34. AN ANALYSIS OF THAILAND'S CAPITAL FLOWS

Wiboonchutikula Paitoon, Tubtimtong Bangorn, Lakshmi Raut and Chaivichayachat Bundit

1. INTRODUCTION

Thailand is currently facing a severe recession resulting from the currency and financial crisis starting in 1997. Most would attribute the crisis to over-borrowing from abroad for financing growth of unproductive and speculative sectors. In Thailand, it is not the first time that the country experienced economic problems from excessive foreign borrowing. Actually, it had suffered from a financial and debt problem before in the early 1980s. At that time, the problem came from large foreign borrowing in the public sector as the Thai government borrowed heavily for financing the fiscal deficits that grew yearly to a peak of 3.5% of GDP in 1982.

Thailand avoided a large-scale debt crisis as occurred in Latin America by changing the exchange rate system in 1984 from pegging to the U.S. dollar to a system that fixed the Thai baht to a basket of currencies. The Thai government also considerably cut its spending and in 1986 a limit was actually set on the magnitude of foreign borrowing in the public sector. This fiscal discipline resulted in a rapid decline in both the government expenditure and the interest payments on foreign loans. In fact, in the second half of the 1980s when exports grew highly at the rate of 20% a year, real GDP also grew at double digit rates for many consecutive years. In addition, the government revenue rose as the government tax collection increased in large volume. The government budget went into surplus and the problems of public debt soon

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disappeared. Actually, throughout 1987 to 1995 the government had its budget in surplus every year without interruption.

The high growth and stable macroeconomic environment since the late 1980s provided enough confidence for Thailand to open up it international financial market. From 1989 to 1993 the Bank of Thailand followed a series of financial market liberalization efforts. First, the interest ceiling on deposits and lending of commercial banks and financial institutions were abolished. Second, foreign exchange controls were freed by allowing foreign exchange earners to open their accounts in foreign currencies. Meanwhile, nonresidents were allowed to open their baht account in Thailand. Third, commercial banks and finance companies were allowed to increase their variety and scope of activities. Lastly, in 1993 the capital flows were liberalized under the Bangkok International Banking Facilities (BIBF) scheme. Qualified local and branches of foreign banks were granted licenses to borrow in the international financial market. The incentive was for investors in Thailand to borrow across borders at a reduced cost and for increased investment to stimulate real income growth (Vichyanond, 1994).

The impact after the opening up of the international financial markets was that Thailand's net capital inflows increased by three times from 1990 to 1995. The structure of capital flows was also changed from direct foreign investment as a major component of the inflows to be dominated by private loans of both the banking and non-banking sectors. Nonresident bath accounts also increased tremendously to gain from interest rate differentials under Thailand's essentially fixed exchange rate system. Some foreign investors also opened the nonresident baht accounts to deposit the savings temporarily before making their investment in the stock market.

All would have been well if Thailand could have continued its miraculous growth with stability that began in the late 1980. Unfortunately, from late 1995 to the middle of 1997, Thailand's economic conditions worsened rapidly. Inflation rose in 1995 but subsisided in 1996. Current account deficits increased to over 8% of GDP in 1995 and persisted for the next two years. Export growth turned from a rate of almost 20% per year to a negative rate in 1996 and declined further in early 1997. On top of all that, there was a scandal in a commercial bank that gave large loans to a group of borrowers without sufficient collateral. With the real estate sector also in a slump, threat of increased nonperforming loans at both the banking and the financial institutions almost led to a run in the deposits. Furthermore, the creditworthiness of the financial sector, as rated by international rating agencies, worsened by the month, and the private sector found it increasingly difficult, if not impossible, to borrow from abroad to cover their increased debt. As the economic malaise

continued, the government also had difficulty deciding or implementing a policy. Therefore, political credibility declined and became another factor contributing to the drying-up of capital inflows.

Eventually, deepened and widespread economic and political problems led to a ripe timing for attacking Thailand's currency. The first Thai baht attack was in early 1997 and soon a few more followed. The Bank of Thailand tried hard to defend the baht so as not to increase the foreign debt burden of both the banking and nonbanking sectors which were, in fact, already in enough trouble. As a result of the action, Thailand's foreign reserves were depleted quickly. At the end, the Bank of Thailand had to lead the baht float in July 1997 in order to avoid using up all the foreign reserves. After floating the baht, Thailand went into a currency and financial crisis, and it had to seek loans from the IMF to cover the official reserve position. Also, it had to accept the requirement of the IMF to impose an economic policy package that was designed to be implemented with the access of the loans.

The interesting question is, therefore, whether foreign capital transaction liberalization had played a part in leading Thailand into the financial crisis. Just as investors voiced concerns about some economic problems in the mid-1990s, their confidence was shattered, and the capital flows suddenly dried up. In other words, while foreign capital flows might help Thailand promote economic growth, these flows could be volatile and thus harmful to the stability of the economy. This paper intends to analyze Thailand's capital flows in three sections. In the first section we use time series data of Thailand's foreign capital flows to examine the nature of volatility of the various types of capital flows. In the second and the third sections, we analyze econometric factors determining capital inflows and discover their impact on both growth and stability. Our quantitative analysis will provide implications for policies that are beneficial for managing Thailand's capital flows in the future.

2. NATURE OF THAILAND'S CAPITAL FLOWS

Tables 1 and 3 provide data on Thailand's net capital flows and capital inflows to Thailand from 1985 to 1996. The capital flows are divided by type of instruments namely, direct foreign investment, portfolio investment, private loans, nonresident baht accounts, other private loans, and borrowing in the banking system. These flows are also classified by source country, namely, the U.S., Japan, EU, Hong Kong, Singapore, and others. These tables show clearly that Thailand's net capital flows changed their composition from direct and portfolio investments to private borrowing in the banking sector and in the nonresident baht accounts. In particular, after 1993 loans in the banking sector,

Table 1. Net Private Capital Flows by Type, 1980–1997.
(Billion Baht)

Year	Total	Bank	Total Non Bank	Direct Investment	Portfolio Investment	Private Loans	Non-Resident Baht A/C	Others
1980	22.59	–9.62	32.21	3.82	1.03	11.28	2.59	13.50
1981	7.21	–7.73	14.94	6.36	0.02	17.69	3.00	–12.13
1982	10.05	–7.14	17.19	4.34	0.61	8.43	3.68	0.13
1983	34.14	15.45	18.68	8.19	0.34	4.20	5.33	0.62
1984	42.86	1.84	41.03	9.62	–0.09	24.57	8.26	–1.34
1985	–4.33	–14.24	9.91	4.38	–3.86	2.11	10.81	–3.53
1986	–13.03	–21.97	8.94	6.88	2.52	–3.33	9.67	–6.80
1987	26.15	5.94	20.21	4.71	12.86	–16.01	10.59	8.06
1988	104.21	21.49	82.72	27.35	11.19	4.64	21.72	17.83
1989	155.31	–7.72	163.02	44.41	36.66	46.93	28.10	6.92
1990	301.78	48.05	253.73	61.12	11.51	114.89	34.31	31.90
1991	293.36	6.61	286.74	47.11	3.85	142.71	52.43	40.65
1992	255.82	49.05	206.78	50.30	14.10	69.16	55.28	17.94
1993	292.38	45.19	247.20	34.46	122.63	–45.56	107.26	28.41
1994	363.03	346.76	16.27	4.37	27.50	–134.85	96.41	22.84
1995	524.01	279.68	244.33	29.06	81.72	38.09	84.16	11.29
1996	176.77	126.77	50.00	36.82	88.24	138.02	73.76	–286.86
1997	78.46	61.50	16.96	26.55	40.63	29.03	91.74	–170.98

Source: Bank of Thailand.

Table 2. Change in Composition of Net Private Capital Flows, 1986–1996. (Percentage)

Net Capital Flows	1986–1989	1990–1992	1993–1996
Bank	11.1	17.5	60.8
Non Bank			
Direct Investment	25.0	17.6	7.1
Portfolio Investment	13.1	18.5	15.2
Loans	27.4	19.9	0.9
Non-Resident Baht Account	17.2	21.8	16.1
Others	6.2	4.7	0.1

Source: Bank of Thailand.

together with nonresident baht accounts, constituted over three quarters of the total net flows.

Table 4 shows that most capital flows into Thailand came from Japan, Hong Kong, Singapore and the U.S. Furthermore, while direct foreign investment came mostly from Japan, most of the rest of the inflows came from Singapore and Hong Kong. However, the financial flows from Hong Kong and Singapore did not originate entirely from these two countries. In fact, they are offshore financial centers acting as intermediaries for investors and borrowers from many other countries. Besides Japan, which was very active in the banking activities in Singapore and Hong Kong, it is very difficult to precisely determine the ultimate source of the inflows channeled through these two financial centers into Thailand.

Table 5 shows net capital flows of direct foreign investment and portfolio foreign investment by invested sector from 1987 to 1997. There was a major change in the sectors that foreign investors invested in Thailand over the past decade. In the late 1980s, about half of total direct foreign investment was in the industrial sector, most production of which was for export. However, for four to five years before Thailand's economic crisis, about 40% of total direct foreign investment was invested in the real estate sector. The same is true for the portfolio investment in Thailand. From 1990 to 1992, about 40% of portfolio foreign investment was in the industrial sector. From 1993 to 1996, most portfolio investment was shifted to the real estate sector. If we consider that the real estate sector is actually a nontraded good sector which could easily be manipulated by speculators, the concentration of investment in this sector could expose foreign investors to both foreign exchange and speculative risks.

Table 3. Private Nonbank Capital Inflows by Type, 1980–1996.
(Billion Baht)

Year	Total	Direct Investment	Portfolio Investment	Private Loans	Non-Resident Baht A/C	Others Capital Flows
1980	99.401	9.259	1.096	30.269	2.799	55.978
(%)	(100.0)	(9.3)	(1.1)	(30.5)	(2.8)	(56.3)
1981	116.515	9.342	0.277	33.028	3.998	69.870
(%)	(100.0)	(8.0)	(0.2)	(28.3)	(3.4)	(60.1)
1982	124.328	9.597	0.615	42.624	6.372	65.120
(%)	(100.0)	(7.7)	(0.5)	(34.3)	(5.1)	(52.4)
1983	122.844	13.994	0.042	34.827	8.628	65.353
(%)	(100.0)	(11.3)	(0.3)	(28.3)	(7.0)	(53.1)
1984	160.386	16.977	2.416	70.438	10.308	60.247
(%)	(100.0)	(10.6)	(1.5)	(43.9)	(6.4)	(37.6)
1985	139.193	10.167	4.079	51.122	13.133	60.692
(%)	(100.0)	(7.3)	(2.9)	(36.7)	(9.4)	(43.7)
1986	112.684	10.526	3.054	48.084	10.855	40.165
(%)	(100.0)	(9.3)	(2.7)	(42.7)	(9.6)	(35.7)
1987	130.065	12.541	17.148	27.659	11.359	61.358
(%)	(100.0)	(9.6)	(13.2)	(21.3)	(8.7)	(47.2)
1988	204.592	32.738	27.754	45.287	25.337	73.476
(%)	(100.0)	(16.0)	(13.6)	(22.1)	(12.4)	(35.9)
1989	348.522	53.079	64.796	103.128	30.270	97.249
(%)	(100.0)	(15.3)	(18.6)	(29.7)	(8.7)	(27.7)
1990	540.109	77.267	87.642	185.646	40.178	149.376
(%)	(100.0)	(14.3)	(16.2)	(34.4)	(7.4)	(27.7)
1991	967.451	94.128	58.586	347.210	306.084	161.443
(%)	(100.0)	(9.7)	(6.1)	(35.9)	(31.6)	(16.7)
1992	1,340.172	135.068	86.375	368.376	576.483	173.870
(%)	(100.0)	(10.1)	(6.4)	(27.5)	(43.0)	(13.0)
1993	2,944.924	67.340	277.253	460.950	1,946.960	192.421
(%)	(100.0)	(2.3)	(9.4)	(15.7)	(66.1)	(6.5)
1994	6,370.151	62.039	225.916	44.096	5,804.325	233.775
(%)	(100.0)	(0.9)	(3.3)	(6.5)	(85.8)	(3.5)
1995	11,501.126	76.746	248.393	533.703	10,370.215	272.069
(%)	(100.0)	(0.7)	(2.2)	(4.6)	(90.2)	(2.3)
1996	16,376.059	103.369	250.755	635.430	15,092.368	294.137
(%)	(100.0)	(0.6)	(1.5)	(3.9)	(92.2)	(1.8)
Change in composition, 1980–1986						
1980–1990	100.0	10.4	5.5	31.8	7.4	45.0
1990–1993	100.0	9.1	9.5	28.4	37.0	16.0
1994–1996	100.0	0.7	2.3	5.0	89.4	2.5

Source: Bank of Thailand.

Table 4.1. Net Direct Foreign Investment by Source Country, 1987–1997.
(Billion Baht)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL	9.040	27.964	45.698	64.695	51.389	53.691	43.812	33.241	49.887	57.472	117.552
Japan	3.269	14.608	18.762	27.931	15.593	8.572	7.733	3.091	13.856	13.250	44.071
U.S.A.	1.816	3.185	5.220	6.154	5.919	11.788	7.236	3.909	6.471	10.870	23.031
Hong Kong	0.796	2.795	5.716	7.027	11.566	14.549	4.898	8.004	6.948	5.444	15.704
Taiwan	0.687	3.136	5.062	7.160	2.754	2.221	1.237	2.074	2.405	3.492	6.135
ASEAN	0.531	1.647	2.812	6.666	6.576	7.170	1.522	4.919	3.989	7.804	9.132
– Singapore	0.537	1.572	2.748	6.136	6.469	6.722	1.545	4.630	3.394	6.969	8.300
E.U.	0.940	2.248	3.819	4.212	3.964	6.887	6.092	2.636	4.651	4.162	10.487
Others	1.005	0.345	4.307	5.545	5.018	2.504	15.094	8.608	11.567	12.450	8.992

Source: Bank of Thailand.

Table 4.2. Net Portfolio Foreign Investment by Source Country, 1987–1997.
(Billion Baht)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL	12.862	11.185	36.659	11.508	0.928	11.512	67.850	–10.283	52.759	28.437	122.034
Japan	0.105	1.187	0.192	1.268	–0.763	–1.145	0.531	–0.115	1.000	0.562	1.005
U.S.A.	0.981	2.688	1.654	6.094	0.536	–0.705	3.745	4.593	1.172	1.204	–13.716
Hong Kong	7.712	–0.403	11.764	9.012	7.301	20.634	10.165	5.705	6.497	–4.465	42.149
Taiwan	0.001	0.099	0.703	3.176	–0.003	–0.092	–0.230	–0.568	–0.507	0.084	–0.438
ASEAN	1.193	3.982	12.090	1.037	–2.353	–1.881	51.179	–1.935	36.115	26.269	57.118
– Singapore	1.191	3.975	12.037	0.941	–2.307	–1.850	51.130	–2.169	36.619	26.278	57.039
E.U.	2.801	3.500	9.258	24.994	–1.763	–7.067	0.321	–20.734	3.169	3.803	33.071
Others	0.069	0.132	0.998	–34.074	–2.026	1.768	2.140	2.771	5.313	0.980	2.845

Source: Bank of Thailand.

Table 4.3. Net Private Loans by Source Country, 1991–1997. (Billion Baht)

	1991	1992	1993	1994	1995	1996	1997
TOTAL	15.858	10.979	8.897	1.873	2.695	–2.877	4.720
Japan	3.127	0.791	0.423	–3.950	1.400	–2.815	–1.368
U.S.A.	1.512	0.170	2.147	0.387	0.139	–1.454	0.600
Hong Kong	4.433	3.295	0.578	1.640	0.605	0.908	3.275
Taiwan	0.079	0.019	–0.003	–0.147	–0.017	0.108	2.198
ASEAN	4.442	4.915	0.505	3.321	–0.105	1.687	–1.145
– Singapore	4.438	4.783	0.667	3.321	–0.050	1.629	–1.101
E.U.	1.122	1.351	2.524	0.218	0.883	–1.179	0.468
Others	1.143	0.439	2.722	0.403	–0.210	–0.132	0.692

Source: Bank of Thailand.

Table 4.4. Net Non Resident Baht Accounts by Source Country, 1992–1996. (Billion Baht)

	1992	1993	1994	1995	1996
TOTAL	44.52	67.83	51.14	84.16	76.76
Japan	2.44	–6.80	11.29	2.75	–11.39
U.S.A.	–1.17	–24.22	–98.17	–6.00	–49.76
Hong Kong	10.13	–30.14	9.55	11.14	10.55
Taiwan	1.56	4.73	9.55	11.14	10.55
ASEAN	27.70	71.82	69.78	25.19	89.01
– Singapore	27.72	71.27	68.43	22.66	82.00
E.U.	6.24	52.03	10.17	1.69	–18.42
Others	–2.39	0.42	38.97	38.26	46.24

Source: Bank of Thailand.

Therefore, it is interesting to find out whether these types of foreign investments might be as volatile as other short-term inflows.

According to the conventional belief, both bank loans and nonresident baht accounts are short-term flows, while direct and portfolio investment are long-term flows. The short-term inflows tend to be speculative and easily reversible, while the long term inflows are based on economic fundamentals, and the flows are reversed only when the fundamentals change. Therefore, the change in Thailand's capital flow composition might be considered as a factor explaining

Table 5.1. Net Direct Foreign Investment by Sector, 1987–1997.
(Billion Baht)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Financial Institution	442.8	2,576.3	2,843.2	4,530.8	6,822.5	6,555.1	1,641.8	171.2	642.8	1,822.7	24,559.0
Trade	853.3	3,881.5	6,821.9	12,928.5	7,726.4	7,096.0	5,546.0	8,561.0	11,111.6	13,797.6	28,440.0
Construction	1,349.1	1,841.0	6,925.5	3,300.9	3,306.4	14,534.3	3,853.2	1,751.6	906.1	1,782.5	6,648.0
Mining and Quarrying	192.0	472.6	575.1	1,139.2	2,072.8	3,125.5	3,175.7	1,310.3	1,418.6	489.6	934.0
Agriculture	285.9	315.2	603.4	762.7	597.8	–150.6	330.1	–157.7	232.3	51.2	71.0
Industry	4,749.2	16,162.4	21,866.1	31,003.4	23,839.6	9,259.4	11,430.2	12,873.1	14,114.3	17,941.8	44,652.0
Service	748.5	1,109.0	1,593.5	2,054.0	1,654.7	2,150.5	468.1	1,403.5	2,186.1	3,162.2	6,675.0
Investment	—	—	—	-	-	195.3	–405.1	3,670.2	–1,954.3	2,456.8	—
Real Estate	42.9	1,419.1	7,108.4	8,421.2	3,618.9	9,698.5	17,592.4	11,862.6	21,245.8	19,054.0	2,107.0
Others	—	186.4	360.5	554.3	1,750.9	1,227.0	178.9	–8,204.8	–16.4	629.6	3,466.0
TOTAL	9,043.7	27,963.5	45,697.6	64,695.0	51,390.0	53,691.0	43,811.3	33,241.0	49,886.9	61,188.0	117,552.0

Source: Bank of Thailand.

Table 5.2. Net Portfolio Foreign Investment by Sector, 1990–1996. (Billion Baht)

	1990	1991	1992	1993	1994	1995	1996
Financial Institution	1,163.4	256.2	290.5	1,641.8	171.2	642.8	1,822.7
Trade	10,099.9	6,248.1	5,431.5	5,136.4	7,039.4	10,715.6	14,551.0
Construction	3,209.1	2,144.2	14,329.5	3,500.5	1,498.8	832.4	1,425.3
Mining and Quarrying	1,124.8	2,076.4	2,788.6	2,906.4	1,108.9	1,214.0	527.0
Agriculture	416.3	185.6	111.9	351.7	–95.3	278.3	84.1
Industry	20,648.6	17,316.7	6,254.9	7,543.7	11,541.8	15,085.8	19,850.0
Service	1,079.4	1,351.9	1,956.7	812.8	1,533.7	2,037.9	8,806.4
Investment	0.0	0.0	172.9	–305.4	919.9	–2,163.3	756.8
Real Estate	4,784.8	4,669.8	10,173.6	13,134.8	15,872.1	18,544.4	18,909.4
Others	473.5	1,283.4	1,201.9	192.3	–8,222.5	4.1	3,731.0
Total	42,999.8	35,532.3	42,712.0	34,915.0	31,368.0	47,192.0	70,463.7

Source: Bank of Thailand.

parts of the current financial and currency crisis. In this section, we aim to examine the nature of Thailand's capital flows following the methodologies used by Claessens et al. (1995), Chuhan et al. (1996) and Walsh et al. (1998).

Table 5.3. Net Private Loans Sector, 1990–1995. (Billion Baht)

	1990	1991	1992	1993	1994	1995
Financial Institution	9,783.1	12,395.8	11,556.0	22,113.1	13,518.6	49,047.4
Trade	21,192.9	16,198.9	4,860.7	–561.3	–13,464.6	10,100.0
Construction	3,442.2	2,418.5	186.7	442.3	–743.4	–403.2
Mining and Quarrying	–243.6	647.8	–318.1	–858.7	–771.5	31.5
Agriculture	1,834.4	51.5	690.5	–692.2	–284.6	371.8
Industry	47,118.4	77,133.6	45,105.1	26,378.9	–1,665.6	55,060.7
Service	2,534.4	1,799.2	1,669.4	–106.6	825.3	8,121.8
Investment	0.0	5,336.5	–3,233.5	2,190.2	–1,369.7	17,113.2
Real Estate	19,212.5	27,768.6	6,514.5	–4,554.4	10,221.5	11,171.5
Others	10,014.2	1,658.3	2,126.9	29.7	2,490.0	–472.7
Total	114,888.5	145,408.7	69,158.2	44,381.0	8,756.0	150,142.0

Source: Bank of Thailand.

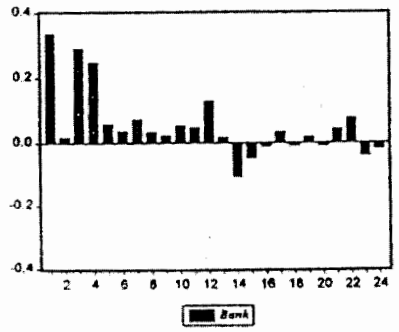
We use monthly data of net capital flows classified by type from January 1991 to December 1997 for our study. We choose this period of time because in 1990, Thailand liberalized the foreign exchange market and interest rate structure. In 1993, the Bank of Thailand liberalized the banking sector and established BIBF in order to facilitate foreign borrowing and to help reduce funding costs. Finally, starting in 1997, Thailand experienced the worst economic crisis and recession in decades after the second World War.

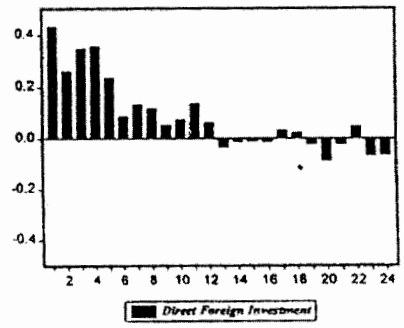
2.1. Persistency

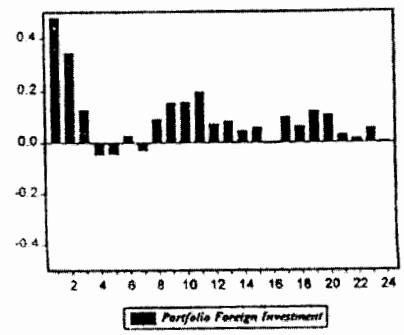
We examine the hypothesis that changes in the composition of the net capital flows in the decade before Thailand's economic crisis matter, and it could explain part of the ongoing currency and financial problems. As shown earlier, Thailand increasingly relied on private foreign borrowing in the 1990s, and, therefore, the net capital flows were dominated by debt instead of equity investment. We suspect that portfolio investment, bank loans, nonresident baht accounts, and other private loans, which are generally used for financing short-term investments, are more volatile than direct foreign investment and private loans, which are generally used for financing long-term investments. In the literature, short-term flows are sometimes referred to as "hot money," in the sense that they are speculative and likely to flow in and out quickly; whereas the long-term flows are known as "cool money," in the sense that they are more likely to be persistent or to keep flowing in for a continuing period of time. We would like to examine empirical validity of such belief.

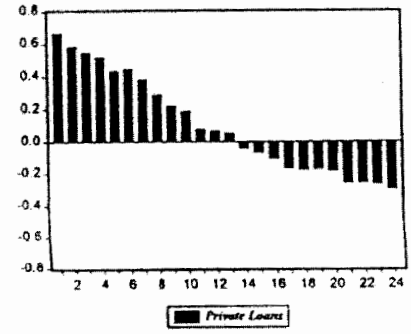
To do so, we apply autocorrelation functions of the time series analysis to our monthly data of capital flows, separated by type and by time period. If the capital flows were persistent and not volatile we expect the autocorrelation to be positive. On the contrary, if the flows were not persistent or they were volatile, we expect the auto-correlation to be zero or negative. The parameter estimates are shown in Table 6. From 1990 to 1993, capital flows in the form of direct foreign investment, bank loans, and nonresident baht accounts exhibit low autocorrelations with signs changing from month to month. Meanwhile, net flows in the form of portfolio investment and private loans show positive autocorrelations for a certain time span but the coefficients turned negative afterwards. From 1994 to 1997, except for private nonbank loans, the autocorrelation coefficients of the rest of the capital flows were not significantly different from zero. For some types of the flows, the autocorrelation coefficients seemed to alternate their signs from one lagged period to another. Therefore, our data suggest that almost all flows, both short-term and long-term, seem to become more volatile or less persistent after the early 1990s.

Table 6.1. Autocorrelation of Private Capital Flows by Type, 1990–1997.









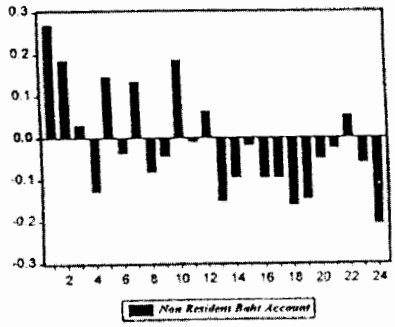


Table 6.2. Autocorrelation of Private Capital Flows by Type, 1990–1993.

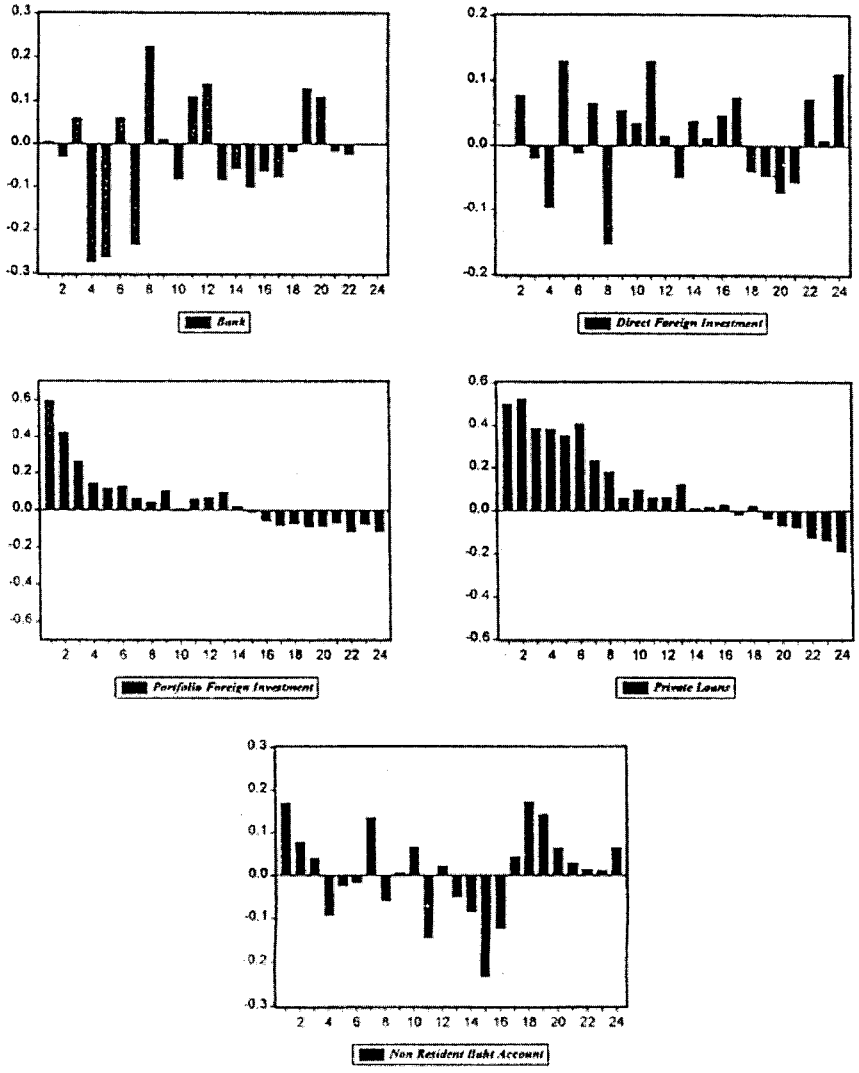
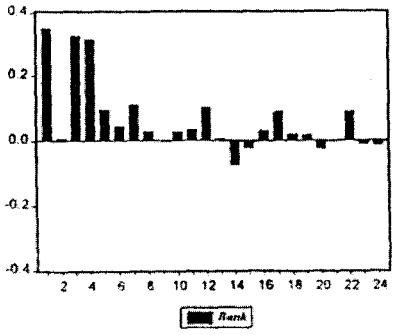
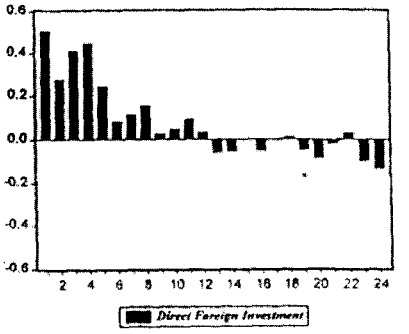
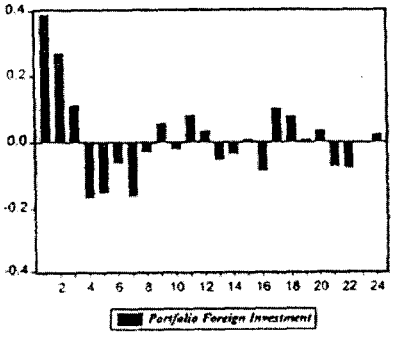
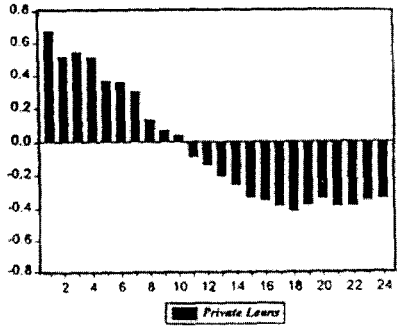


Table 6.3. Autocorrelation of Private Capital Flows by Type, 1990–1997.









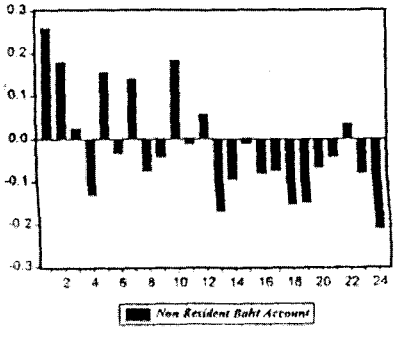


Table 7. Q Statistics and Significance Levels.

	Jan 1994–Dec 1997	Jan 1990–Dec 1993	Jan 1990–Dec 1997
Bank	19.831	12.463	24.204
Prob.	0.228	0.712	0.085
Direct Investment	44.320	5.303	64.252
Prob.	0.000	0.994	0.000
Portfolio Investment	18.331	36.443	49.546
Prob.	0.305	0.003	0.000
Private Loans	116.140	67.126	214.390
Prob.	0.000	0.000	0.000
Non Resident Baht Account	14.634	11.241	26.695
Prob.	0.552	0.794	0.045

To test whether the autocorrelations, which were individually estimated to have low values, were different from zero jointly, we estimated autocorrelations up to lag 15 and computed Q-statistics on the joint significance of the 15 autocorrelations for each type of capital flows. Table 7 shows that from 1990 to 1993 the Q-statistics of private nonbank loans and portfolio investment were higher than those of direct foreign investment, bank loans, and nonresident baht accounts. From 1994 to 1997, private, nonbank loans had the highest value of Q-statistics while the value of the rest of the capital flows remained low. This confirms the earlier finding that when we decompose our analysis into two subperiods, namely, one before and the other after 1993, we find that all types of capital flows became more volatile after 1993.

Another method we use for detecting whether different types of capital flows were similar in terms of their persistency is the augmented Dickey-Fuller unit root test with optimal lags being judged by the Akaike Information Criterion. The test examines each type of capital flows in terms of its stationarity. If the capital flow series differed in their stationarity, then they might support the notion that capital flows were dissimilar. That is, some flows might be more persistent than others.

Table 8 shows the augmented Dickey-Fuller test statistics for the entire period of 1990 to 1997 and the breakdown periods of 1990–1993, 1994–1996, and 1995–1997. For the entire period, all but one type of capital flows (namely private loans) was able to reject the nonstationarity hypothesis. For the subperiod of 1990–1993, none was able to reject the nonstationarity hypothesis. However, for the later subperiods of either 1994–1997 or

Table 8. Test of Nonstationarity.

	Jan 1990–Dec 1997	Jan 1990–Dec 1993	Jan 1994–Dec 1997
Bank	–1.801	–4.222	–1.262
Number of lags	2	0	1
Direct Investment	–3.815	–4.824	3.097
Number of lags	0	1	6
Portfolio Investment	–5.715	0.909	4.901
Number of lags	0	2	3
Private Loans	–0.534	–1.255	–0.322
Number of lags	3	1	2
Non Resident Baht Account	–3.114	–4.355	–2.218
Number of lags	4	0	4

1995–1997, there were more types of flows that the nonstationarity hypothesis could not be rejected. Again, we may conclude that the flows became more volatile in the latter subperiod, and they were increasing similarly in terms of their instability.

The stationarity tests and autoregressions both address the issue of persistence in a univariate analysis. However, if we set our analysis in a multivariate framework, we will be able to detect some relationships among the capital flows. The detected relationships will suggest whether the flows had any differences in terms of their persistency. For example, one flow might have an effect on both its own future and that of other flows' future. In contrast, for another flow, it might have an effect on its own future, but it was not influenced by any other flows. In this case, we may interpret that the latter flow was more persistent than the former flow.

We use Granger causality test to test the above relationships and to detect whether there were differences among capital flows. Table 9 shows that during 1990–1993, except for direct foreign investment, each of the rest of the flows was caused by at least one other flow. In contrast, there is no evidence that direct foreign investment was Granger-caused by any other flows. However, from 1994–1997, we see that all flows were Granger-caused by each other, implying that there were no differences among flows. This implies that the flows were getting similar in terms of their volatility after the early 1990s. In other words, before 1993, except for direct foreign investment, each of the rest of the flows followed other flows, while direct foreign investment did not. But after 1993, all flows followed one another, and they became less persistent.

Table 9. Granger Causality Among Flows.

Jan 1990–Dec 1993			
			Prob. F
Portfolio Investment	Cause	Non Resident Baht Account	0.010
Non Resident Baht Account	Cause	Portfolio Investment	0.013
	Cause	Private Loans	0.014
Jan 1994–Dec 1997			
			Prob. F
Bank Loans	Cause	Direct Investment	0.013
	Cause	Non Resident Baht Account	0.089
Direct Investment	Cause	Private Loans	0.023
	Cause	Non Resident Baht Account	0.042
Portfolio Investment	Cause	Bank	0.012
	Cause	Direct Investment	0.097
Private Nonbank Loans	Cause	Direct Investment	0.033

We next use a vector autoregression (VAR) to examine the relationships among all flows. Each VAR has five equations, one for each type of flows. The equations express each flow its own past values and those of the other flows. Table 10 shows the results for 1990–1993 and 1994–1997. It is clearly shown that direct foreign investment was different from other flows: that the variation of direct foreign investment could not be explained by contemporaneous changes in other flows, while the rest seem to influence each other. Here it shows that direct foreign investment had characteristics slightly different from other flows in term of its persistency. Thus, while it is true that the nature of direct foreign investment in terms of its volatility become more similar to other short-term capital flows after early 1990s, the multivariate results seem to suggest that, after all, direct foreign investment was different from other flows in the sense that it responded less to the disturbances in other flows than other types of capital flows did.

2.2. *Volatility*

We also test the predictability of each type of capital flows by computing root mean square errors and the Theil Inequality coefficient. Our hypothesis is that long-term flows are more predictable than short-term flows. It is easier to capture systematically the patterns of long-term flows than the short-term flows, and it is easier to predict the long-term flows by simply using their past value. In our investigation, we test all forms of capital flows with different

Table 10. VAR Estimation of Capital Flows.

	Jan 1990–Dec 1993		Jan 1994–Dec 1996		Jan 1994–Dec 1997	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Dependent variable is Bank Loans						
Bank Loans	0.4501	0.3383	–0.3489*	0.2741	0.2999	0.2468
Direct Investment	–1.7506	0.1727	–1.2793	2.0324	–5.1652*	2.1275
Portfolio Investment	0.3271	0.9184	0.1196	0.5570	1.0118*	0.5725
Private Loans	0.9013*	0.4409	–0.7448*	0.3040	–0.1654	0.4073
Non Resident Baht Account	0.5672	0.1345	–0.2794	0.2528	0.1903	0.2342
R^2	0.2483		0.2147		0.3375	
Dependent variable is Direct Investment						
Bank Loans	–0.0612	0.0519	0.0014	0.0242	–0.0158	0.0290
Direct Investment	–0.1007	0.2647	–0.1725	0.1795	0.5827	0.2498
Portfolio Investment	–0.0160	0.1408	0.0133	0.0492	–0.0041	0.0672
Private Loans	–0.0327	0.0676	0.0222	0.0269	–0.0247	0.0478
Non Resident Baht Account	–0.1128	0.2062	0.0003	0.0223	–0.0294	0.0275
R^2	0.1179		0.0047		0.3312	
Dependent variable is Portfolio Investment						
Bank Loans	0.2124	0.1879	0.1269*	0.0755	0.0240	0.0673
Direct Investment	–1.1245	0.2647	0.0554	0.5599	0.3655	0.5796
Portfolio Investment	1.0574*	0.5102	–0.1483	0.1534	–0.1276	0.1560
Private Loans	–0.3959*	0.2449	0.1744*	0.0838	0.0653	0.1110
Non Resident Baht Account	–0.1736	–0.2323	0.1488*	0.0697	–0.0521	0.0638
R^2	0.4585		0.2992		0.0560	
Dependent variable is Private Loans						
Bank Loans	–0.0866	0.2222	0.0066	0.1304	0.0189	0.0705
Direct Investment	1.2385	1.1346	–0.1650	0.9666	–1.4594*	0.6072
Portfolio Investment	–0.3012	0.6033	–0.0734	0.2649	0.0676	0.1634
Private Loans	–0.0196	0.2896	0.7064*	0.1446	0.6912*	
Non Resident Baht Account	–1.4431*	0.8834	0.0465	0.1203	0.0861	0.0669
R^2	0.3465		0.4983		0.5964	
Dependent variable is Non Resident Baht Account						
Bank Loans	0.1280*	0.0973	0.3949*	0.2398	–0.0043	0.2110
Direct Investment	0.1154	0.4966	1.6469	0.1778	1.1006	1.8182
Portfolio Investment	–0.4203	0.2641	–0.2107	0.4873	–2.9897	0.4893
Private Loans	–0.0246	0.1268	0.2401	0.2660	0.1497	0.3481
Non Resident Baht Account	0.3374	0.38681	0.2926	0.2212	0.0270	0.2002
R^2	0.2190		0.1794		0.0240	

* Denotes reject of the null hypothesis at 5% significance level.

types of ARIMA (p,d,q) to search for suitable representative models. We finally find that AR(3) is the most appropriate model in our analysis. Next, we computed the Theil Inequality coefficients. If the coefficient is close to zero, it implies a perfect fit of the model. If, in the opposite, the coefficient is close to one, it implies that the estimated time series models do not work well. Our test results are shown in Table 10. For all subperiods, direct foreign investment is the only type of capital flows that was most predictable, while bank loans and nonresident baht accounts had the highest coefficients, implying the least predictable.

The above result is confirmed by computing the volatility index based on the ARCH and GARCH models. The ARCH model of Engle (1982) assumes that movements of capital flows are subject to volatility clustering. It, therefore, creates heteroscedasticity and volatility when large changes in capital flows are followed by large changes in either direction. The GARCH model (Bollerslov, 1986) generalizes the above ARCH model by allowing the current conditional volatility to depend on both error terms of the ARCH model and the past conditioned volatility. Hence, the model takes into account the volatility that comes from one extreme flow followed by another, and thus, measures the volatility more efficiently.

We firstly construct the volatility index from the mean of the variance of GARCH (1,1) for each type of capital flows. Then we compute the index in percentage term in order to compare degrees of volatility among the flows. The result is shown in Table 11. For all subperiods, the volatility index of bank loans was the highest, followed by nonresident baht accounts, private loans, portfolio investment and direct investment. In the end, both bank loans and nonresident baht accounts were the most volatile capital flows, and the volatility was intensified in the few years before the currency and financial crisis in 1997.

3. DETERMINANTS OF THAILAND'S FOREIGN CAPITAL FLOWS

In order to find determinants of each type of foreign capital flows, we use the cointegration method to find a long-run relationship between each type of the flows and factors that significantly influence it. The estimation method follows three steps. Firstly, we use the Dickey and Fuller unit root test to test for stationarity of the capital flows data. If there are autocorrelation problems, we apply the Augmented Dickey-Fuller test method to correct them before we proceed to the next step. Secondly, we find the long-run relationships among the variables by constructing the Johansen's likelihood ratio test to search for

an optimal lag and numbers of cointegration vectors used in the model. Thirdly, we construct the error-correction mechanism to explain the short run adjustment process towards the long run equilibrium.

3.1. Direct Foreign Investment

In the 1980s, direct foreign investment was the major component of Thailand's capital flows. Direct foreign investment, mainly from Japan and the Asia NICs, whose price competitiveness and access to world markets had deteriorated, flowed into Thailand in large amounts in the late 1980s. The contribution of direct foreign investment increased from 5% during 1970 to 1986 to about 10% during 1987 to 1990. Of all the foreign investment inflow, about 50% was invested in the manufacturing sector, concentrated in the electronic and the labor intensive goods industries producing for export. At that time, Thailand's relatively low wages, foreign investment promotion, and GSP privileges, added to the already favourable investment climate, made it a major foreign investment recipient.

From 1991 to 1996, Thailand's capital flows had changed their composition from direct foreign investment to portfolio, and in the most recent year, to

Table 11. Volatality Index of Capital Flows.

	Mean of Conditional Variance	(%)
1990.1–1997.12		
Bank Loans	1180000000	100.00
Direct Investment	8427308	0.71
Portfolio Investment	66822876	5.66
Private Loans	163000000	13.81
Non Resident Baht Account	521000000	44.15
1990.1–1993.12		
Bank Loans	435000000	100.00
Direct Investment	16997096	3.91
Portfolio Investment	61722262	14.19
Private Loans	125000000	28.74
Non Resident Baht Account	105000000	24.14
1994.1–1997.12		
Bank Loans	1710000000	100.00
Direct Investment	22603468	1.32
Portfolio Investment	90154692	5.27
Private Loans	190000000	11.11
Non Resident Baht Account	780000000	45.61

private borrowing in both the banking and nonbanking sectors. Direct foreign investment declined at the rate of about 2% a year during 1991 to 1996. Major investors from Japan and Asian NICs reduced their direct foreign investment in Thailand in response to prolonged recession in Japan and the strategy of shifting their export base from Thailand to lower-wage countries such as China, Vietnam, India, and Mexico. It is interesting to note that the sectors the foreign investors invested in Thailand were also subject to changes in the first half of the 1990s. As mentioned earlier, in the late 1980s, about half of the total direct foreign investment was in the industrial sector. However, for four to five years before Thailand's crisis, about 40% of total direct foreign investment was invested in the real estate sector. The source countries were also changed from Japan to an unspecificed group of countries aggregated as "others" in the table.

Survey articles on determinants of direct foreign investment in LDCs can be found in Agarwal (1980) and De Mello, Jr. (1997). Here, we postulate that Thailand's direct foreign investment is dependent upon factors grouped into two categories. The first group includes characteristics of the host country, namely, Thailand's real GDP growth, production costs, and domestic policies. The second group includes factors that push foreign investors to invest in Thailand, such as home country's real income growth, and capital cost in the host country in comparison with that in Thailand.

In the first group we use the following variables for measuring the host country's pull factors: (1) real GDP growth reflecting the size of the domestic market as well as the rapid expansion of the economy (the higher Thailand's real GDP growth the greater direct foreign investment flowing into the country can be expected); (2) real wages representing Thailand's comparative advantage as a low labor cost country, suitable for direct investment in labor-intensive goods for export to a third country; (3) real depreciation of the Thai baht favoring price competitiveness of Thailand's exports and attracting foreign investors using Thailand as the export base; and (4) Thailand's openness policies represented by export promotion and import liberalization, eventually leading to increased export and import as a percentage of GDP. The more open the host country's economy, the more direct foreign investment it can attract.

The second group of variables representing the push factors in the home country includes : (1) real GDP growth of the investing countries (it is presumed that high growth in the home country leads to a greater possibility for investment expansion from home to abroad); and (2) differential investment cost between the host and the home countries. Here we use differences between the U.S. government long-term bond yield and Thailand's discount rate as the proxy. The U.S. government bond yield represents a summary measure of the

Table 12. Determinants of Direct Foreign Investment.

Table 12.1. Ordinary Least Squares (OLS) Results.

(Dependent Variable is FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGDP	0.792371	0.311313	2.545258	0.0244
IMP/GDP	1.794374	0.793094	2.262499	0.0414
RWAGE	–0.520157	0.694736	–0.748712	0.4674
REXC	–0.326389	0.903879	–0.361097	0.7238
USG	–0.501226	1.944873	–0.257716	0.8007
C	4.243241	66.7172	0.0636	0.9503
AR(1)	0.729363	0.247691	2.944644	0.0114

R-squared	0.823989	Mean dep. var	17.6164
Adjusted R-squared	0.742754	S.D. dep. var	19.71086
S.E. of regression	9.99724	AIC	4.873835
Sum squared resid	1299.282	Schwarz criterion	5.222341
Log likelihood	–70.11712	F-statistic	10.1432
Durbin-Watson stat	1.701164	Prob(F-statistic)	0.000286
Inverted AR Roots	0.73		

long-term investment returns to foreign investors in their home country, and Thailand's discount rate measures the opportunity cost of borrowing in the host country (see Wang & Swain, 1995).

From the above hypothesis, we specify our direct foreign investment function in the following form:

$$FDI = f(GGDP, RWAGE, REXC, IM/GDP, ORGDP, IND)$$

where FDI = direct foreign investment, GGDP = real GDP growth of Thailand, RWAGE = real wage rate, REXC = real exchange rate, IM/GDP = import per GDP, OGGDP = real GDP growth of the investing countries, and IND = differences between the U.S. government long-term bond yield and Thailand's discount rate.

We use time series data for the period of 1977 to 1995 for estimating the above function, and the final results with the best fit are shown in Table 12. We find that there was a long run positive relationship between direct foreign investment and Thailand's real GDP growth, real depreciation of local currency, and the openness policy. However, Thailand's direct foreign investment was inversely related to the country's increased real wages and the

Table 12.2. Dickey and Fuller Unit Root Test.

Variable	At level	First difference	Variable	At level	First difference
FDI	−1.4858 [0]	−3.7293 [0]	RWAGE	0.9656 [4]	−3.5030 [3]
	(−3.0199)	(−3.0294)		(−3.0659)	(−3.0659)
GGDP	−6.5624 [0]	−10.668 [0]	REXC	−2.1796 [0]	−4.0547 [0]
	(−3.0199)	(−3.0294)		(−3.0199)	(−3.0294)
IMP/GDP	−1.2388 [0]	−5.1998 [0]	USG	−1.1798 [0]	−3.5740 [0]
	(−3.0199)	(−3.0294)		(−3.0199)	(−3.0294)

opportunity cost of foreign investors investing in their home market rather than in Thailand. In other words, Thailand's direct foreign investment was determined by the host country's growth, cost competitiveness, openness

Table 12.3. Cointegration Test.

12.3A: Cointegrating LR test based on Maximum Eigenvalue of the stochastic matrix.

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.957916	143.3195	94.15	103.18	None **
0.78243	79.95757	68.52	76.07	At most 1 **
0.672588	49.4529	47.21	54.46	At most 2 *
0.566383	27.12218	29.68	35.65	At most 3
0.34362	10.41032	15.41	20.04	At most 4
0.094711	1.990016	3.76	6.65	At most 5

*(**) denotes rejection of the hypothesis at 5%(1%) significance level.
L.R. test indicates 3 cointegrating equation(s) at 5% significance level.

12.3B: Estimated cointegrating vector.

FDI	GGDP	IMP/GDP	RWAGE	REXC	U.S.G	C
1	−2.003803	−3.610039	0.452757	10.69629	1.226677	36.82994
	−0.7218	−0.39219	−0.17011	−2.80264	−0.85275	
Log likelihood	−306.4597					

Table 12.4. Empirical Estimates of ECM.

		D(FDI) = –0.2959*Error + 1.3659
SE. =	(–0.0599)	(–1.9093)
T-stat. =	(–4.9418)	(–0.7154)
		R-squared = 0.57569 SE. = 8.538824

policies, and the opportunity cost of the foreign investors' investment at home in comparison with investing abroad.

By estimating adjustment parameters in the error correction model, we find that they are negative and highly significant. If there is any discrepancy between direct foreign investment and its determinants in the short-run, it will be eliminated in the long-run and the speed of adjustment is about 29% per year.

3.2. Portfolio Foreign Investment

Foreign portfolio investment in Thailand increased significantly during the economic boom in the late 1980s, accounting for 13% of total net capital flows. After Thailand opened up the capital account in the early 1990s, it grew even more rapidly and it constituted over 17% of the overall net flows (see Tables 1 to 3). From the late 1980s to the early 1990s, most of portfolio foreign investment came from Hong Kong, Singapore, the U.K., and the U.S. After 1993, investment from Singapore accounted for over 60% of the total portfolio foreign investment, followed by Hong Kong and the U.K. Before 1992, most investment was in the industrial and the trade sectors. After 1992, investment in the real estate sector jumped, and it became the sector that absorbed the most of the portfolio investment.

The determinants of portfolio foreign investment are found by revising Chaivichayachat's (1996) model, which is based on the portfolio adjustment theory extended to the international economy version. He finds that the determinants of portfolio equity foreign investment are inflation rates, price per earning ratio, private investment index, interest rate differentials, and the relative risk between the stock exchange of Thailand and the New York stock exchange. We revise the above model and use yearly data to find the long-run relationship between the portfolio investment and its determinants by using the cointegration method and the error correction model.

We postulate that possible determinants of portfolio foreign investment include both macroeconomic factors attracting the investment and factors that

directly affect investment returns, and in turn motivate foreign investors to mobilize the funds to Thailand. The first set of factors includes Thailand's real GDP growth, inflation rate, current account balance, foreign exchange reserves, and foreign exchange risk. The second set of factors include growth of real income of the investing countries, expected returns of investment in Thailand's stock market, and differences of asset yields in the host and the home countries. Finally, the portfolio investment function can be written in the following form:

$$FPI = f(GGDP, CB, ECPI, FR, EREXC, OGGDP, ERSET, DAY)$$

where GGDP = real GDP growth of Thailand, ECPI = expected GDP inflation rate, CB = current account balances, FR = foreign exchange reserves, EREXC = foreign exchange risk, OGGDP = growth of real income of the investing countries, ERSET = expected returns of investment in Thailand's stock market, and DAY = differences of asset yields in the host and the home countries.

The model with best parameter estimation results is presented in Table 13. We find that factors that significantly determine Thailand's portfolio foreign

Table 13. Determinants of Portfolio Foreign Investment.

Table 13.1. Ordinary Least Squares (OLS) Results.

(Dependent Variable is FPI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECPI	1.649552	0.846805	1.947971	0.0774
GGDP	2.041273	0.39941	5.110725	0.0003
EREXC	−1.486286	0.698717	2.127588	0.0579
ERSET	1.526696	0.687986	2.21908	0.0487
DAY	−9.073485	3.744459	2.423177	0.0338
C	−142.2217	156.738	−0.907385	0.3837
AR(1)	0.706278	0.196544	3.593488	0.0042

R-squared	0.751295	Mean dep. var	18.047
Adjusted R-squared	0.615638	S. D.dep. var	33.09318
S. E. of regression	20.51675	AIC	6.327785
Sum squared resid	4630.308	Schwarz criterion	6.67404
Log likelihood	−75.49096	F-statistic	5.538193
Durbin-Watson stat	1.950081	Prob(F-statistic)	0.007223
Inverted AR Roots	0.71		

Table 13.2. Dickey and Fuller Unit Root Test.

Variable	At level	First difference	Variable	At level	First difference
FPI	2.2252 [3]	−5.1417 [2]	EREXC	−1.5271 [0]	−4.1957 [0]
	(−3.0818)	(−3.0818)		(−3.0400)	(−3.0521)
ECPI	1.7463 [4]	−3.4760 [3]	ERSET	−3.4251 [0]	−7.0138 [0]
	(−3.1003)	(−3.1003)		(−3.0400)	(−3.0521)
GGDP	−6.1611 [0]	−10.169 [0]	DAY	−2.0050 [2]	−3.4802 [2]
	(−3.0400)	(−3.0521)	—	(−3.0659)	(−3.0818)

investment during 1977 to 1995 is reduced to five variables, namely, the real GDP growth rate, expected inflation, expected change in the Thai currency, expected returns on investing in Thailand's stock market, and the interest rate

Table 13.3. Cointegration Test.

13.3A: Cointegrating LR test based on Maximum Eigenvalue of the stochastic matrix.

Eigenvalue	Likelihood Ratio	5% Critical Value	1% Critical Value	Hypothesized No. of CE(s)
0.920763	115.7798	94.15	103.18	None **
0.833615	70.14424	68.52	76.07	At most 1 *
0.652672	37.86212	47.21	54.46	At most 2
0.522062	18.82736	29.68	35.65	At most 3
0.259987	5.538439	15.41	20.04	At most 4
0.006582	0.118861	3.76	6.65	At most 5

*(**) denotes rejection of the hypothesis at 5%(1%) significance level.
L.R. test indicates 3 cointegrating equation(s) at 5% significance level.

13.3B: Estimated cointegrating vector.

FPI	ECPI	GRGDP	EREXC	ERSET	DAY	C
					3.06773	—
1	−1.202291	5.708735	2.416238	3.426286	3.067738	−53.07268
	−0.44848	−2.18865	−4.96827	−1.07638	−2.93277	
Log likelihood	−291.1842					

Table 13.4. Empirical Estimates of ECM.

		D(FPI) = –0.3795*Error + 4.54
SE. =	(–0.1048)	(–6.9097)
T-stat. =	(–3.6199)	(–0.6570)
		R-squared = 0.450241 SE. = 29.31553

differentials. Additionally, the estimated error correction terms also imply that the speed of adjustment of discrepencies between short-run and long-run equilibrium is approximately 38% a year.

3.3. Private Loans

Private loans, mostly in the form of public borrowing, was the largest component of Thailand's net capital flows in the first half of the 1980s. The borrowing was so much that the country almost fell into a major debt crisis, as in many Latin American countries during the time. After learning from past mistakes, Thailand's fiscal policy became more self-disciplined, and foreign borrowing in the public sector was restrained to a manageable level. However, since the late 1980s, foreign borrowing in the private sector increased. After the country adopted the BIBF scheme in 1993, borrowing in the banking sector together with the nonbanking sectors, increased to account for over 70% of the total foreign flows. Most loans came from the financial centers in Singapore and Hong Kong. Although it is difficult to trace the ultimate source of these loans, it is likely that the majority of them came originally from Japan since Japanese banks play a dominant role in the international bank lending in these two financial centers. It is also difficult to be precise on the sectors that the loans went to because much of the funds were distributed to different sectors passing through the commercial banks and the financial institutions. However, Table 5 suggests that a large portion of the funds went to the real estate sector after 1993.

The studies of determinants of private foreign loans are few, and Kengchon (1995) stands out as a valuable study in the case of Thailand's foreign borrowing during 1970 to 1989. His regression specification is based on the neoclassical investment model with a financing constraint. Foreign loans are dependent upon factors that determine both the demand and the supply sides of loans. On the side of the borrowing country, the factor that leads to an increase in the demand for loans is expected real GDP growth rate. Those that lead to a decrease in the demand are available domestic savings, and foreign exchange

Table 14. Determinants of Privte Loans.

Table 14.1. Ordinary Least Squares (OLS) Results.

(Dependent Variable is FPL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGDP	3.868137	1.01123	3.825181	0.0015
DEBT	–5.620368	3.472688	–1.618449	0.1251
ISGAP	9.152577	3.655304	2.503916	0.0235
OTHERS	–0.634864	0.28628	–2.21763	0.0414
C	75.42167	69.13184	1.090983	0.2914
AR(1)	0.695983	0.190327	3.656772	0.0021

R-squared	0.622774	Mean dep. var	13.555
Adjusted R-squared	0.504891	S. D.dep. var	53.31544
S. E. of regression	37.51488	AIC	7.476476
Sum squared resid	22517.86	Schwarz criterion	7.774033
Log likelihood	–107.4579	F-statistic	5.282975
Durbin-Watson stat	1.624505	Prob(F-statistic)	0.004704
Inverted AR Roots	0.7		

risk. On the supply side, the determinants are liquidity situation in the world financial markets and creditworthiness of the borrowing country. We revise the above model and postulate that Thailand's foreign loans depend on the country's real GDP growth rate, the investment-saving gap, the domestic and world interest rate differentials, creditworthiness, and the availability of other types of foreign capital substitutable for the foreign loans.

Our model of foreign private loans is therefore specified in the following form:

Table 14.2. Dickey and Fuller Unit Root Test.

Variable	At level	First difference	Variable	At level	First difference
FPL	2.4929 [4] (–3.0400)	–8.8277 [2] (–3.0294)	ISGAP	–2.7014 [0] (–3.0038)	–5.2663 [0] (–3.0114)
GGDP	–6.8274 [0] (–3.0038)	–10.609 [0] (–3.0114)	OTHERS	0.0048 [1] (–3.0114)	–8.4271 [0] (–3.0114)
DEBT	–2.1649 [3] (–3.0294)	–4.3074 [0] (–3.0114)			

Table 14.3. Cointegration Test.

14.3A: Cointegrating LR test based on Maximum Eigenvalue of the stochastic matrix.

Eigenvalue	Likelihood Ratio	5% Critical Value	1% Critical Value	Hypothesized No. of CE(s)
0.897956	87.77524	68.52	76.07	None **
0.637672	37.56351	47.21	54.46	At most 1
0.305336	15.22896	29.68	35.65	At most 2
0.223929	7.213781	15.41	20.04	At most 3
0.071688	1.636532	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level.
L.R. test indicates 3 cointegrating equation(s) at 5% significance level.

14.3B: Estimated cointegrating vector.

FPL	GGDP	DEBT	ISGAP	OTHERS	C
1	–44.38015	–3.772925	–43.86603	0.833577	525.0179
–20.4415	–6.41749	–18.8393	–0.47029		
Log likelihood	–384.1238				

$$FPL = f(GGDP, ISGAP, IND, CR, OTHER)$$

where GGDP = real GDP growth rate of Thailand, ISGAP = the investment-saving gap, IND = domestic and world interest rate differentials, CR = creditworthiness, and OTHERS = the availability of other types of foreign capital substitutable for the foreign loans.

We use yearly data from 1977 to 1995 for estimating the above model, and the cointregration and error correction results are shown in Table 14. The best fitted equation has only three statistically significant variables, namely, real

Table 14.4. Empirical Estimates of ECM.

		D(FPL) = 0.1155*Error + 1.7548
SE. =	(–0.0339)	(–9.6935)
T-stat. =	(–3.4045)	(–0.1810)
		R-squared = 0.3668 SE. = 45.4667

GDP growth rate, investment-saving gap, and the availibility of other types of capital flows. However, short-run adjustments to the long-run equilibrium appear to be divergent.

3.4. Nonresident Baht Account

Private capital flows in the form of nonresident baht accounts increased rapidly after Thailand's foreign exchange control was greatly relaxed in 1991. Foreign investors are allowed to bring in these funds and deposit them in a nonresident baht account opened at Thailand's commercial banks. These funds can be withdrawn for investment, lending, paying for exports, or transferring to other baht accounts. The ultimate purpose of all the above permission is for facilitating trade and investment in the productive sector. In the 1980s, the average net capital flow in the form of nonresident baht accounts was about 10.4 billion baht a year, accounting for only 7% of the total private nonbank flows. In the 1990s, it was increased to 80.2 billion baht a year and accounted for about 60% of the total flows. In the 1980s, most of funds in nonresident baht account came from the U.S., Singapore, Hong Kong, the U.K., and Japan. In the 1990s, almost half of the funds came from Singapore, with the rest mainly coming from Hong Kong and the U.K.

Table 15.1. Ordinary Least Squares (OLS) Results.

(Dependent Variable is NRB)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TVOL	2.578334	0.372288	6.925637	0.0000
RSET	0.086445	0.110373	0.78321	0.4500
EREXC	–3.792817	1.98535	–1.910402	0.0825
RDEP	42.80398	6.69559	6.392862	0.0001
OTHERS	–0.204949	0.045543	–4.500168	0.0009
C	–68.87969	30.78714	–2.237287	0.0469
AR(1)	–0.838185	0.217428	–3.854995	0.0027

R-squared	0.911675	Mean dep. var	29.8055
Adjusted R-squared	0.863497	S. D.dep. var	34.80145
S. E. of regression	12.85784	AIC	5.393209
Sum squared resid	1818.566	Schwarz criterion	5.739465
Log likelihood	–67.07978	F-statistic	18.92326
Durbin-Watson stat	2.563966	Prob(F-statistic)	0.000033
Inverted AR Roots	–0.84		

Table 15.2. Dickey and Fuller Unit Root Test.

Variable	At level	First difference	Variable	At level	First difference
NRB	–0.1709 [0]	–4.3326 [0]	EREXC	–1.5271 [0]	–4.1957 [0]
	(–3.0400)	(–3.0521)		(–3.0400)	(–3.0521)
TVOL	–1.3095 [0]	–5.7309 [0]	RDEP	–1.3376 [0]	–4.0220 [3]
	(–3.0400)	(–3.0521)		(3.0400)	(–3.1003)
RSET	–3.5969 [0]	–6.9813 [0]	OTHERS	–3.3333 [2]	–3.6731 [3]
	(–3.0400)	(–3.0521)		(–3.0659)	(–3.1003)

The determinants of capital flows in the form of nonresident baht accounts are different from other types of flows in that they are short-term almost by definition. They are deposited in local commercial banks to gain from domestic

Table 15.3. Cointegration Test.

15.3A: Cointegrating LR test based on Maximum Eigenvalue of the stochastic matrix

Eigenvalue	Likelihood Ratio	5% Critical Value	1% Critical Value	Hypothesized No. of CE(s)
0.96944	145.6461	94.15	103.18	None **
0.879793	82.86117	68.52	76.07	At most 1 **
0.775876	44.72752	47.21	54.46	At most 2
0.544078	17.80754	29.68	35.65	At most 3
0.161642	3.66974	15.41	20.04	At most 4
0.027188	0.496153	3.76	6.65	At most 5

*(**) denotes rejection of the hypothesis at 5%(1%) significance level.
L.R. test indicates 3 cointegrating equation(s) at 5% significance level.

15.3B: Estimated cointegrating vector.

NRB	TVOL	RSET	EREXC	RDEP	OTHERS	C
1	–3.452888	–0.289536	7.659068	–52.75636	0.334983	32.82504
	–0.1847	–0.03791	–0.85095	–2.84314	–0.0247	
Log likelihood	–324.4305					

Table 15.4. Empirical Estimates of ECM.

		D(NRB) = 0.0189*Error + 4.628
SE. =	(–0.0143)	(–3.1381)
T-stat. =	(–1.3230)	(–1.4748)
		R-squared = 0.0986 SE. = 13.3141

and foreign exchange rate differentials, for speculation in the changes of foreign exchange rates, and for awaiting other trade and investment opportunities. Therefore, by the interest parity condition and the portfolio adjustment theory, we can postulate that factors determining net flows of nonresident baht accounts are domestic, and foreign interest rates spreads, real exchange rate changes, trade volume, returns on investment in Thailand's stock market (if the investors should shift from the nonresident baht account deposit to portfolio investment) and the supply of other types of capital flows. Specifically, the model can be written as follows:

$$NRB = f(IND, REXC, TVOL, RSET, OTHERS)$$

where IND = domestic and foreign interest rates spread, REXC = real exchange rate changes, TVOL = trade volume, RSER = return on investment in Thailand's stock market, and OTHERS = the supply of other types of capital flows.

Our estimation results are shown in Table 16. The estimated parameters of all postulated variables are statistically significant, and we can conclude that the major determinants of the net capital flows in the form of nonresident baht accounts were differentials of the Thai and foreign interest rates, changes of real exchange rates, returns on investment in Thailand's stock market, and the availability of other types of capital flows. The estimated error correction adjustment parameters are positive. If short-run disturbances exist, they seem to be divergent from the long-run equilibrium, suggesting that this type of capital flows is rather unstable.

4. IMPACT OF THAILAND'S FOREIGN CAPITAL FLOWS

4.1. Use of a Growth Accounting Framework

In our earlier paper (Wiboonchutikula et al. (1995)), we used the growth accounting methodology to find the impact of capital flows. Within the

Table 16. Regression Estimates for Aggregate Gross Foreign Capital Inflows to Thailand.

Variables	Industries			
	Light	Heavy	Petro-chemical	Overall
Constant	0.2190	0.0170	0.1070	0.0650
Absolute T Stat.	2.8900	0.0860	2.5700	0.8100
Y90–95	–0.1170	0.0030	0.0280	0.0110
Absolute T Stat.	2.6000	0.0140	0.6800	0.1100
Labor	–0.0040	0.0180	0.0004	0.0800
Absolute T Stat.	1.8000	1.7000	0.3200	1.7000
Capital	–0.2750	–0.2900	0.0360	–0.5760
Absolute T Stat.	0.3600	0.1200	0.2300	1.0100
FI	–1.3080	–0.1620	–0.0880	0.1930
Absolute T Stat.	0.9300	0.1700	0.7530	0.6200
DFI	1.3970	–0.2240	0.0360	–0.2540
Absolute T Stat.	1.7900	0.2000	0.2800	0.6200
R-square	0.6380	0.1470	0.0100	0.0640

Source: Wiboonchutikula Paitoon, Lakshmi Raut, and Bangorn Tubtimtong (1996).

aggregate production function framework, the main determinants of output Y_{it} of industry i in time period t are domestic capital stock K_{it}, foreign capital stock F_{it}, labor L_{it} as follows:

$$Y_{it} = A_{it} L_{it}^{\alpha 2} K_{it}^{a21} F_{it}^{\alpha 22}$$

$$A_{it} = B_{it}\left[1 + \eta\left(\frac{FI}{Y}\right)_{it}\right] \tag{1}$$

where A_{it} is the total factor productivity level of industry i in period t. Presumably, the sectors in which foreign capital is invested has higher productivity compared to the rest of the economy. In the above specification, we have assumed that the total factor productivity parameter, A_{it}, is endogenously determined by the share of foreign direct investment in GDP, the output due to productivity differential of the sector where foreign capital is invested as compared to the rest of the economy, B_{it}, denotes the residual total factor productivity level.

Let us reinterpret our model in Feder's (1982) framework (which he developed to study the effect of export). More specifically, we assume that the marginal products of labor and capital in the foreign investment sector are

$(1+\alpha)$ times higher than those of the rest of the economy; and that marginal and average productivity of labor within the rest of the economy are approximately equal. Then, it can be shown that $\delta = \eta/(1-\eta)$. By taking the natural logarithm and then the first difference of this production function, using the approximation that $\log(1+z) = z$ when z is small, and denoting the natural logarithm of an upper case variable by its lower case, and the difference a variable by a dot over it we obtain the following equation:

$$Y_{it} = \alpha_{0t} + \alpha_1 i_{it} + \alpha_{21}\left(\frac{I}{Y}\right)_{it} + \alpha_{22}\left(\frac{FI}{Y}\right)_{it} + \eta\Delta\left(\frac{FI}{Y}\right) + \varepsilon_{it}$$

$$= \alpha_{0t} + \alpha_1 i_{it} + \alpha_2\left(\frac{I}{Y}\right)_{it} + \alpha_4\Delta\left(\frac{FI}{Y}\right) + \varepsilon_{it} \qquad (2)$$

where (FI/Y) is the average annual change in the foreign direct investment/output ratio during period t, and I is the domestic investment rate. In this specification, if $\alpha_3 + \alpha_4 = 0$, then the sector with foreign capital does not have higher factor productivity relative to the rest of the economy.

Our study categorizes Thailand's industries into three broader groups: light, heavy, and petro-chemical. The estimate results are shown in Table 16. With the exception of the light industry, there is no statistical evidence for the hypothesis that sectors with a higher rate of total (direct as well as portfolio) foreign investment has higher productivity growth. In the light industry, however, it appears that sectors with higher total foreign capital flows are associated with higher productivity growth. The causality of whether foreign capital flows were higher to the sectors which had higher productivity growth, and thus more attractive for investment, or whether foreign capital flows into a sector led it to have higher productivity growth is not clear from these results. Further research along these lines will be very useful.

4.2. Use of the VAR Model

We also use the nonstructural vector autoregressive (VAR) model together with the impulse response function to study the impact of changes in each type of capital flows on growth and stability. The stability variables are represented by inflation, current account balance, and interest rates. The VAR model is expressed in the following form:

$$NFI_{i,t} = \alpha + \sum_{j=1}^{n} \beta jNFI_{i,t-j} + \sum_{j=1}^{n} \delta jGGDP_{i,t-j} + \sum_{j=1}^{n} \gamma jCPI_{i,t-j}$$

$$+ \sum_{j=1}^{n} \eta jISGAP_{i,t-j} + \sum_{j=1}^{n} \pi jDISCOUNT_{i,t-j} + \varepsilon t$$

where NFI_i = net foreign capital flows, GGDP = growth rate of real GDP, CPI = consumer price index, ISGAP = investment saving gap, DISCOUNT = discount rate, i = each type of foreign capital flows; i = 1 : bank (BANK); i = 2 : direct foreign investment (DFI); i = 3 : portfolio foreign investment (PFI); i = 4 : private loans (LOAN); i = 5 : nonresident baht account (NR); and i = 6 : total of net foreign capital flows.

The above model is estimated by using the yearly data from 1977 to 1995. The results of estimating the model using the OLS method are shown in Table 17. The growth of real GDP determined all types of capital flows except for bank loans. Inflation determined portfolio foreign investment and nonresident baht accounts. The balance of current account represented by investment-saving gaps determined direct foreign investment.

After constructing and estimating all of the above equations in the VAR model, we are now ready to use the impulse response function to simulate the dynamic impact of changes in each type of capital flows on variables representing growth and stability. The method is to allow for one standard deviation shock in the innovation of each flow, where the shock comes from an unanticipated change in each type of capital flows. The results are shown in Tables 18 to 25. For easy interpretation, we also show the percentage distribution of components of forecasting errors in order to determine the impact of changes in each type of capital flows on all the growth and stability variables.

A change in most types of capital flows had an impact on real GDP growth and current account balances. However, the effects on inflation and interest rates were quite little. An unanticipated shock in portfolio foreign investment and the nonresident baht accounts had more dynamic impact on real GDP growth than other types of capital flows. Meanwhile, direct foreign investment and private loans had a relatively large impact on the current account balances represented by the investment-saving gaps.

5. CONCLUSION

Foreign capital of all types flowed into Thailand at a rapid rate from the late 1980s to the first half of the 1990s following the country's policy of opening

Table 17. Impact of Capital Flows by VAR.

Dependent Variable	Total	Bank	Direct Investment	Portfolio Investment	Private Loans	Non Resident Baht A/C
AR(1)	1.2492*	1.2161*	0.538*	0.3356	0.3509	1.2797*
T-stat	8.672	2.0721	2.7579	–0.5377	1.124	8.7277
GGDP(–1)	–2.2059*	7.3469	0.5972*	–2.4513*	2.8134*	–1.0339*
T-stat	–1.9689	1.5758	2.366	–4.3116	2.3558	–7.5369
ISGAP(–1)	–19.4303	12.6665	2.3711*	2.001	–0.7972	–1.5706
T-stat	–2.76	0.5965	1.5388	0.3937	–0.0786	–1.3217
CPI(–1)	0.2219	–0.6449	0.2591	0.8802*	0.9844	0.3154*
T-stat	0.1338	–0.2005	1.7026	1.7685	0.879	2.0883
DISCOUNT(–1)	4.6174	–14.8544	–1.376	–4.4662	13.0954	1.2443
T-stat	0.5159	–0.4445	–0.7005	–0.5776	0.8307	0.6805
R^2	0.9648	0.6981	0.8873	0.7772	0.6152	0.9859
Log likelihood	–86.4728	–82.2383	–59.6576	–64.293	–76.5011	–41.7634

Table 18. Impulse Response to One SD Innovation and Variance Decomposition of Bank Loans.

Response of Bank Loans

Period	BANK	GGDP	ISGAP	CPI	DISCOUNT
1	58.184	0.000	0.000	0.000	0.000
	-10.623	0.000	0.000	0.000	0.000
2	30.814	15.337	8.480	-3.724	-6.639
	-15.766	-10.731	-11.886	-8.303	-11.632
3	51.728	6.140	-10.223	11.203	7.442
	-28.334	-7.698	-14.277	-7.319	-9.393
4	32.237	10.872	4.343	0.886	-10.146
	-32.703	-13.922	-17.695	-9.762	-11.677
5	45.262	8.037	-6.065	13.625	2.770
	-45.577	-11.449	-19.317	-10.040	-11.684
6	38.031	9.524	2.681	9.196	-7.119
	-48.634	-16.271	-19.483	-10.381	-11.840
7	45.955	9.116	-0.886	16.805	-0.767
	-61.670	-15.620	-21.462	-12.945	-12.654
8	46.357	9.991	3.614	16.754	-4.940
	-67.535	-19.685	-21.251	-13.068	-12.208
9	53.050	10.625	3.244	21.700	-2.518
	-82.037	-21.140	-23.658	-17.744	-13.550
10	57.839	11.702	5.746	23.963	-4.129
	-93.329	-25.222	-24.743	-19.824	-13.566

Variance Decomposition of Bank Loans

Period	S.E.	BANK	GGDP	ISGAP	CPI	DISCOUNT
1	1.000	58.184	0.000	0.000	0.000	0.0000
2	2.000	68.556	5.005	1.530	0.295	0.9377
3	3.000	87.743	3.545	2.291	1.810	1.2919
4	4.000	94.757	4.356	2.175	1.561	2.2542
5	5.000	106.406	4.025	2.050	2.877	1.8554
6	6.000	114.025	4.203	1.840	3.156	2.0055
7	7.000	124.421	4.067	1.550	4.475	1.6882
8	8.000	134.341	4.041	1.402	5.394	1.5833
9	9.000	146.500	3.927	1.228	6.730	1.3609
10	10.000	159.903	3.830	1.160	7.895	1.2090

Table 19. Impulse Response to One SD Innovation and Variance Decomposition of Direct Foreign Investment.

Response of Direct Foreign Investment

Period	DIRECT	GGDP	ISGAP	CPI	DISCOUNT
1	6.655	0.000	0.000	0.000	0.000
	–1.109	0.000	0.000	0.000	0.000
2	5.887	3.076	3.117	0.365	–0.648
	–1.750	–1.578	–1.417	–0.330	–0.763
3	3.944	–1.121	0.992	0.822	0.000
	–1.863	–1.386	–1.704	–0.460	–0.807
4	3.665	0.918	2.030	0.991	–0.085
	–1.922	–1.462	–1.504	–0.473	–0.553
5	2.701	–1.197	0.806	1.122	0.102
	–1.920	–1.354	–1.500	–0.502	–0.553
6	2.642	0.105	1.367	1.166	0.018
	–1.798	–1.266	–1.333	–0.515	–0.439
7	2.156	–1.042	0.667	1.209	0.099
	–1.733	–1.138	–1.245	–0.539	–0.411
8	2.168	–0.256	0.999	1.216	0.040
	–1.640	–1.055	–1.145	–0.566	–0.359
9	1.918	–0.895	0.607	1.228	0.083
	–1.598	–0.950	–1.071	–0.595	–0.340
10	1.944	–0.431	0.807	1.225	0.047
	–1.556	–0.893	–1.016	–0.626	–0.316

Variance Decomposition of Direct Foreign Investment

Period	S.E.	DIRECT	GGDP	ISGAP	CPI	DISCOUNT
1	6.655	100.000	0.000	0.000	0.000	0.0000
2	9.934	80.007	9.587	9.844	0.135	0.4260
3	10.824	80.670	9.148	9.132	0.691	0.3588
4	11.685	79.054	8.466	10.855	1.313	0.3131
5	12.132	78.292	8.827	10.511	2.073	0.2975
6	12.546	77.643	8.261	11.016	2.802	0.2784
7	12.847	76.861	8.536	10.774	3.558	0.2715
8	13.126	76.357	8.215	10.901	4.266	0.2610
9	13.367	75.697	8.371	10.719	4.959	0.2556
10	13.593	75.235	8.194	10.716	5.606	0.2483

Table 20. Impulse Response to One SD Innovation and Variance Decomposition of Portfolio Foreign Investment.

Response of Portfolio Foreign Investment

Period	PORT	GGDP	ISGAP	CPI	DISCOUNT
1	14.031	0.000	0.000	0.000	0.000
	-2.480	0.000	0.000	0.000	0.000
2	1.073	-12.861	0.370	1.532	-1.986
	-7.199	-3.388	-2.981	-0.988	-2.740
3	-9.104	12.893	9.359	-0.399	-4.381
	-8.652	-7.783	-3.764	-1.491	-3.229
4	13.582	-1.674	-7.894	2.259	8.207
	-13.588	-10.756	-7.258	-2.451	-5.533
5	4.221	-14.658	-0.497	1.111	-3.554
	-16.339	-15.973	-8.825	-1.808	-7.210
6	-13.953	12.476	11.073	-0.488	-6.403
	-22.458	-23.799	-13.055	-2.716	-9.124
7	12.180	4.265	-7.213	2.059	8.906
	-32.382	-23.504	-18.940	-3.138	-15.007
8	9.816	-19.495	-4.758	1.718	-1.060
	-30.104	-35.938	-17.926	-2.338	-15.569
9	-18.046	10.788	13.902	-0.914	-9.892
	-46.783	-45.625	-28.540	-4.840	-19.794
10	8.888	11.427	-5.291	1.778	9.194
	-55.773	-42.988	-33.948	-4.608	-29.031

Variance Decomposition of Portfolio Foreign Investment

Period	S.E.	PORT	GGDP	ISGAP	CPI	DISCOUNT
1	14.031	100.000	0.000	0.000	0.000	0.0000
2	19.231	53.541	44.721	0.037	0.635	1.0660
3	26.942	38.697	45.684	12.086	0.345	3.1877
4	32.372	44.407	31.912	14.319	0.726	8.6358
5	35.982	37.319	42.424	11.609	0.683	7.9653
6	42.531	37.473	38.970	15.087	0.502	7.9679
7	45.946	39.138	34.254	15.392	0.631	10.5850
8	51.129	35.291	42.200	13.296	0.623	8.5908
9	57.863	37.281	36.424	16.154	0.511	9.6301
10	60.608	36.131	36.754	15.485	0.552	11.0785

Table 21. Impulse Response to One SD Innovation and Variance Decomposition of Private Loans.

Response of Private Loans

Period	LOANS	GGDP	ISGAP	CPI	DISCOUNT
1	28.858	0.000	0.000	0.000	0.000
	–5.101	0.000	0.000	0.000	0.000
2	16.669	4.486	14.309	3.626	6.538
	–9.029	–5.810	–6.940	–3.628	–6.329
3	–11.384	–11.078	7.818	8.538	12.052
	–12.305	–7.056	–7.950	–4.856	–6.201
4	–0.261	–5.335	6.639	1.247	–1.805
	–9.056	–5.215	–6.648	–3.766	–7.268
5	3.757	0.119	5.948	1.968	0.692
	–8.489	–5.675	–4.534	–2.495	–4.387
6	–2.793	–3.382	3.338	3.597	3.109
	–5.216	–3.714	–3.960	–3.013	–4.598
7	0.026	–2.060	2.817	1.671	–0.482
	–3.697	–3.148	–3.525	–2.241	–3.311
8	1.453	–0.428	2.696	1.714	0.019
	–4.046	–2.767	–2.992	–1.901	–2.429
9	–0.360	–1.357	2.010	2.188	0.833
	–2.370	–1.971	–2.556	–2.023	–2.337
10	0.263	–1.093	1.839	1.655	–0.103
	–1.816	–1.806	–2.295	–1.826	–1.518

Variance Decomposition of Private Loans

Period	S.E.	LOANS	GGDP	ISGAP	CPI	DISCOUNT
1	28.858	100.000	0.000	0.000	0.000	0.0000
2	37.302	79.821	1.447	14.715	0.945	3.0724
3	43.852	64.495	7.429	13.826	4.475	9.7758
4	44.726	62.002	8.564	15.494	4.379	9.5603
5	45.324	61.064	8.340	16.810	4.453	9.3330
6	45.905	59.898	8.673	16.916	4.955	9.5569
7	46.070	59.469	8.811	17.169	5.051	9.4994
8	46.206	59.220	8.768	17.409	5.159	9.4438
9	46.330	58.909	8.807	17.504	5.355	9.4256
10	46.410	58.710	8.832	17.601	5.464	9.3937

Table 22. Impulse Response to One SD Innovation and Variance Decomposition of Non Resident Baht Account.

Response of Non Resident Baht Account

Period	NON	GGDP	ISGAP	CPI	DISCOUNT
1	3.291	0.000	0.000	0.000	0.000
	-0.582	0.000	0.000	0.000	0.000
2	2.442	-4.330	-1.247	0.653	0.597
	-1.308	-0.980	-0.664	-0.416	-0.701
3	6.657	-2.453	-0.490	-0.715	-1.010
	-1.590	-1.069	-1.149	-0.680	-1.157
4	6.968	-7.764	-2.185	0.467	0.542
	-2.877	-2.178	-1.788	-0.892	-1.559
5	13.293	-7.861	-1.924	-0.971	-1.173
	-4.204	-3.196	-2.792	-1.376	-2.394
6	17.108	-15.492	-4.206	0.008	0.174
	-7.189	-5.442	-4.209	-1.965	-3.466
7	28.212	-19.694	-5.044	-1.506	-1.568
	-11.360	-8.722	-6.445	-2.977	-5.226
8	39.622	-32.851	-8.754	-0.896	-0.574
	-18.881	-14.483	-9.764	-4.371	-7.704
9	61.634	-45.900	-11.936	-2.721	-2.538
	-30.509	-23.663	-14.912	-6.580	-11.515
10	89.765	-71.716	-18.949	-2.811	-2.169
	-49.889	-38.789	-22.709	-9.795	-17.091

Variance Decomposition of Non Resident Baht Account

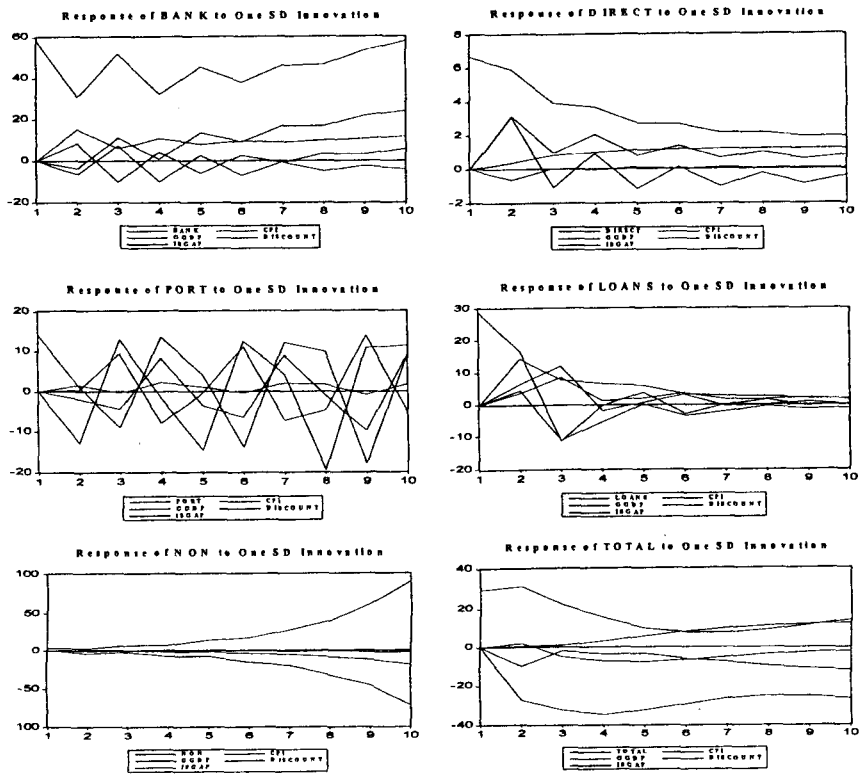
Period	S.E.	NON	GGDP	ISGAP	CPI	DISCOUNT
1	3.291	100.000	0.000	0.000	0.000	0.0000
2	6.155	44.334	49.493	4.106	1.127	0.9397
3	9.486	67.909	27.525	1.995	1.043	1.5283
4	14.286	53.729	41.668	3.219	0.567	0.8179
5	21.181	63.832	32.731	2.290	0.468	0.6787
6	31.608	57.961	38.722	2.799	0.210	0.3078
7	47.042	62.132	35.007	2.413	0.197	0.2501
8	70.284	59.614	37.530	2.632	0.105	0.1187
9	104.888	61.296	36.001	2.477	0.114	0.1119
10	156.761	60.231	37.046	2.570	0.083	0.0692

Table 23. Impulse Response to One SD Innovation and Variance Decomposition of Net Foreign Capital Flows.

Response of Total					
Period	TOTAL	GGDP	ISGAP	CPI	DISCOUNT
1	29.521	0.000	0.000	0.000	0.000
	–4.920	0.000	0.000	0.000	0.000
2	31.306	–9.712	–27.038	0.572	2.176
	–9.308	–8.648	–6.844	–1.052	–3.463
3	21.956	–1.945	–32.140	1.085	–4.996
	–11.487	–9.931	–10.613	–2.073	–5.076
4	15.457	–3.600	–34.727	3.375	–7.278
	–13.801	–9.852	–12.425	–2.863	–5.071
5	9.983	–3.379	–32.237	5.990	–7.755
	–14.955	–10.025	–13.876	–3.349	–5.195
6	7.865	–6.104	–29.386	8.346	–6.646
	–15.386	–8.878	–15.151	–3.508	–4.980
7	7.671	–7.714	–26.490	10.101	–5.164
	–15.130	–8.649	–15.972	–3.565	–4.749
8	9.285	–9.836	–25.243	11.248	–3.747
	–14.708	–8.119	–16.777	–3.638	–4.552
9	11.497	–11.043	–25.347	11.925	–2.842
	–14.449	–8.435	–17.380	–3.848	–4.454
10	13.911	–12.124	–26.874	12.347	–2.459
	–14.736	–8.829	–18.209	–4.223	–4.431

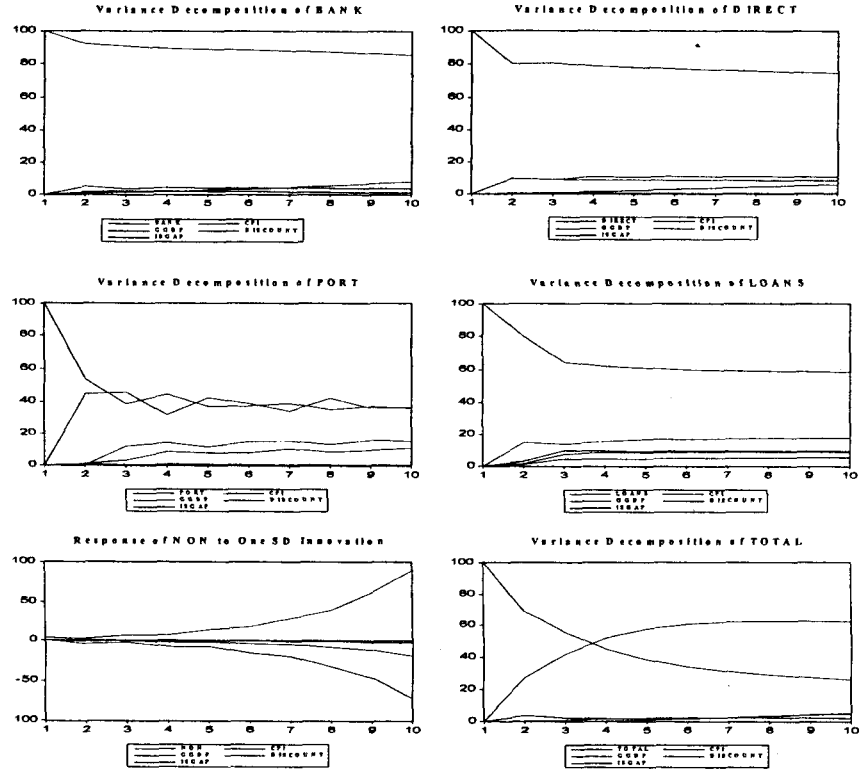
Variance Decomposition of Total						
Period	S.E.	TOTAL	GGDP	ISGAP	CPI	DISCOUNT
1	29.521	100.000	0.000	0.000	0.000	0.0000
2	51.788	69.037	3.517	27.257	0.012	0.1766
3	65.015	55.208	2.321	41.733	0.036	0.7025
4	75.823	44.746	1.932	51.660	0.224	1.4377
5	83.639	38.199	1.751	57.311	0.697	2.0412
6	89.844	33.871	1.979	60.366	1.467	2.3162
7	94.978	30.961	2.431	61.796	2.444	2.3682
8	99.908	28.845	3.166	62.232	3.476	2.2809
9	105.016	27.305	3.971	62.150	4.436	2.1376
10	110.678	26.163	4.775	61.850	5.238	1.9739

Table 24. Impulse Response to One SD Innovation of Each Capital Flow.



up the external financial sector. Investors were also attracted by Thailand's sound economic fundamentals, namely, high growth, low inflation, and stable exchange rates. However, from the early 1990s, the major components of the private capital flows were drastically changed from direct and portfolio foreign investment to borrowing in the banking sector and deposits in the nonresident baht accounts. As foreign investors grew suspicious of Thailand's macroeconomic stability and export growth in the mid-1990s, capital inflows quickly dried up, culminating in a severe currency and financial crisis in 1997. This study analyzes all aspects of Thailand's capital flows using the various econometric methods in order to learn how the change in Thailand's capital flow structure might play a part in the country's current economic crisis.

Table 25. Variance Decomposition of Each Capital Flow.



Our study on the nature of Thailand's capital flows in the 1990s shows that in a univariate framework, all types of capital flows, both long-term and short-term flows, were quite similar in their persistency or volatility. However, based on the multivariate results, direct foreign investment responded less to disturbances in other flows than other types of capital flows did. This implies that direct foreign investment was more persistent than other flows. Furthermore, by computing the volatility index based on the ARCH and GARCH models, the results show that bank loans and capital flows in the form of nonresident baht accounts were more volatile than other flows. In all models, the findings are consistent: capital flow volatility increased in the years immediately preceding Thailand's crisis in 1997.

All types of capital inflows were attracted by Thailand's high real GDP growth rates and stable exchange rates. Additional variables that determined direct foreign investment were production costs and the openness policy. Portfolio foreign investment responded significantly to economic stability and factors directly affecting investment returns. Bank loans reacted to current account balances, and nonresident baht accounts were sensitive to interest rate differentials.

We also find that most types of foreign capital flows contributed to affected overall production growth, but they did not have much effect on productivity changes of industries except for light industries. An unanticipated shock in portfolio foreign investment and the nonresident baht accounts had more dynamic impact on real GDP growth than other types of capital flows. Meanwhile, direct foreign investment and private loans had a relatively large impact on the current account balance, as represented by the investment-saving gap.

Although opening up the capital account can potentially benefit growth, the desirable impact is sensitive to macroeconomic policies, a strong banking and financial system, and the general economic and political conditions. In Thailand, as the financial sector and its supporting institutions were not yet developed, the capital inflows could easily be used for financing speculative sectors and industries supported by government protection or assistance. As Thailand is integrating into the world economy, a wrong policy is quickly and severely punished. It is also very difficult and increasingly costly to protect any sectors which are not internationally competitive and institutions which are not efficient.

NOTE

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