.1	71.9	0.2	159.4	56.3	0.08**
<i>Malaysian Equity Inflow</i>						
Equity	172.6	52.4	0.07**	172.1	11.5	0.19

Notes: Capital control period is September 1998 to March 1999; no-controls period is period prior to September 1998.

* denotes significant at 5 percent level and ** denotes significant at the 10 percent level.

^a Reported test is based on Siegel-Tukey test.

^b In billions of U.S. dollars.

Source: Bank Negara Malaysia, U.S. Treasury International Capital (TIC) Transaction Report.

Table 12.3. Thailand, January 1988 to March 1999: Descriptive Statistics for Monthly Capital Flow Data (in millions of U.S. dollars)

Variable	Mean, No Controls	Mean, Control Period	Equality in Means <i>t</i> -Test Probability	Standard Deviation, No Controls	Standard Deviation, Controls	Equality in Variance Test ^a
Foreign reserve level ^b	32.8	28.2	0.02*	5.3	2.8	0.5
Private capital inflows	11,907	-54,366	0.00*	36,776	71,554	0.01*
U.S. TIC Bilateral Capital Flows:						
<i>Gross Flows</i>						
All	1,629.4	3,243.9	0.00*	1,566.4	1,672.4	0.51
All bonds	1,577.2	3,133.8	0.00*	1,560.0	1,660.3	0.52
U.S. private and foreign bonds	11.1	25.7	0.00*	11.6	12.7	0.03*
Equity	55.7	111.5	0.09**	88.7	175.2	0.46
<i>Net Flows</i>						
All	476.9	585.6	0.66	711.3	884.9	0.00*
All bonds	490.3	672.4	0.47	717.6	891.8	0.00*
U.S. private and foreign bonds	1.3	-1.3	0.3	7.2	7.4	0.9
Equity	-12.4	-84.8	0.01*	79.7	161.8	0.41
<i>Thailand Equity Outflow</i>						
Equity	21.6	13.3	0.43	31.2	14.3	0.48
<i>Thailand Equity Inflow</i>						
Equity	34.0	98.2	0.03*	78.3	168.1	0.72

Notes: Capital control period is May 1997 to January 1998; no-controls period is January 1988 to April 1997 and February 1998 to March 1999.

* denotes significant at 5 percent level and ** denotes significant at the 10 percent level.

^a Reported test is based on Siegel-Tukey test.

^b In billions of U.S. dollars.

Source: Bank of Thailand, U.S. Treasury International Capital (TIC) Transaction Report.

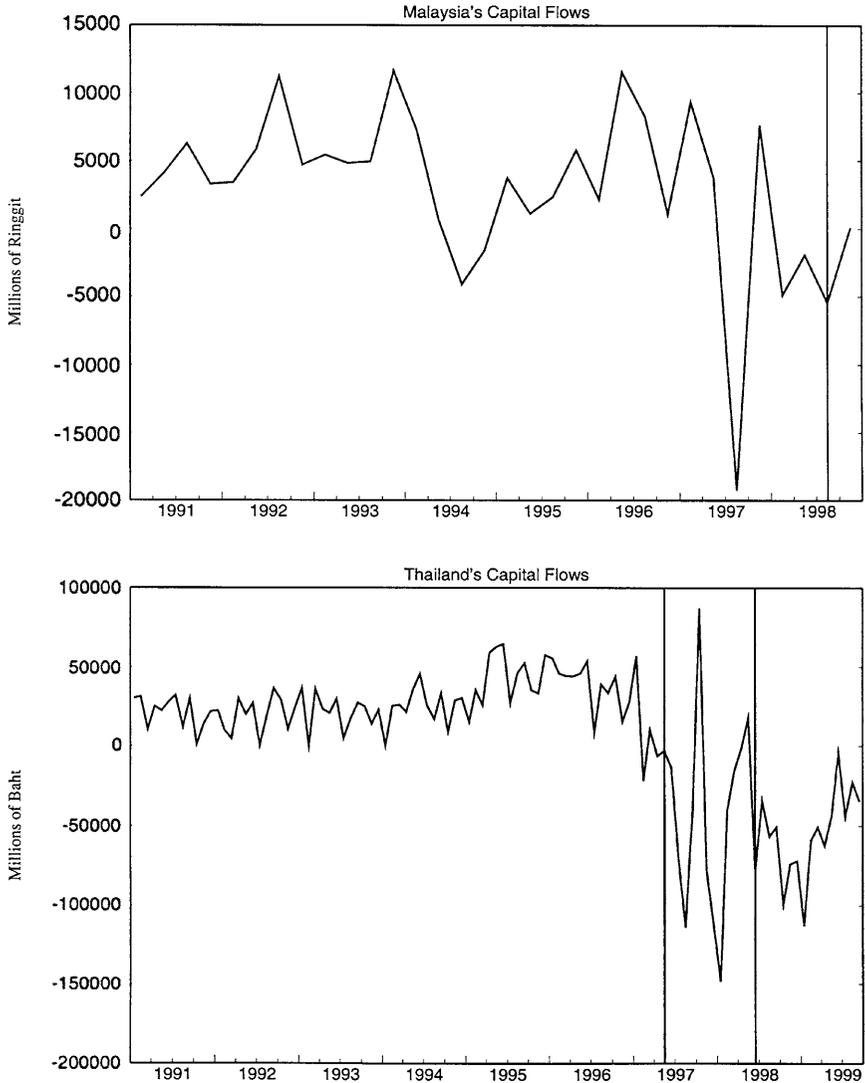


Figure 12.4. Capital flows for Malaysia and Thailand. (Source: Bank Negara Malaysia and Bank of Thailand websites.)

1999. The frequency of the data is monthly, and these times series were constructed using the International Capital Reports of the U.S. Treasury Department. We consider four broad categories of flows in the capital account: equity flows, U.S. private and foreign bond flows, all bond flows (including official U.S. flows), and total flows. We construct both gross

and net flows. Many studies seem to use net measures for equity and gross measures for bond flows. Gross bond flow measures tend to be used to abstract from the effect of sterilization policy actions and other types of reserve operations.

Once again we employ descriptive statistics in analyzing the data. The lower panels of Tables 12.2 and 12.3 report the results for Malaysia and Thailand, respectively. In the case of Malaysia, controls in general do not seem to be associated with lower capital flows to/from the United States. There is some indication that gross bond flows and especially equity flows were lower during the period of capital controls, but most of the time this difference was not statistically significant. This result might arise in part because the data focus exclusively on flows to and from the United States, which was not heavily involved in Malaysia, and in part because the period prior to the employment of controls lead to a significant amount of capital outflow and volatility.

The results for Thailand are suggestive that, if anything, capital flows increased during the period of capital controls. For example, gross flows of all bonds nearly doubled during the control period. These flows rose on average from \$1.5 billion to over \$3 billion during the controls period. (It should be noted, however, that these data include official flows as a result of the intervention in the foreign exchange market by the Bank of Thailand.) Despite the fact that the numbers are not statistically significant, the results consistently show that the level and the variability of these flows increased during the control episode.

Overall, our examination of the monthly data suggests that the experiences of Malaysia and Thailand were quite different. In the next section we analyze their experiences further using daily financial data.

12.5 THE EFFECTIVENESS OF CONTROLS: EVIDENCE FROM DAILY FINANCIAL DATA

In this section we employ an eclectic variety of tests to examine whether the periods when capital controls are in place are different. First, we examine the movement of these data and look at changes in mean, variance, and persistence. We then turn our attention to testing for volatility spillovers.

12.5.1 Interest Rates, Stock Returns, and Exchange Rates during Control and Crisis Periods

In Section 12.2 we provided a sketch of what theory predicts as regards the behavior of selected key financial variables following the introduc-

tion of measures that curtail international capital movements. In this section we confront those predictions with the data from the recent episodes for Malaysia and Thailand. We examine the behavior of daily interest rates and changes in interest rates, stock returns, exchange rate changes, bid–ask spreads on foreign exchange, domestic–foreign interest rate differentials, and onshore–offshore interest rate differentials (where relevant).

For each of these time series we provide descriptive statistics (means and standard deviations) and test for the equality of first and second moments between the capital control and free capital mobility periods. A correlogram for the individual subperiods is also used to assess whether the persistence of shocks changes as a result of the change in policy. We compare the crisis and tranquil periods with the aim of assessing the extent to which observed changes in the key variables may be attributed to the crisis rather than the capital controls. Tables 12.4 and 12.5 report the results for each country.

In the case of Malaysia (Table 12.4), controls seem to be associated with the kind of changes one would expect *a priori* if the controls were effective. The interest rate declines, and its level becomes more stable and persistent. Domestic–foreign interest rate spreads become lower and less variable. This holds for the spreads based on three, six, and twelve months. Similarly, the exchange rate also becomes more stable (the ringgit was pegged to the U.S. dollar on September 2, 1998). However, as the burden of adjustment in asset markets falls more on prices than on quantities, equity prices become more volatile. Bid–ask spreads in the foreign exchange market widen and became more volatile, reflecting reduced market liquidity.

The upper panel of Figure 12.5 shows that bid–ask spreads are indeed more volatile, compared to spreads prior to the flotation of the Thai baht in July 1997. However, starting in July 1997, there was a sharp widening of spreads which continued to deteriorate until controls were applied. With the application of capital controls, the large increase in volatility brought on by the region's financial crisis diminished, but volatility remained above precrisis levels.

The results for the pre- and postcontrol comparisons for Thailand (Table 12.5) are somewhat different from those we saw for Malaysia. In both countries the volatility of interest rates declines during the control episode, but in Thailand the level of interest rates rises. While Thai domestic–foreign interest rate spreads widen, they do not become more volatile. As in Malaysia, stock returns tend to be more variable following the introduction of capital controls consistent with the view that more of the burdens of adjustment fall on prices when the change in

Table 12.4. Malaysia, January 1, 1996 to July 23, 1999: Descriptive Statistics for Daily Data

Variable	Mean, No Controls	Mean, Control Period	Equality of Means <i>t</i> -Test Probability	Standard Deviation, No Controls	Standard Deviation, Control Period	Equality of Variance Test ^a	Auto-correlation, No Controls	Auto-correlation, Control Period
Interest rate	8.328	5.720	0.000*	1.549	1.452	0.000*	0.935	0.956
Change in interest rate	0.121	-0.545	0.004*	0.386	0.140	0.157	0.212	0.219
Domestic-foreign interest rate spread: 3-month	3.192	1.473	0.000*	1.490	1.469	0.002*	0.912	0.934
Domestic-foreign interest rate spread: 6-month	3.163	1.491	0.000*	1.586	1.463	0.000*	0.914	0.940
Domestic-foreign interest rate spread: 12-month	3.045	1.541	0.000*	1.699	1.493	0.000*	0.925	0.942
Stock returns	-0.194	0.652	0.000*	2.089	3.385	0.000*	-0.080	0.133
Exchange rate changes	0.064	-0.011	0.405	1.241	0.166	0.000*	-0.011	0.049
Bid-ask spread	-0.006	-0.008	0.012*	0.015	0.006	0.000*	0.153	0.275

^a Siegel-Tukey test is reported. Other test results are available from the authors upon request.

* denotes significant at 5 percent level.

Source: Bloomberg.