ESSAYS ON FINANCIAL LIBERALIZATION

by

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ABSTRACT

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Financial liberalization is one of the main reform strategies of developing economies during the globalization process. Development of the more sophisticated financial sectors by the contribution of foreign banks and investors is expected to lead to a sustainable economic growth in these economies. However, free capital mobility which is another outcome of the financial integration has led to a highly unstable international financial environment leaving the developing economies in deep financial turmoil.

First, the capital flows under two different policy approaches to liberalization; shock therapy and gradualism are analyzed. Two emerging economies, India and Turkey which are the two cases of gradualism and shock therapy, respectively are selected for the analysis. The study analyzes the two countries' liberalization reforms and the nature of capital flows in the course of their liberalization. The impact of capital flows on the economies is also examined and the results of a detailed analysis of growth pattern in two countries suggest that there is a strong relation between the economic growth and the non-resident cash flows in the shock therapy case, Turkey. There is also evidence

suggesting that India, following a gradualist approach, is less prone to crises with more stable financial variables than Turkey.

The thesis continues with the analysis of the changing dynamics of macroeconomic variables in the process of Turkish and Indian financial liberalization. Results suggest that there is an increased interdependency among the fundamentals as the countries move towards financial liberalization process. There is also evidence on increasing impact of foreign fundamentals suggesting decreased autonomy.

The link between financial liberalization and volatility in emerging markets is the last topic of the thesis. Examining ten emerging stock markets with different degrees of liberalization, it is found that in countries with limited liberalization, events causing sudden changes in volatility are local while fully liberalized markets are subject to global events and so the volatility contagion. There is also evidence on decreasing volatility in the last four years of the analysis, suggesting that maturing liberalization might have a stabilizing effect and might decrease the boom-bust cycles in the stock markets.

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Love…

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CHAPTER I

CAPITAL FLOWS UNDER TWO DIFFERENT LIBERALIZATION EPISODES: INDIA & TURKEY

1.1. Introduction

Capital account liberalization is the last step of economic liberalization and international integration programs coming after the interest rate deregulation, international trade liberalization and current account liberalization. Liberalization of capital flows is also one of the topics in the economic literature with greatest disconnection between the economic theory and the empirical cases. Neoclassical theory suggests that free flows of external capital should be equilibrating and help smooth a country's consumption and production paths. However, in the real world, liberalization of capital flows has constantly been associated with serious economic and financial crises in Asia and Latin America in the 1990s. There is a large body of empirical work presenting the close link between the liberalization of the financial system and economic and financial crises particularly in developing countries. The recent Asian crisis, for example, is an excellent case for examining the role of capital account liberalization in causing or accelerating the region's financial meltdown. In a recent study by Williamson and Drabek (1998), it is indicated that the only difference between the countries that did or did not have economic crisis is the status of their capital account. Their finding is also in

parallel with Stiglitz's (2000) study concluding that the growth benefits of capital account liberalization are obscured by the costs of associated volatility. It is now well known that, premature financial liberalization seriously contributed to the occurrence and the depth of the crises in countries like Thailand, Korea and Indonesia even if it was not the origin of the crises. On the other side, India and China, two of the economies with controlled capital accounts, managed to avoid the crisis and sustained their economic growth.

Theoretically, it is possible that the instability caused by capital account liberalization is more than compensated for by faster long-run economic growth due to greater availability of capital inflows (Fisher 1997; Summers 2000). Although this statement is frequently suggested by the proponents of liberalization reforms, the results of empirical studies on the effects of capital account liberalization on economic growth are mixed. While Edison, Levine, Ricci and Slock (2002) do not find a strong relation between international integration and economic growth, Borensztein, De Gregorio and Lee (1998) find that there is a positive link between FDI and economic growth when the education level is high in the host country. In contrast, Mody and Murshid (2002) find that there is a one-to-one relation between the capital inflows and the domestic investment, but the link becomes weaker over time.

Another aspect of liberalization reforms, which is not often discussed in the literature, is the method of their implementation. In launching the process of economic policy reforms, two possible approaches are shock therapy and gradualism from which the shock therapy is often recommended due to its total ability to purge the remains of the previous system. On the contrary, the gradualist approach is less appreciated because of its retarding effect on the reforms as the opposed interest groups often collaborate to

decelerate the process that would affect their interests. Marangos (2002) highlights the basics of these two policy approaches in a simple manner that the shock therapy model fits well with the interdependent, mutually supportive and interactive character of the economic relations which implies that the reforms should be introduced simultaneously. On the other hand, the gradualist approach is based on the need for a well established economical, political, institutional and ideological structures before the reforms are implemented. The two examples of shock therapy are Chile and Poland, which showed superior performance as compared to other east European countries that followed the gradualist approach (Nayar, 1998). In contrast, India, well known with the gradualist reforms taken during the course of international integration, was able to overcome the destructive influence of Asian crisis while many Asian countries' economies were collapsing one by one.

In the empirical literature, studies examining the channels through which financial liberalization promotes economic growth rarely take the potential effect of policy implementations into consideration. Classification of liberalization episodes based on the path chosen for liberalization is essential, especially, for policy implications.

The purpose of this chapter is to examine two liberalization episodes, India and Turkey, in greater detail. India's gradualist approach to reform- sometimes referred as frustratingly slow pace of implementation- is contrasted with Turkey's financial liberalization which can well be described as a shock therapy. Based on an analytic review of liberalization reforms applied in two countries, I consider the total outcome of reforms to assess the extent to which the two different approaches were effective and successful in the development of these economies.

1.2. The Liberalization Reforms

The liberalization episodes that I analyze are India and Turkey. The chronology of the episodes and details of the measures are summarized in Table 1. I discuss the episodes with a brief summary of pre-liberalization periods below.

The Indian financial system was quite well developed even before the Independence and unrestricted until the 1960s when the government started to use controls for the purpose of directing credit towards development programs. By the end of 1960s, fourteen major commercial banks were nationalized and all commercial banks (private and public) were directed to lend to priority sectors. Through the 1970s, directed credit took the major share of domestic lending and controls on exchange rate and interest rates became the common components of this tightly restricted financial system. By introducing the economic reforms in 1985 as part of the policy changes in the mid-1980s, the government started to reduce the controls on bank deposit rates. Further relaxation of controls on both deposit and lending interest rates and removal of directing lending began by 1990.

Until the late 1980s, international capital inflows and outflows were highly restricted and the purchase of foreign assets by residents, direct investment by foreigners and private external borrowing were absolutely prohibited. Following the balance of payments crisis in 1991, a stabilization program was initiated with the help of IMF and the government began to gradually relax the restrictions on inward capital flows and on currency convertibility for current account transactions. By 1993-94, the rupee was made convertible on the current account with market determined rates. In 1994, India moved to

full convertibility on current account transactions and formally accepted the obligations under Article VIII of the IMF.

As part of a gradualist reform program, restrictions on foreign direct investment, portfolio borrowing and foreign equity ownership have been progressively relaxed starting from 1992. Restrictions on the share of foreign ownership in enterprises for most sectors have been removed and the upper bound for the automatic approval of direct and portfolio investments have been raised. While the external commercial borrowing has been relaxed in the past several years, restrictions on the acquisition of foreign financial assets by the residents and on currency convertibility for capital account transactions are still effective. Although the capital account convertibility was scheduled in Indian government's agenda for much earlier time, the Asian crisis stopped a further move towards the full convertibility. Indeed, India escaped the contagion because of the absence of capital account convertibility (Singh, 2002). Recently, controls on capital account have been slightly reduced to allow residents to invest in foreign equities. In March 2002, all deposit schemes became fully convertible for non-resident Indians.

Liberalization of Turkish financial system started in the early 1980s as part of a structural change program aiming at export-led sustainable growth path. Launching of the new adjustment program was followed by a military regime during 1980-1983. An early attempt to liberalize the financial system started on 1981 with the removal of controls on deposit rates and on the allocation of credits. However, liberalization of banking system without adequate strengthening of regulatory and accounting framework and lack of banking supervision resulted in the collapse of a number of small banks and money brokers. After the "1982 bankers' scandal", liberalization policy tools were on and

off until the late 1980s and Turkey completed the liberalization of domestic financial system in late 1980s during which, highly subsidized export promotion and import liberalization together with regulated capital movements were the characteristics of macro policies. The exchange rate regime was liberalized in 1984 and restrictions on holdings of foreign exchange denominated deposit accounts by the residents were removed. Turkish Central Bank's control mechanism over commercial banks was simplified and revised. In 1987, Central Bank initiated open market operations as a new monetary instrument. The big step on the international integration of Turkey was the liberalization of capital account in August 1989 by removal of all restrictions on capital movements and on borrowing by residents in international markets. Liberalization program has been completed by the full convertibility of Turkish lira at the beginning of 1990 with acceptance of the Article VIII of IMF Articles of Agreement.

The major difference between Indian and Turkish liberalization experience is that India has not completed its external liberalization yet due to ongoing controls on capital account. Even tough, there are only a few years between the starting of their liberalization policies, today; India and Turkey present different images in terms of financial openness and international integration.

Table1. A chronology of Liberalization Reforms

TURKEY	
1980	Interest rate ceilings on loans and deposits were eliminated
1982	Banking crisis.
1984	Exchange rate controls removed 1984.
1986	Re-opening of Istanbul Stock Exchange, Limitations were placed on the net foreign asset positions of commercial banks.
1988	Article 15 of Decree 32 was accepted. Foreigners were not required a preapproval to purchase or sell securities listed on the Istanbul exchange, Permission for foreign investors and investment funds to buy and sell securities and become partners in Turkish companies.
1989	Permission for the foreign investors to trade in listed securities without any restrictions and paying withholding or capital gains tax.
1990	Permission for the residents to invest abroad up to US$5 million; investments above US$5 million would be subject to authorization, Capital flows were liberalized
1991	Banking crisis.
1994	Central Bank abandoned its interventionist policy
1995	Signing "Customs Union agreement with EU".
1996	Standard and Poor's lowered Turkey's debt rating from B+ to B
1997	The overnight repo rate jumped to 79.84%,
1999	Inflation rates sharply declined from 92.5% at the beginning of the year to 54.3% by the end, IMF and World Bank loans for structural and financial reforms.
2000	Turkey's long-term foreign currency rating was upgraded to 'B+ , The lira depreciated to its lowest level, Banking crisis, daily average overnight interest rate jumped to more than 1,000%., IMF's approval of Turkey's macroeconomic reforms with a US$10 billion loan package.
2001	Introduction of free floating exchange rate regime, Interest rates were cut and the banking sector recovered, IMF approved an additional US$8 billion loan package, S&P lowered Turkey's debt rating to 'B-'.
INDIA	
1975	The exchange rate was pegged to a basket of currencies on a controlled, floating basis (previously pegged to the Sterling)
1986	Indian nationals and foreigners were allowed to transfer capital abroad up to Rs 1 million
1990	OTC exchange was launched and the Bombay Stock exchange was linked to the Frankfurt Stock Exchange, The government liberalized foreign investment policy, Credit rating on Indian debt downgraded from Baa3 to Ba2, Government increased direct taxes, imposed import restrictions to manage the debt.
1991	The IMF approved loans amounting to $1.8 billion, The government launched a new liberalization program, The rupee was devalued 20%, FDI regulations were significantly liberalized.
1992	Permission for foreign institutional investors to make investments in all securities traded on the primary and secondary markets, Dual rate system was created, Restrictions on the use of foreign currency loans and credit lines were abolished, Stock market scandal, Permission for foreign portfolio investors to invest directly in listed Indian securities.
1994	Full convertibility of Rupee for current account transactions
2000	The Bombay Stock Exchange (BSE) Sensex reached a peak on Feb. 14 due to heavy buying by foreign funds, S&P downgraded its outlook on India's credit rating from positive to stable.
2001	The Central Bank cut interest rates, Further reduction in controls on equity markets, S&P downgraded India's currency ratings and outlook, Interest rates were cut gain, S&P affirmed the sovereign credit ratings and negative outlook for India.
2003	India has formally moved from debtor to creditor in its relations with the IMF.

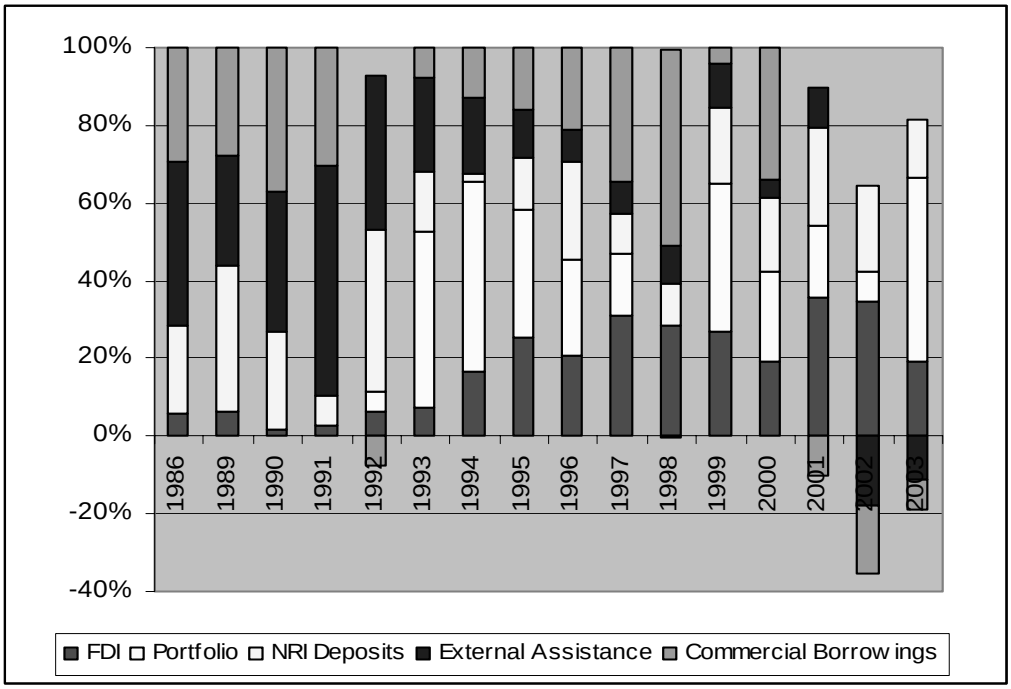
1.3. Capital Flows

In 1990s, the nature of the capital movements has dramatically changed in both countries. From a near absence of any private capital flows till 1992, today private inflows constitute a main proportion of total flows in India. The official flows representing grants and loans from bilateral and multilateral sources represented 75-80% of flows till 1991. Following the ease of controls on capital movements, the proportion of flows shown as external assistance had declined to about 20% and fell below 5% by late 1990s (Chart 1). Even though, Turkey faced a large surge of private capital inflow in the recent 15 years period, the weight of portfolio and direct investments started to increase progressively only after 2002 (Chart 2).

Following the removal of restrictions on capital account, the total amount of private investments flowing to Turkey has been more than $ 75 billion. During the same period, India has received more than $40 billion in foreign investment. Additionally, when the flow of private capital to emerging markets has shrunk considerably especially after 1996 (Chart 3), private flows to India have strengthened, and reach to $9 to $10 billion per year (Chart 4). Similar to India, Turkey has also strengthened its private capital inflows during the time of fall in emerging markets (Chart 5) and reached to $18 billion in 2004. However, the evolution of private capital flows, as it can be seen in Chart 5, presents an interesting pattern. After the liberalization of capital account in 1990, the continual increase of private capital flows has paused periodically (in almost every three years) by the heavy surge of outflows during the time of economic crises. Considering the sharp increase in inflows after the last twin crises of Turkey in 2000-2001, and even

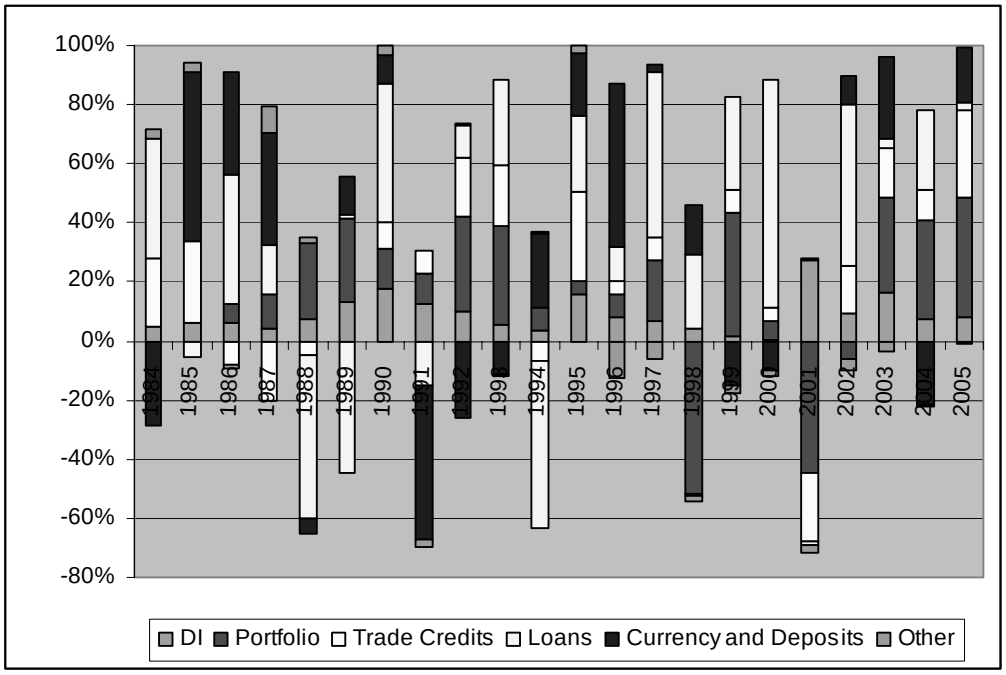
flows reaching almost $12 billion in the first four months of 2005, one can only wish for this pattern to be broken for Turkey.

Chart 1. Composition of Capital Inflows: India



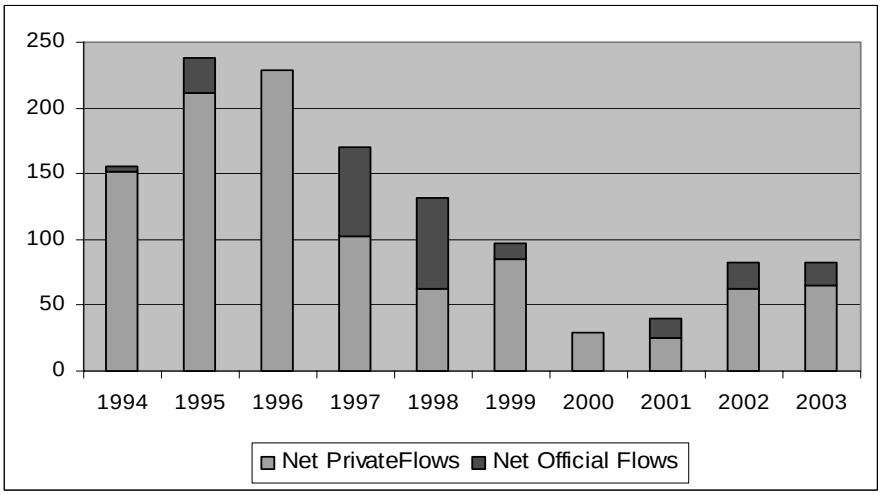
Source: IFS, 2002

Chart 2. Composition of Capital Inflows: Turkey



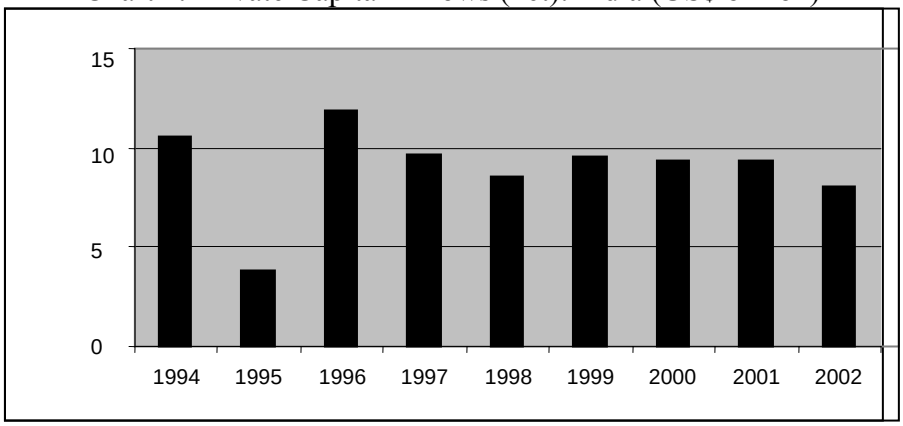
Source: IFS, 2002

Chart 3. Emerging Market Economies: Net Capital Flows (US$ billion)



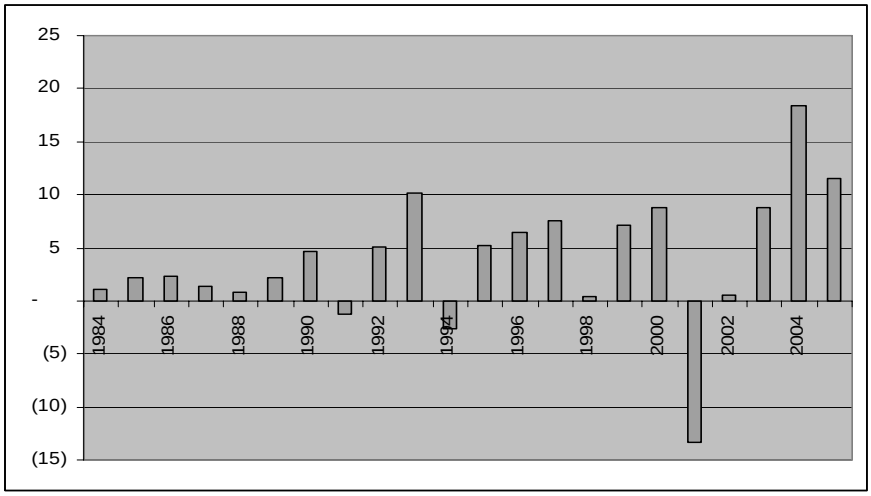
Source: IMF World Economic Outlook, September 2002

Chart 4. Private Capital Inflows (net): India (US$ billion)



Source: IFS, 2002

Chart 5. Private Capital Inflows (Net): Turkey (US$ billion)



Source: IFS, 2002

Table 2 summarizes the nature of total foreign capital that India attracted during the 1990-2002 period. Gradual opening of financial system and current account liberalization in 1993 led to a surge of capital inflows, and India has attracted about $22 billion in portfolio investments since 1993-94 and more than $24 billion in FDI. Portfolio flows began in 1993 and India continued to receive an average of $ 2.5 billion portfolio investment each year till the Asian crises. In 1998, the Indian stock market experienced an outflow reaching $ 61 million but soon the inflows went back to the $ 2-3 billion per year level. The large proportion of FDI and portfolio flows can also be attributed to the government's policy of limiting debt creating inflows, which is limited access to foreign bank borrowings, only by few large private companies with high credit ratings. In some years though, such debt creating flows were significant and constituted about 40 per cent of inflows.

The decomposition of foreign capital that Turkey has received during 1986-2005 is given in Table 3. Since the liberalization of capital account, Turkey has attracted a total of $34 billion in portfolio investments and more than $19 billion in FDI. Portfolio flows began in 1986 and continued to grow with the same volatile pattern of private capital flows. However, FDI followed a more stable pattern and Turkey continued to receive an average of $850 million FDI each year till 2001. The sharp increase in FDI flows in the last two years can be attributed to the sudden increase in real estate investments which contributed to more than 55% of total FDI flows in 2003.

Table 2. Foreign Capital Inflows (Non-Resident Capital Flows): India (US $ million)

Year	Foreign Direct Investment	Portfolio Investment	Other Investment	Total Foreign Capital Inflow
1990	0.00	0.00	6,138.73	6,138.73
1991	73.54	4.64	4,179.81	4,257.98
1992	276.51	283.58	2,586.57	3,146.66
1993	550.37	1,369.12	3,324.77	5,244.26
1994	973.27	5,491.13	3,023.60	9,488.00
1995	2,143.63	1,590.48	1,423.33	5,157.44
1996	2,426.06	3,958.32	10,413.20	16,797.58
1997	3,577.33	2,555.66	8,357.17	14,490.16
1998	2,634.65	-601.15	9,837.40	11,870.90
1999	2,168.59	2,317.07	5,622.69	10,108.35
2000	2,656.85	2,774.19	6,075.40	11,506.44
2001	4,333.95	2,040.51	1,565.78	7,940.24
2002	3,029.87	967.32	-233.63	3,763.56
Total	**24,844.60**	**22,750.90**	**62,314.80**	**109,910.00**

Source: IFS, 2002

Table 3. Foreign Capital Inflows (Non-Resident Capital Flows): Turkey (US $ million)

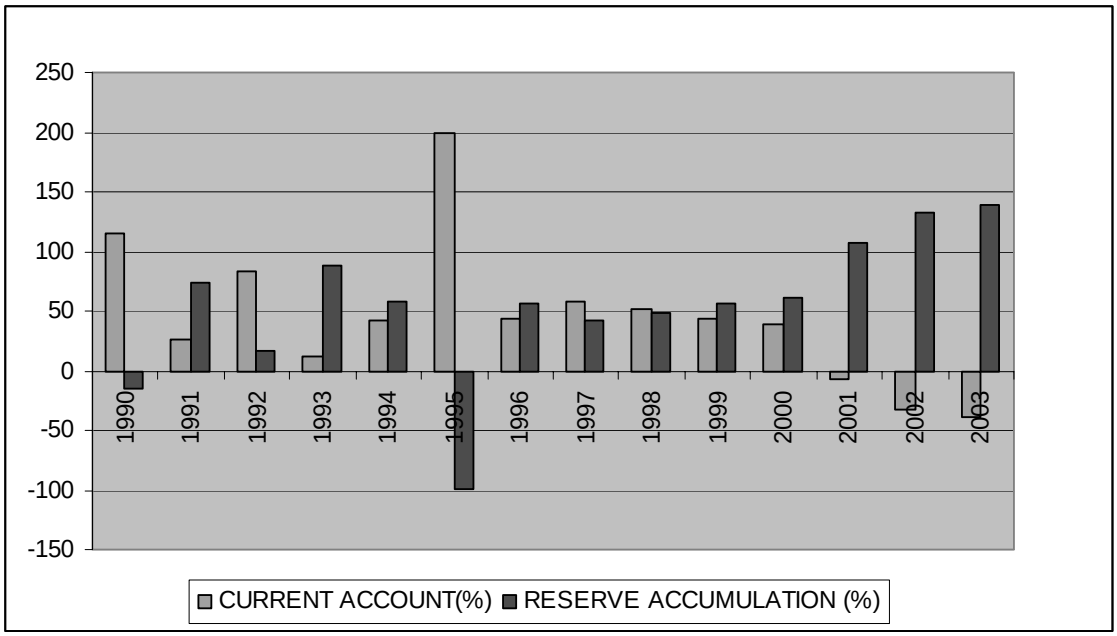
Year	Foreign Direct Investment	Portfolio Investment	Other Investment	Total Foreign Capital Inflow
1986	125.00	146.00	2,166.00	2,437.00
1987	115.00	307.00	2,448.00	2,870.00
1988	354.00	1,184.00	-1,062.00	476.00
1999	663.00	1,445.00	-1,640.00	468.00
1990	684.00	681.00	3,199.00	4,564.00
1991	810.00	714.00	-1,240.00	284.00
1992	844.00	3,165.00	2,896.00	6,905.00
1993	636.00	4,480.00	7,715.00	12,831.00
1994	608.00	1,123.00	-8,334.00	-6,603.00
1995	885.00	703.00	4,017.00	5,605.00
1996	722.00	1,950.00	3,970.00	6,642.00
1997	805.00	2,344.00	6,531.00	9,680.00
1998	940.00	-5,089.00	6,762.00	2,613.00
1999	783.00	4,188.00	3,716.00	8,687.00
2000	982.00	1,615.00	9,389.00	11,986.00
2001	3,266.00	-3,727.00	-12,296.00	-12,757.00
2002	1,037.00	1,503.00	1,733.37	4,273.37
2003	1,753.00	3,851.00	4,365.00	9,969.00
2004	2,733.00	9,411.00	14,436.00	26,580.00
2005 (Jan-May)	892.00	4,294.00	5,239.00	10,425.00
Total	**19,637.00**	**34,288.00**	**54,010.37**	**107,935.37**

Source: IFS, 2002

Foreign exchange position of both India and Turkey showed an improvement following the heavy surge of foreign capital. The increasing share of reserve accumulation in use of capital account in India can be clearly seen in Chart 6. In 1993, the first year of foreign capital inflow, almost the entire net capital inflows were absorbed as foreign exchange reserves and from 1995 onwards the RBI has typically absorbed about 50 per cent of the net capital inflows into international reserves. In Turkey, however, the contribution of capital inflows to the foreign reserve accumulation became significant after the 1994 economic crisis. In terms of the allocation of inflows, while there's no clear pattern before 1994, in post-crisis period, the share of reserve accumulation in use of capital inflow increased up to 67% and the amount channeled to current account deficit financing decreased to 33% (Chart 7). This result is consistent with the post-crisis stabilization program of Turkey, which required pegged exchange rate and therefore, heavy intervention in foreign exchange market during the time of currency speculations.

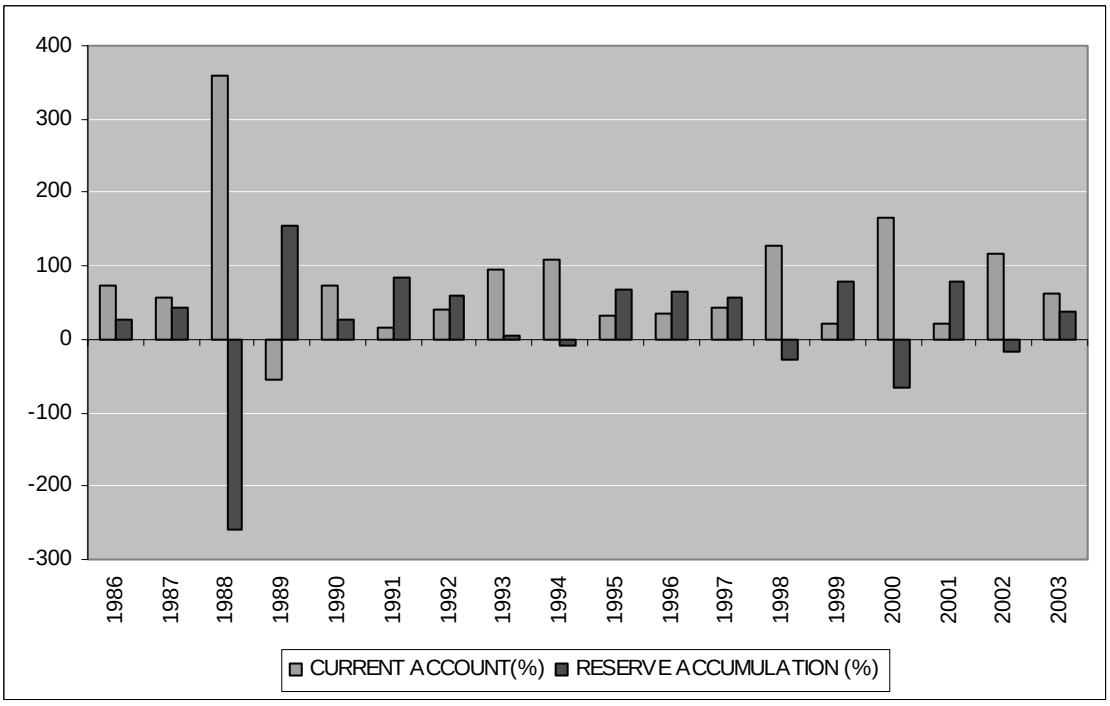
The rising reserves in India reduced the vulnerability of the economy to minor shocks and also brought in large amount of investments from nonresident Indians. However, in Turkey, the foreign exchange reserves have never reached to the level of Indian reserves (Table 4) and have not been sufficient to rescue the economy from two major economic crises which will be discussed in detail in the next section.

Chart 6. Allocation of Capital Account (%): India



Source: RBI Annual Report, 2003

Chart 7. Allocation of Capital Account (%): Turkey



Source: IFS, 2002

1.4. Economic Performance

1.4.1. Financial and Economic Overview

The question that needs to be addressed is whether the free flow of foreign capital helped India and Turkey overcome the constraints on the economy and grow at a faster rate than the pre-liberalization period. Or has it imposed costs that have jeopardized growth and made the economies more vulnerable to shocks.

In both countries, the economies during the 1990s were characterized by rising inflows of foreign capital. Although capital inflows helped the economies to strengthen their foreign reserves (Table 4) and also India's current account position[1], a significant proportion of inflows was short term portfolio flows and these flows were large enough to destabilize the foreign exchange market.

In India, the surge in capital inflows beginning from 1993 put an excessive pressure on the value of the rupee. If the exchange rate regime was a pure float, increasing inflows would have led to an appreciation of rupee and a widening current account deficit due to increase in imports. However, the RBI has chosen to intervene in the foreign exchange markets to absorb the excess dollars on a regular basis. The intervention in the foreign exchange markets were often in excess of $2 billion in a month and in 1997 exceeded $14 billion (Khanna, 1999). This resulted in constantly increasing foreign exchange reserves with the RBI. The large inflows of foreign capital led to three episodes of real appreciation in the value of the rupees after 1992. These coincide with the capital surge in 1993-95, 1996, 1997 and 1999-2000, when the real

[1] In India, current account deficit, which had peaked at 3% of GDP in 1991 declined and has been below 1 per cent of GDP most of the decade. India saw a surplus in its current account in 2001-02.

exchange rate appreciated by 10.7 per cent (in August 1995), 14 per cent (in 1997) and by 5 per cent per cent in 2000-01 over the March 1993 level.

Table 4. Foreign Exchange Reserves (US $ million)

Year	India	Turkey
1986	5,924.00	1,372.00
1987	5,618.00	1,730.00
1988	4,226.00	2,301.00
1999	3,368.00	4,738.00
1990	2,236.00	6,003.00
1991	5,631.00	5,098.00
1992	6,434.00	6,115.00
1993	15,068.00	6,227.00
1994	20,809.00	7,121.00
1995	17,044.00	12,391.00
1996	22,367.00	16,388.00
1997	25,975.00	18,614.00
1998	29,522.00	19,442.00
1999	35,058.00	23,191.00
2000	39,554.00	22,313.00
2001	51,049.00	18,733.00
2002	71,890.00	26,884.00
2003	107,448.00	33,793.00

Source: IFS, 2002

The period of Indian gradual liberalization was not only characterized by rising capital inflows and appreciation pressures. There were at least three depreciation episodes (1995-96, 1997-98 and 2000) that initiated by a number of domestic and external events. In the same period, Turkey, the shock therapy case, has also experienced three economic crises (1994, 1998-1999, 2000-2001). Since these crisis episodes reflect the characteristics of Turkish economy during the last 15 years, this section will continue with a detail analysis of each crisis in parallel with Indian depreciation episodes.

1994 Crisis:

In Turkey, after the removal of controls on capital account in 1990, the banking sector has extended its role in the financial system while private corporations continued

to credit financing from banking sector without any change in their capital structure policies. High yield debt instruments and overvalued currency due to short term foreign capital flows led the banks to switch from conventional banking functions towards an institutional arbitrageur role by borrowing in foreign currency and lending in domestic market. In January 1994, the vulnerability of the banking system (foreign exchange exposure reaching $4.6 billion) and a rising current account deficit led to the downgrading of Turkey's rating to a nonivestment grade, which initiated the capital outflow and foreign exchange deposit withdrawals. Net capital flow by non-residents had been reversed into outflow reaching $6.6 billion (Table 3) that finally forced the government to devaluate at 19% and dragged the economy into a crisis period. The outcome of 1994 crisis was harsh for the Turkish economy. Turkish Lira was depreciated by more than 130% against US dollar, foreign reserves shrunk down to $3 billion due to Central Bank's intervention in both foreign exchange and TL market, overnight interest rates rising to 700% and inflation rate at about 103%. Crisis period lasted until the government initiated a stabilization program in April 1994. Economy recovered in a short period of time with an IMF stand by agreement and short term precautions like full deposit insurance coverage, emergency loans to insolvent banks, increase in reserves and liquidity requirements and offering high interest rates in (triple digits) public sector's debt securities.

In India, the Rupee came under stress in the second half of 1995. An indication of the widening of the current account deficit and a minor decline in capital flows due to the political uncertainty and quick change in the government and the pronounced appreciation of the US dollar against major currencies triggered off market expectations

and resulted in depreciation of the Rupee from about Rs. 31.50 in April 1995 to about Rs. 35.60 per dollar in October 1995. Following intervention by the RBI, the rupee stabilized in the range of Rupees 34 to 36.

1998 Crisis:

After 1994 crisis, rapidly recovering Turkish economy together with high interest rates started to attract foreign capital again. Until October 1995, rising capital inflows contributed to the accumulation of foreign reserves up to $17 billion.

The next recession, in 1999, was mainly caused by contagion effects of the Russian crisis in late 1998 and two devastating earthquakes in 1999. Stock market crash, portfolio outflow reaching $5.1 billion, melting down of the reserves by $5.2 billion and further increase in interest rates were the initial effects of the Russian crisis. Crisis also affected the exports as Russia being one of the major trading partners. The real interest rates were kept higher to defend the Turkish lira for a considerable period of time after the Russian crisis.

The 1997 episode in India was foreign originated, which is caused by a small outflow of portfolio investment from the Indian stock market due to the Asian crisis. The interventions of RBI could not bring the confidence in rupee and exporters delayed their repatriations in anticipation of further depreciation in the value of rupee. The RBI turned into the money market and increased bank rate, raised CRR (Cash Reserve Ratio) and imposed a surcharge on import finance and tightened export credit. This resulted in sharp increase in short term interest rate with the inter bank call money rates rising to historical high of 50%. Private sector also found it much more difficult to raise funds from banks and real interest rates in the economy continued to be higher than anytime before. Real

interest rates in 1990s were as high as 6-9% compared to 1-2% in the 1980s (Khanna, 1999).

The 2000-2001 Twin Crises:

After 1999 elections, Turkish macro policy was characterized by an exchange rate-based disinflation and structural reform program under the regulation of IMF. Program was successful in lowering the interest rates and reaching the monetary, exchange rate and public finance targets. On the contrary, disinflation part of the program did not work well. In the last weeks of 1999, exchange rate basket increased by 20% while the rate of change in CPI was 39%, corresponding to real appreciation of domestic currency.

The increase in domestic absorption together with the appreciation of the TL resulted in a widening of current account deficit from 0.7% of GNP in 1999 to 4.9% of GNP in 2000. The slowdown of structural reforms in the second half of 2000 and rapid expansion of current account deficit ignited the massive panic among the financial investors. Reaction was a sudden outflow of capital by non-residents, which reduced the reserves by almost $7 billion. A new rescue package promised by IMF in the late December relaxed the financial markets temporarily, however, liquidity squeeze continued. On the other hand, keeping the interest rates high to suppress the foreign exchange demand was, clearly, creating further instability in the economy.

A political conflict at the state level brought the second episode of twin crises in February 2001. Interest rates increased to three digits due to speculative attack and CB had to sell $5.1 billion foreign exchange in two days. Turkish lira was devaluated by 40%. Disinflation and stabilization program of 2000 ended as the transition to free

floating was announced on February 22. The impact of the crisis has lasted until a new stand-by agreement with IMF, promising additional $8 billion support together with a national program called “Transition to Strong Economy” stabilized the markets.

The depreciation of Indian rupee by 5.8% in the first three quarters of 2000 was due to the rising import demand given high oil prices. In all three episodes, the RBI intervened both in spot and forward market for foreign exchange by selling large amount of dollars. The interventions were large and RBI sold about $ 2-5 billion in spot and additional $ 3-5 billion in forward market.

1.4.2. Capital Flows and Economic Growth

Tables 5 and 6 give the growth pattern and the decomposition of capital flows during 1980-2004 which covers both pre- and post-liberalization periods of India and Turkey. The first thing that draws our attention is the link between the growth pattern and capital flows generated by non-residents in Turkey. While in the early stages of financial liberalization, growth is relatively independent of the capital movements, in the second decade, export-led growth process has been replaced by a capital oriented growth pattern. In 1990’s, the level and the direction of capital movements seem to be highly effective in the evolution of the growth path. However, we do not see such a strong relation in Indian growth and capital flows. Neither high growth periods nor the bust periods are characterized by heavy surge of capital movements. In the decade of 1990, however, Turkey has experienced three crises episodes (1994, 1998, 2000-2001 twin crises) and in each one of them, capital outflows generated by non-residents have either caused or accelerated the crisis. One can easily see the drastic impact of net cash flows by non-residents (NCF_NR) on GDP growth rate by the analysis of data given in Table 6. In

1994, the amount of non-resident capital flows reversed were $6.7 billions that accompanied a negative growth rate of 5.5%. In twin crises of 2000-2001 (November 2000-December 2001), total non-resident capital outflow was $15 billions ($5 billions portfolio outflow only in November 2000) which had a higher impact on the economy than the ones experienced in 1994 and 1998 crises. Growth regressed by 7.3%. Tables 5 and 6 also represents the breakdown of non-resident and resident capital flows as direct investment, portfolio investment and other investments which include investments by official (government and monetary authority) and non-official (banks and other sectors) groups. Outflows from portfolio investments and short-term bank loans as being two components of "hot money" flow had particular importance on the intensity of the crises in Turkey. In 1998, while the net capital flow by non-residents was positive ($2.6 billions), portfolio outflow has reached to $5 billions and again the economy deteriorated by 4.7% in the post-crisis period 1999. The other "hot money" flow item, short-term bank loans have contributed to non-resident capital outflow by $6.6 billions in 1994 and by $7.1 billions in the twin crises period. Chart 8 also provides a clear illustration of growth-NCF_NR relation after the liberalization of capital account in Turkey. In India, however, there is no evidence of this relation, suggesting that the growth is not directly capital oriented (Chart 8).

In Table 6, it is worth to examine the recovery periods of Turkey after three crises episodes and also the boom periods of 1990 and 1992-1993. The positive relation between the growth rate and the level and direction of non-resident capital flows is clear. As FDI being positive and $850 millions on average, positive non-resident capital inflow was mostly affected by "portfolio" and "other investments". While the contribution of

other investments was higher in the early boom periods, this pattern changed into equal contribution of both portfolio and other investment items after 1999. Thus, the growth being highly dependent on these naturally unstable capital flow components brings the conclusion that the growth pattern of Turkey has become more volatile rather than being sustainable during 1990-2003.

Table 5. Growth Pattern and Decomposition of Capital Flows: India (US$ billion)

Year	GDP growth (%)	NCF (NR)	FDI (NR)	Portfolio (NR)	Other (NR)	NCF (R)	FDI (R)	Portfolio (R)	Other (R)
1980		0.80	-	-	0.80	-0.32	-	-	-0.32
1981	6.53	0.89	-	-	0.89	-0.05	-	-	-0.05
1982	3.78	1.15	-	-	1.15	-0.69	-	-	-0.69
1983	7.43	1.51	-	-	1.51	0.54	-	-	0.54
1984	3.68	3.30	-	-	3.30	-0.25	-	-	-0.25
1985	5.47	3.23	-	-	3.23	0.05	-	-	0.05
1986	4.87	4.24	-	-	4.24	-0.25	-	-	-0.25
1987	4.77	5.61	-	-	5.61	0.13	-	-	0.13
1988	9.92	6.90	-	-	6.90	0.28	-	-	0.28
1989	5.72	7.10	-	-	7.10	0.11	-	-	0.11
1990	5.81	6.14	-	-	6.14	-0.61	-	-	-0.61
1980-1990	**5.80**	**40.86**	**-**	**-**	**40.86**	**-1.06**	**-**	**-**	**-1.06**
1991	0.91	4.26	0.07	0.01	4.18	-0.81	-	-	-0.81
1992	5.27	3.15	0.28	0.28	2.59	0.93	-	-	0.93
1993	4.87	5.24	0.55	1.37	3.33	1.83	-	-	1.83
1994	7.59	9.49	0.97	5.49	3.02	1.09	-0.08	-	1.17
1995	7.52	5.16	2.14	1.59	1.42	-1.30	-0.12	-	-1.18
1996	7.40	16.80	2.43	3.96	10.41	-4.95	-0.24	-	-4.71
1997	4.46	14.49	3.58	2.56	8.36	-4.86	-0.11	-	-4.74
1998	5.98	11.87	2.64	-0.60	9.84	-3.29	-0.05	-	-3.24
1999	7.10	10.11	2.17	2.32	5.62	-0.53	-0.08	-	-0.45
2000	4.01	11.51	2.66	2.77	6.08	-2.12	-0.42	-0.17	-1.52
2001	5.45	7.94	4.33	2.04	1.57	1.44	-0.70	-0.07	2.21
2002	4.30	3.76	3.03	0.97	-0.23	4.30	-0.45	-0.04	4.79
1991-2002	**5.40**	**103.7**	**24.8**	**22.7**	**56.2**	**-8.2**	**-2.2**	**-2.8**	**-5.7**

Notes:

1. NCF-Net Cash Flows, NR-Non-resident, R- Resident
2. Shaded areas represent the crisis periods.
3. Source: IFS, 2002

Table 6. Growth Pattern and Decomposition of Capital Flows: Turkey (US$ billion)

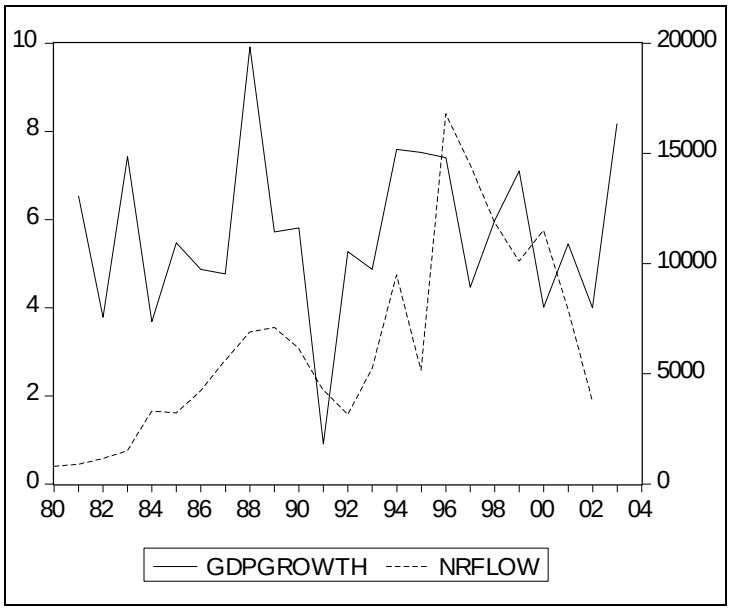
Year	GDP growth (%)	NCF (NR)	FDI (NR)	Portfolio (NR)	Other (NR)	NCF (R)	FDI (R)	Portfolio (R)	Other (R)
1980		1.96	0.02	-	1.94	0.09	-	-	0.09
1981	4.86	0.85	0.10	-	0.76	0.36	-	-	0.36
1982	3.56	1.36	0.06	-	1.31	-0.18	-	-	-0.18
1983	4.97	1.33	0.05	-	1.28	0.18	-	-	0.18
1984	6.71	2.70	0.11	-	2.59	-1.63	-	-	-1.63
1985	4.24	1.61	0.10	-	1.52	0.13	-	-	0.13
1986	7.01	2.44	0.13	0.15	2.17	-0.31	-	-	-0.31
1987	9.04	2.87	0.12	0.31	2.45	-0.98	-0.01	-0.03	-0.95
1988	2.54	0.48	0.35	1.18	-1.06	-1.43	-	-0.01	-1.43
1989	0.25	0.47	0.66	1.45	-1.64	0.31	-	-0.06	0.37
1980-1989	**4.80**	**16.07**	**1.68**	**3.08**	**11.31**	**-3.47**	**-0.01**	**-0.09**	**-3.37**
1990	9.26	4.56	0.68	0.68	3.20	-0.53	0.02	-0.13	-0.41
1991	0.93	0.28	0.81	0.71	-1.24	-2.68	-0.03	-0.09	-2.56
1992	5.98	6.91	0.84	3.17	2.90	-3.26	-0.07	-0.75	-2.44
1993	8.04	12.77	0.64	4.48	7.66	-3.87	-0.01	-0.56	-3.29
1994	-5.46	-6.67	0.61	1.12	-8.40	2.41	-0.05	0.04	2.42
1995	7.19	5.53	0.89	0.70	3.94	-0.96	-0.11	-0.47	-0.38
1996	7.00	6.64	0.72	1.95	3.97	-1.16	-0.11	-1.38	0.33
1997	7.53	9.68	0.81	2.34	6.53	-2.71	-0.25	-0.71	-1.75
1998	3.09	2.61	0.94	-5.09	6.76	-3.45	-0.37	-1.62	-1.46
1999	-4.71	8.54	0.78	4.19	3.57	-3.71	-0.65	-0.76	-2.30
2000	7.15	11.99	0.98	1.62	9.39	-3.40	-0.87	-0.59	-1.94
2001	-7.32	-12.76	3.27	-3.73	-12.30	-1.89	-0.50	-0.79	-0.60
2002	7.79	4.21	1.04	1.50	1.67	-3.05	-0.18	-2.10	-0.78
2003	5.95	9.97	1.75	3.85	4.37	-2.87	-0.50	-1.39	-0.99
2004	8.93	26.57	2.73	9.41	14.43	-9.54	-0.86	-1.39	-7.29
1990-2004	**4.09**	**90.84**	**17.49**	**26.91**	**46.44**	**-40.66**	**-4.53**	**-12.70**	**-23.44**

Notes:

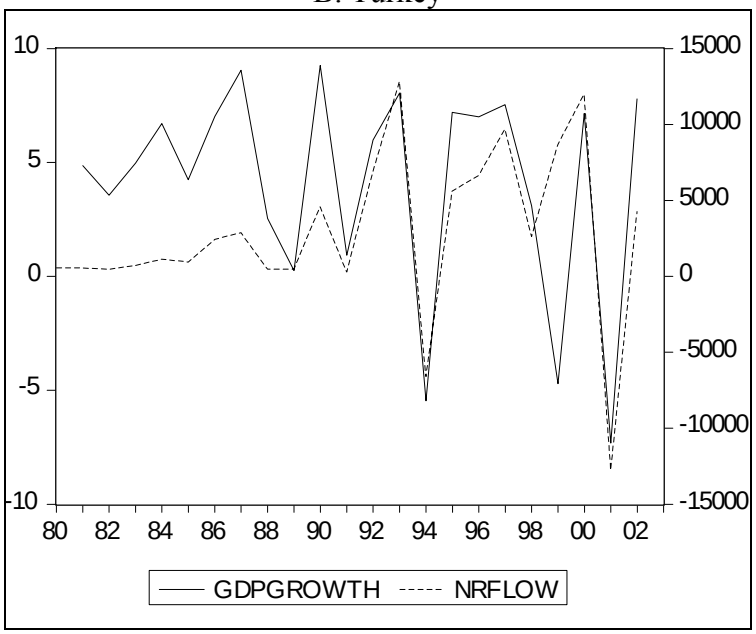
1. NCF-Net Cash Flows, NR-Non-resident, R- Resident
2. Shaded areas represent the crisis periods.
3. Source: IFS, 2002

Chart 8. Growth and Net Capital Flow by Non-Residents

A. India



B. Turkey



1.5. The Impact of Capital Flows

1.5.1. Evidence from Financial Data

In this section, I examine the behavior of selected key economic variables before and after liberalization of India and Turkey. In section I, I provided a summary of what theory predicts and what empirical studies found regarding the impact of financial liberalization. In this section, I re-examine those findings with the data from the two different liberalization episodes. I examine the behavior of quarterly foreign reserves, exchange rate changes, stock returns, interest rates and changes in interest rates. For each of these time series, I provide descriptive statistics (mean and standard errors) and test for the equality of first and second moments between the pre- and post-liberalization periods. Tables 7 and 8 gives the test results for each country.

In the case of India (Table 7), liberalization seems to have a stabilizing effect on the interest rate and exchange rate. The interest rate declines and becomes more stable. Following the liberalization of current account and reduction of controls on capital flows, both foreign exchange reserves and stock market returns increase, however, both variables become more volatile and the difference is statistically significant.

The results for pre- and post-liberalization comparisons for Turkey are rather different than those observed for India. While both the level and volatility of interest rate decrease in India, interest rate becomes higher and more volatile in Turkey. Similarly, the exchange rate also becomes more volatile and the difference is statistically significant. In contrast to stock return behavior of India, Turkish stock returns decrease and become less volatile after the liberalization of capital account, however, the difference is not

significant. The only common behavior is of foreign reserves which increases and become more variable in both countries.

Table 7. India: Descriptive Statistics for Quarterly Data

Variable	Mean Pre-liberalization	Mean Post-liberalization	Equality in means t-test probability	Standard Deviation Pre-liberalization	Standard Deviation Post-liberalization	Equality in variance test
Foreign Exchange Reserves	4773.40	39003.45	0.00*	1567.81	25899.45	0.034**
Interest Rate	10.99	8.38	0.003*	4.21	4.03	0.10***
Change in Interest Rate	-0.05	-0.035	0.98	4.03	3.54	0.14
Exchange Rate	15.03	40.90	0.00*	6.53	6.13	0.077***
Change in Exchange Rate	0.422	0.356	0.73	0.940	0.898	0.008*
Stock Market Return	0.18	0.56	0.18	3.9	4.95	0.012**

Table 8. Turkey: Descriptive Statistics for Quarterly Data

Variable	Mean Pre-liberalization	Mean Post-liberalization	Equality in means t-test probability	Standard Deviation Pre-liberalization	Standard Deviation Post-liberalization	Equality in variance test
Foreign Exchange Reserves	1,450.30	16,625.08	0.00*	757.08	9,577.19	0.009*
Interest Rate	44.98	67.50	0.014**	11.38	34.18	0.83
Change in Interest Rate	0.12	-0.19	0.97	9.55	32.12	0.19
Exchange Rate	682.47	49,354.9	0.00*	665.62	606,419.1	0.004*
Change in Exchange Rate	57.51	24,001.00	0.09***	64.04	87,281.55	0.22
Stock Market Return	1.69	1.031	0.22	8.24	6.168	0.18

Notes:

1. Pre-liberalization Periods:
   January 1980 – December 1993 (India); January 1980 – December 1989 (Turkey)
2. *, ** and *** denote the significance at 1, 5 and 10% respectively.
3. For equality in variance test, Siegel-Tukey test is reported.
4. Stock market returns are based on weekly returns of Bombay SE Sensitivity Index and Istanbul SE IMKB-100 Price Index

Overall, the results between the two countries are quite different. The only shared characteristic is more variable and increasing foreign exchange reserves. All the other variables react differently in the two markets and the behavior of Turkey reflects more the expected reaction of financial variables in a liberalized market. Although the decreasing volatility of stock market in Turkey after liberalization seems contradictory since the international portfolio flows are naturally volatile, it is consistent with the findings of Kaminsky and Schmukler (2003). They find that one of the long-term benefits of liberalization is to reduce the boom-bust cycles in equity markets. As Turkey being the shock therapy case, one can assume a maturing liberalization process for Turkey.

1.5.2. Capital Flows and Economic Growth: Re-visited

From the discussion on the capital flows and the economic growth in Section IV, there is evidence that the non-resident cash flows GDP growth rate are highly correlated. Since non-resident cash outflows may cause growth to regress, the VAR methodology would allow us to examine the reaction of GDP growth to NCF_NR and that of NCF_NR to GDP growth.

In this section, this relation is tested in a simple VAR system where the two system variables, the quarterly GDP growth rate and the non-resident cash flows are treated endogenously. The following model is considered for the analysis:

$$GDPgrowth^k_t = \alpha_{10} + A_{11}(L)GDPgrowth_{t-1} + A_{12}(L)NCF\_NR_{t-1} + \varepsilon_{1t}$$

$$NCF\_NR^k_t = \alpha_{20} + A_{21}(L)GDPgrowth_{t-1} + A_{22}(L)NCF\_NR_{t-1} + \varepsilon_{2t}$$

where

$GDPgrowth^k_t$ = GDP growth rate in country k during time period t

$NCF\_NR^k_t$ = Net Capital Flow by Non-Residents in country k during time period t

α_{i0} = are the 1x2 vectors containing a constant and a time trend

A_{12} = the polynomials in the lag operator L

ε_{it} = disturbance terms

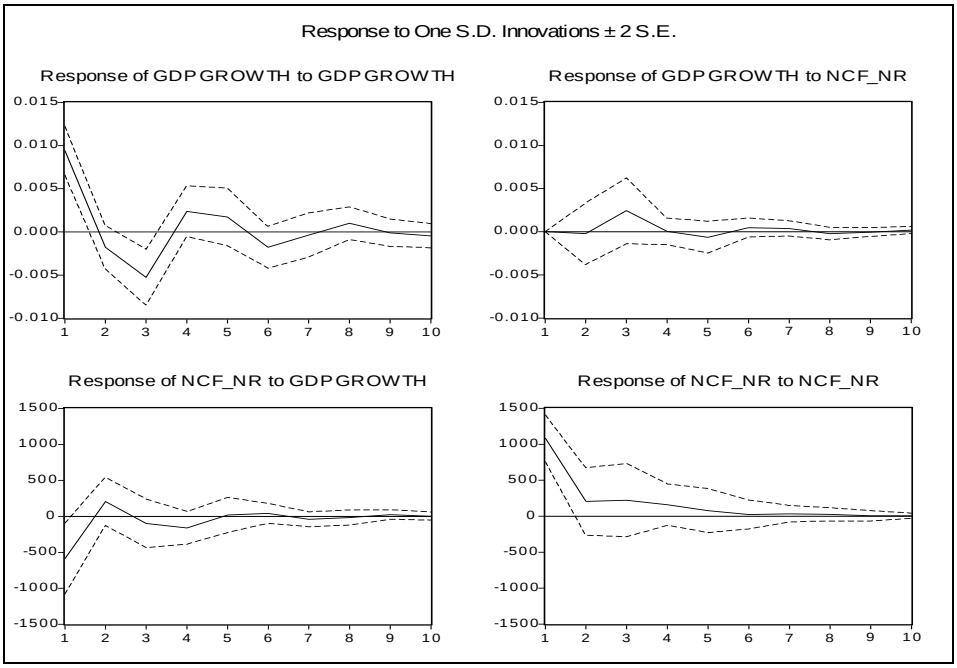
k = India, Turkey

The impulse responses of GDP growth and NCF_NR for India and Turkey are quite contrasting (Chart 9). First, consider the impulse responses of Indian and Turkish GDP growth rates to a one standard deviation increase in non-resident flows. The impact effect of NCF_NR shows that there is no instantaneous reaction of Indian GDP growth. Even there is a reaction of GDP growth in the next periods, it is very small and insignificant. In contrast, in the case of Turkey, there is a significant response of GDP growth in the short-run. Growth increases by 1.5% in response to a positive NCF_NR shock, however, positive response dies off quickly in the third period suggesting that there is no sustainable growth effect of the flows. The response of NCF_NR to an innovation in GDP growth is again contrasting for the two countries. While there is no significant response of NCF_NR to Indian GDP growth, NCF_NR to Turkey increases by $550 million instantaneously in response to a one-unit shock to growth.

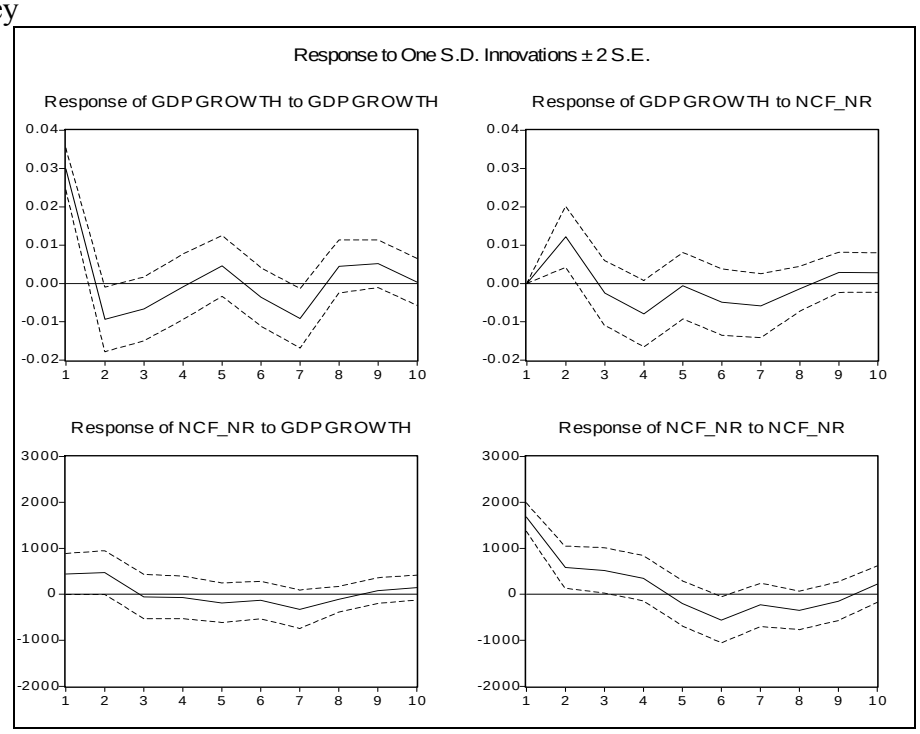
The impulse responses of Indian and Turkish variables fit well with the findings of previous section. The significant response of GDP growth to a NCF_NR shock in Turkey is consistent with the view that the boom-bust cycles of the Turkish economy are mostly driven by the capital movements as a result of capital-oriented growth strategy. Impulse response analysis also illustrates the difference in the global integration of two countries. The considerable amount of GDP growth response and also the instantaneous response of NCF to a shock in Turkish economy, which is the shock therapy case of the study, contrast with the more autonomous behavior of variables in the case of India which follows the gradualist approach for global integration.

Chart 9. Impulse Responses of GDP Growth and Net Capital Flows by Non-Residents*

A. India



B. Turkey



* Impulse responses are constructed with estimates from 2-variable quarterly UVARs with 2 lags for India and 4 lags for Turkey at 10 quarters horizon.

1.6. Conclusion

This chapter discusses the impact of capital flows on India and Turkey, following two different approaches for financial liberalization. The macroeconomic analysis in section IV shows that in the period of 1990s, the rising capital flows are associated with fluctuations in both economies' key variables. There are a number of sub-periods when both India and Turkey has experienced currency appreciations as well as severe depreciation episodes, especially in Turkey. Interest rates have also been subject to sharp fluctuations as being one of the main policy tools of RBI and CBRT to defend the domestic currency. The flow of short term capital imposed severe constraint on the Central Banks' capacity to pursue a counter cyclical monetary policy. Faced with the trilemma, RBI chose to manage the value of the rupee as its main target and adjusted interest rates and credit flows to stabilize the rupee in the foreign exchange market. Although, Turkey also conducted a managed float regime in the same period, uncontrolled capital flows have been the origin of massive speculative attacks on Turkish lira and, of course, reduced the ability of CBRT to defend the currency.

The analysis of the growth pattern shows that the overall growth rate in both economies marginally declined in the 1990s. Further analysis of data on growth rates and capital flows in a VAR system provides evidence on the strong relation between the GDP growth rate and non-resident cash flows in Turkey. Given the highly volatile characteristic of foreign capital flows, lack of interdependence among the Indian GDP growth and foreign capital flows may be a good reason of less volatile economic growth in India. When the change in key financial variables is examined in both countries, the

volatility, which is measured as a standard deviation of selected time series, in India is less during the period of liberalization as compared to Turkey.

Overall, the conclusion that emerges from this chapter is that the liberalization and capital flows have not delivered what they were intended to achieve yet- namely, the greater availability of investable resources and higher rate of growth, even for Turkey which completed its liberalization in 1990. However, India, following a gradualist approach in the course of liberalization, has been a more stable economy, being able to survive both contagion effects of Asian crisis and also the speculative attacks of foreign investors on domestic currency. On the other hand, Turkey, removing all restrictions on capital flows in 1990, has experienced three major crises in the decade of 1990 and in 2001.

It is not possible to draw a general policy conclusion from the results of this section. Nevertheless, the analysis shows that the shock therapy case was more prone to crisis whereas the country following gradualist approach presented a more stable economic development. Further research on the effectiveness of these two approaches should include more countries, which also makes possible to classify the exact timing of liberalization reforms.

CHAPTER II

THE IMPACT OF FINANCIAL LIBERALIZATION ON MACROECONOMIC VARIABLES: A TWO-COUNTRY ANALYSIS

2.1. Introduction

In the past two decades, financial liberalization has been the central issue in the political economy of nations. Industrial countries have been the first at initiating and completing the economic reforms through the liberalization of their financial system. While developing countries historically have imposed restrictions on capital movements, in the last decade, the general trend is towards the opening of their financial system by liberalizing the capital flows. Liberalization efforts, however, have different outcomes for different economies and in this context, there is a large economic literature on the merits and costs of financial liberalization. In this chapter, it is aimed to analyze the effect of liberalization policies on the dynamics of two developing economies, Turkey and India, rather than identifying the benefits or costs of liberalization efforts.

The standard economic theory suggests that liberalization leads to a more efficient allocation of resources, higher level of investment and higher economic growth. The reasoning, as put forth in the earlier literature, such as McKinnon (1973) and Shaw (1973), is that higher interest rates brought about by liberalization would stimulate savings, which in turn would lead to a higher level of investment and economic growth.

The empirical evidence, however, is much less clear. In fact, in a comprehensive recent study of the impact of financial liberalization on key macroeconomic variables in a large number of developed and developing economies, Reinhart and Tokathidis (2001) found that while liberalization does result in higher interest rates and financial deepening, it does not necessarily lead to higher savings and investment. Actually, they show that in the majority of countries, financial reforms are followed by declines in savings.

It should be noted that the nature of the effect of liberalization on savings and investment may depend, to a large extent, on income level. Rossi (1988) argued that consumption growth in low-income countries is more likely to follow income growth rather than changes in expected rates of return due to liquidity constraints. Indeed, a large body of empirical studies supports the presence of liquidity constraints in developing countries. As Vaidyanathan (1993) demonstrates, the incidence of liquidity constraints among the households is inversely related to the degree of economic development, which would imply that saving in low-income countries is less responsive to changes in interest rates.

Despite the lack of evidence on its positive consequences for saving and growth, it is argued that financial liberalization may bring other benefits by accelerating the financial deepening process. For instance, Reinhart and Tokathidis (2001) found that liberalization delivers financial deepening, as measured by the credit and monetary aggregates. Kaminsky and Schmukler (2003) present evidence that as the liberalization process matures, it may have a stabilizing effect on asset markets. They find that one of the long-term benefits of liberalization is to reduce the boom-bust cycles in equity markets.

However, the issue of financial liberalization has remained controversial especially for the developing countries. The effects of the increase in financial fragility have surpassed the marginal benefits of financial liberalization. Critiques mostly arise due to the organic relation between unregulated capital flows and the currency crises. McKinnon and Pill (1999) demonstrate that there is an overborrowing syndrome arising as the liberalization proceeds, especially liberalization of capital account. They argued that if accumulating debt is denominated in foreign currency, this will increase the country's vulnerability to exchange rate fluctuations.

The close link between financial liberalization and banking crises is another indicator of increased financial fragility. Demirguc-Kunt and Detragiache (1998) examined the banking crises during the period 1980-1995 for a sample of 53 developed and developing countries and they found that banking crises are more likely to occur in liberalized financial systems. They also found a two-way interaction between banking and currency crises. In the process of financial liberalization, banks become vulnerable to external economic shocks if the banking system is not sufficiently developed. However, as the institutional environment gets stronger, the link between the liberalization and vulnerability disappears. Kaminsky and Reinhart (1999) also examined the same link and found that the banking crises and currency crises are strongly related and that the banking crises are often preceded by financial liberalization.

In this framework, highly volatile free capital flow is treated as the source of this strong link. Stiglitz (2000) argues that the free capital flow is systematically associated with greater instability as capital flows are pro-cyclical, exacerbating economic

fluctuations even if they are not the origin of the fluctuations. Finally, intervention to regulate the short term capital flows, including tax or direct controls is inevitable.

While there is a wide range of empirical literature exploring the link between financial liberalization, economic growth and financial fragility, the dynamics of macroeconomic variables in the liberalization framework have not been subject to comprehensive studies yet. Decreasing autonomy is a common outcome of financial liberalization as the economies integrate with global markets. The purpose of this chapter is to examine the changing dynamics of certain macroeconomic variables by analyzing different liberalization episodes from two emerging economies, Turkey and India. As being two of the fast growing economies of the last decade and experiencing the process of financial liberalization in about the same period, yet at different degrees, Turkey and India have been a good match for this analysis. The questions the study addresses are:

- Is the interdependence among domestic fundamentals affected by liberalization? The growing amount and the complexity of trade and international relations will increase the weight of domestic players with foreign ties and their influence in the market mechanism and in domestic policy decisions. Thus we expect to see a higher degree of interdependence among domestic fundamentals.
- Does liberalization increase international interdependence? Changing level of financial openness will shift domestic players' interests into a more international direction. Moreover, foreigners will become active players in domestic markets. Thus, under conditions of financial integration, we expect to see a tendency towards increasing international interdependence.

- Does the effectiveness of monetary policy deteriorate or improve? If the liberalization increases the interdependence among the domestic fundamentals, then, the economy's respond to the change in policy instrument will be more, which suggests that the external effects of policy implementation is reduced and so, monetary policy becomes more effective.

I find that following liberalization, interdependence among the domestic fundamentals increases and fundamentals become more responsive to foreign fundamentals suggesting increased international interdependence and policy effectiveness. Further analysis of the data shows that for Turkey, there is a strong long-run equilibrium relation among the domestic and foreign fundamentals, while this relation is weaker for India. Considering relatively limited liberalization of the Indian financial system, this result suggests a positive and increasing relationship between domestic and international interdependence and the degree of liberalization.

2.2. Methodology and Data

The objective of this chapter is to examine whether there is a change in the dynamics of certain macroeconomic variables following the financial liberalization process. It uses cointegration and error correction models to analyze the degree of interrelation among the selected fundamentals.

In a recent study of the impact of financial liberalization on the interest rates in developing and industrial countries, Honohan (2004) argues that modeling the dynamic behavior of real interest rates can provide us some clue about the link between financial liberalization and globally integrating world markets. The estimates of real *ex ante* interest rates in a dynamic error-correction model indicate that developing country

interest rates are highly affected by world interest rates and following liberalization, the impact of world interest rates and speed of convergence both increase. Honohan also detects the predictive power of nominal wholesale interest rates on subsequent exchange rate movements for the developing countries. However, he refuses to conclude a strong statement as UIP prevails for developing countries due to the empirical failure of UIP theory for the industrial countries. Instead, his interpretation on this relation is the larger predictable component in future exchange rate changes in high inflation developing countries as compare to industrial countries.

This section, rather than examining only interest rate convergence following liberalization, aimed to explore the behavior of the economy's selected fundamentals. In this perspective, our hypothesis is that following financial liberalization, the monetary policy effectiveness increases while the autonomy disappears. Growing integration with the world economy has strong effects on the preferences and capabilities of both domestic and foreign economic interest groups. Increasing pressure of interest groups in a liberalized financial environment would change the dynamic path of economic variables while constraining the governments' policy choices and thus decreasing the policy autonomy. On the other hand, increasing interdependence among the macroeconomic variables would improve the effectiveness of monetary policy as the macro variables respond more to the policy instruments such as interest rate. As, for example, exchange rate become more responsive to the interest rate following liberalization, then the negative effects of policy implementation on the economy– change in the interest rate in this case- are automatically reduced since the monetary authority does not need to do drastic changes on the policy instrument.

Similar approach is used by Edison and Reinhart (2001) to examine the effect of capital controls on interest rate, equity return and the change in exchange rate for the five emerging countries, Brazil, Malaysia, the Philippines, South Korea, and Thailand. In their study, three capital control episodes, Brazil, Malaysia and Thailand have been analyzed in a simple VAR system. Their results suggest that capital controls had little effect in reducing international interdependence among currencies, equity markets and interest rates for both Brazil and Thailand. However, following the introduction of controls, Malaysia's equity market and exchange rate were more autonomously determined.

I examine the expected impacts of liberalization from two directions. One is the changing degree of interdependence among domestic fundamentals and the other is the changing reaction of domestic fundamentals to foreign fundamentals. In this context, all domestic and foreign fundamentals are considered in a system which is divided into two subsystems reflecting different levels of financial liberalization. The long-run coefficients of the system are determined and then the multivariate Granger causality test, which is a block exogeneity test, is conducted. Block exogeneity test is conducted in two-steps. First, the cointegrating relations among the variables are determined by using the Johansen's Maximum Likelihood Method (Johansen, 1988). Then, a system of equations, including long-run error terms, is estimated using the seemingly unrelated regression method (SUR) where a series of regression relations exhibit contemporaneous correlation in the disturbances across equations. In this framework, the estimated coefficient of the long-run error term reflects the process by which the dependent variable adjusts in the short-run to its long-run equilibrium path or speed of adjustment. The coefficients of the lagged variables, in turn, capture the short-run impact on two countries' fundamentals.

Data:

This section focuses on five monthly time series, the domestic industrial production index (DIPI), domestic interest rate (DIR), trade-weighted average real exchange rate (EX), trade-weighted average foreign industrial production index (FIPI) and foreign debt-weighted average foreign interest rate (FIR). Domestic variables represent the two sample countries' (Turkey and India) variables. I calculate the exchange rate and the foreign variables using the trade shares of each country's trading partners or foreign currency decomposition of external debt. For the exchange rate variable, rise of which represents the depreciation of domestic currency, arithmetic average of bilateral exchange rates between the domestic currency and the currencies of trading partners are taken. Foreign IP index, FIPI, is computed by taking the arithmetic average of IP indexes of trading partners. Finally, foreign interest rate is computed by taking the arithmetic average of interest rates of countries which are determined based on foreign currency decomposition of external debt of the country.

The motivation for choosing these variables is that their dynamics can reflect the changing path of preferences and interrelations among the interest groups. Interest rate and exchange rate are the two important parameters in the economy reflecting the governments' economic policy decisions. In an open economy, these two variables are also essential for the activities of international firms and investors. Therefore, the dynamics of these two variables analyzed together with the industrial production index, which mostly captures the consumption behavior, would provide a clear picture of changing international interdependence.

Data are monthly and cover the period 1980:01-2003:09. The sources of the data are IFS (International Financial Statistics), CBRT (Central Bank of Turkish Republic), Turkish Treasury and RBI (Reserve Bank of India). For each country (Turkey and India), I split the sample into "BEFORE" and "AFTER" periods. The "BEFORE" period represents the early stage of financial liberalization (interest rate deregulation, mostly the liberalization of domestic financial system). "AFTER" is the period after the country takes full action to move towards a more liberal financial system. For Turkey, full convertibility of capital account and for India, full convertibility of current account are taken as the cutoff dates for "BEFORE" and "AFTER" split. The break points for Turkey and India are 1989 and 1994, respectively.

2.3. Empirical Results

2.3.1. Stationarity and Cointegration Tests

Recent works by Granger (1986), Engle and Granger (1987), and Engle and Yoo (1987) have investigated the causal relationship between two variables when a common trend exits between them. Engle and Granger (1987) have shown that if variables such as X_t and Y_t are integrated of order one and the stochastic error term is stationary, then X_t and Y_t are said to be cointegrated, and there must exist an error-correction representation that may take the following form:

$$\Delta x_t = \alpha_1 + \alpha_x \hat{e}_{t-1} + \Sigma_{i=1} \alpha_{11}(i)\Delta x_{t-i} + \Sigma_{i=1} \alpha_{12}(i)\Delta y_{t-i} + \varepsilon_{xt}$$
$$\Delta y_t = \alpha_2 + \alpha_y \hat{e}_{t-1} + \Sigma_{i=1} \alpha_{21}(i)\Delta x_{t-i} + \Sigma_{i=1} \alpha_{22}(i)\Delta y_{t-i} + \varepsilon_{yt}$$

Table 9 represents the results of unit root tests obtained using Augmented Dickey-Fuller test. Except Turkish interest rate, Turkish EX and Indian DIPI in the "AFTER"

period, results support the presence of unit roots in all series for both countries. In both subsamples, series are integrated of order one, I(1).

Having confirmed the existence of nonstationarity in all series except Turkish DIR, EX and Indian DIPI, the next step involves Johansen's cointegration test to check whether the variables are cointegrated for each sample country. At this point, recall that for the time series to be cointegrated, all series must have the same order of integration. For Turkey, while DIR and EX are I(0), the other variables are I(1) in the second period. However, it should be noted that if X_t is stationary, ΔX_t is stationary as well (Enders, 1995). Then, it is possible that all five variables (three I(1) and two I(0)) are cointegrated such that a linear combination is stationary. I first determine the optimum lag lengths by using the likelihood ratio, LR test[2]. The results of Johansen's cointegration tests are presented in Table 10. In the "BEFORE" period, while there are two cointegrating vectors among Turkey's variables, there is one cointegrating relation among India's variables. In the "AFTER" period, there is one cointegrating relation among the variables for both Turkey and India.

[2] LR tests were conducted for the hypothesis of lag 2 against lag 6. Test results rejected the null hypothesis of 2 lags for both samples. It should be noted that specifying multivariate ECMs with long lags can quickly deplete scarce degrees of freedom, especially in small samples. Consequently, lag profile is limited to 6.

Table 9. Unit Root Tests

I. Turkey			
		ADF Test Statistics	
		1980:01 – 1989:12	**1990:01 – 2003:09**
ln(FIPI)	Level	-1.78	-2.09
	First Difference	-3.8	-3.017
FIR	Level	-1.26	-2.29
	First Difference	-3.21	-3.89
ln(DIPI)	Level	-1.63	-2.64
	First Difference	-2.89	-2.94
DIR	Level	-1.91	-3.87
	First Difference	-3.53	-6.59
ln(EX)	Level	0.13	-3.5
	First Difference	-6.39	-5.19
II. India			
		ADF Test Statistics	
		1980:01 – 1994:07	**1994:08 – 2003:09**
ln(FIPI)	Level	-1.86	-1.61
	First Difference	-4.82	-2.72
FIR	Level	-1.46	-2.08
	First Difference	-5.07	-2.93
ln(DIPI)	Level	-1.8	-3.49
	First Difference	-6.47	-4.82
DIR	Level	-2.65	-0.96
	First Difference	-5.86	-4.43
ln(EX)	Level	-2.49	-2.45
	First Difference	-3.64	-3.81

Notes: Mac Kinnon critical values for the ADF test for;

Turkey's first subperiod:
- with trend are -4.04, -3.45 and -3.15
- without trend are -3.45, -2.89, -2.58

Turkey's second subperiod:
- with trend are -4.04, -3.45 and -3.15
- without trend -3.47, -2.88, -2.58

India's first subperiod:
- with trend are -4.02, -3.44 and -3.14
- without trend -3.47, -2.88, -2.58

India's second subperiod:
- with trend are -4.05, -3.45, -3.15
- without trend -3.45, -2.89, -2.58 at 1%, 5% and 10% levels of significance respectively.

Table 10. Johansen Cointegration LR Test

I. Turkey

1. 1980:01 – 1989:12

Eigenvalue	Likelihood Ratio	5 % Critical Value	1 % Critical Value	Hypothesized no. of Vectors
0.34	114.78	68.52	76.07	None**
0.28	66.58	47.21	54.46	At most 1**
0.18	29.44	29.68	35.65	At most 2

Cointegrating Vectors
-3.7ln(FIPI) + 0.09FIR + 1.8ln(DIPI) + 0.05DIR + 0.6ln(EX)=0
-4.15 ln(FIPI) - 0.11FIR + 0.29ln(DIPI) + 0.07DIR - 2.13ln(EX)=0

2. 1990:01 – 2003:09

Eigenvalue	Likelihood Ratio	5 % Critical Value	1 % Critical Value	Hypothesized no. of Vectors
0.30	104.45	68.52	76.07	None**
0.13	47.17	47.21	54.46	At most 1
0.11	25.53	29.68	35.65	At most 2

Cointegrating Vector: -3.61ln(FIPI) + 0.07FIR + 2.68ln(DIPI) - 0.008DIR + 2.14ln(EX)=0

II. India

1. 1980:01 – 1994:07

Eigenvalue	Likelihood Ratio	5 % Critical Value	1 % Critical Value	Hypothesized no. of Vectors
0.23	89.24	68.52	76.07	None**
0.12	45.01	47.21	54.46	At most 1
0.09	23.37	29.68	35.65	At most 2

Cointegrating Vector: -5.31ln(FIPI) - 0.0004FIR + 1.8ln(DIPI) + 0.014DIR + 0.015ln(EX)=0

2. 1994:08 – 2003:09

Eigenvalue	Likelihood Ratio	5 % Critical Value	1 % Critical Value	Hypothesized no. of Vectors
0.25	77.01	68.52	76.07	None**
0.19	47.32	47.21	54.46	At most 1
0.15	25.74	29.68	35.65	At most 2

Cointegrating Vector: 1.96ln(FIPI) - 0.09FIR + 0.34ln(DIPI) + 0.15DIR + 1.84ln(EX)=0

** denotes rejection of the hypothesis at 1% significance level.

2.3.2. Seemingly Unrelated Regression with ECM Approach

For each country, I estimate a five equation system by using the seemingly unrelated regression method. The assumption of contemporaneous correlation in the disturbances is tested following the procedure outlined in Judge et al (1988:456) and LM statistic suggested by Breusch and Pagan (1980) is used as the test statistic. Results indicate the presence of contemporaneous correlation for each subsystem (Table 11).

Table 11. Test for Contemporaneous Correlation

	Turkey		**India**	
	1980:01-1989:12	**1990:01-2003:09**	**1980:01-1994:07**	**1994:08-2003:9**
λ	19.60	80.53	30.32	23.22

Notes:

In the context of the five-equation system, the null and the alternative hypotheses for the test are:

$$H_0 : \sigma_{12} = \sigma_{13} = \sigma_{14} = \sigma_{15} = \sigma_{23} = \sigma_{24} = \sigma_{25} = \sigma_{34} = \sigma_{35} = \sigma_{45} = 0$$

H_1 = at least one covariance is non-zero

where $\sigma_{ij} = E[e_{it}e_{js}]$ and $t = s$

In the five-equation case, λ, the Lagrange Multiplier statistic, is given by:

$$\lambda = T(r^2_{21} + r^2_{31} + r^2_{41} + r^2_{51} + r^2_{23} + r^2_{24} + r^2_{34} + r^2_{25} + r^2_{35} + r^2_{45})$$

where r^2_{ij} is the squared correlation:

$$r^2_{ij} = \sigma^2_{ij} / (\sigma^2_{ii}\, \sigma^2_{jj})$$

Under H_0, λ has an asymptotic χ^2 distribution with 10 degrees of freedom. If the λ is greater than the critical value at the specified significant level, the null hypothesis is rejected. (The 5% critical value from the χ^2 distribution with 10 degrees of freedom is 18.3.)

Before reporting the results of SUR, it is necessary to present the whole system's details. First, besides the domestic and foreign variables described in the previous part, cointegrating vectors obtained from Johansen ML procedure have also entered into the system as the variables showing the long-run equilibrium relation between the contemporaneous variables. Second, there are a number of crisis episodes that each

country has experienced during the sample period. Three dummy variables for Turkey and one dummy variable for India are generated to control the crisis episodes. First dummy for Turkey, "dummy80-98", controls the crises that occurred between 1980 and 1998. The common point for these crisis episodes is that they are all due to internal factors[3]. Second dummy for Turkey, "russiancrisis" is a proxy for the Russian crisis in August 1998 and controls for potential contagion effect. The third dummy, "twincrises", controls the twin crises that Turkey experienced in November 2000 and February 2001. India's dummy variable (BOPcrisis) controls the balance of payments crisis of June 1991.

Another event that needs to be accounted for is the shift in foreign monetary policy reflected in a continuous decrease in foreign interest rates. Beginning 2001, foreign interest rates that compose our foreign debt-weighted average foreign interest rate for Turkey show a decreasing trend (Chart 10) and if it is not controlled, there might be a spurious correlation between the decline in the foreign interest rates and the twin crises of Turkey since both incidents start at the same period. When the origin of twin crises is considered,[4] this correlation is expected to be artificial and needs to be treated with a dummy variable. Therefore the decreasing trend in foreign interest rates is taken as a policy change and a dummy variable, "frgpolicy", is used to control this policy change. The following system of equations has been estimated for each country and each subperiod.[5]

$$\Delta y_{mt} = \alpha_m + \gamma_m \mu_{t-1} + \sum_{i=1}^{6} (\alpha_{m1}(i) \Delta y_{1,t-i}) + \sum_{i=1}^{6} (\alpha_{m2}(i) \Delta y_{2,t-i}) + \ldots\ldots\ldots + \sum_{i=1}^{6} (\alpha_{m5}(i) \Delta y_{5,t-i}) + \varepsilon_{m,t}$$

where

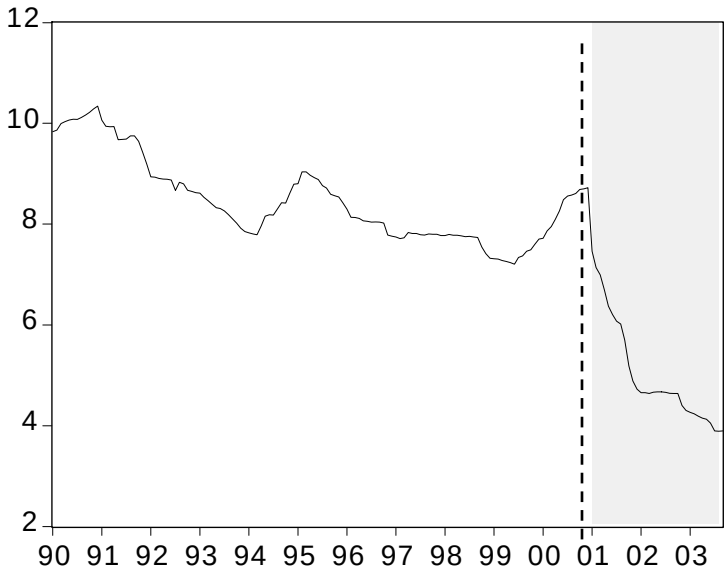
[3] We don't see the contagion effect of the foreign economy disturbances on Turkish economy until the Russian crisis.
[4] Mostly due to the sudden reversal of capital inflows as a reaction to rapid expansion of current account deficit and slowdown of structural reforms in the second half of 2000.
[5] Country-specific dummy variables are also added in each SUR system.

y = system variables {FIPI, FIR, DIPI, DIR, EX}

μ = error correction term

m = 1, ...5

Chart 10. Foreign Interest Rate



2.3.3. Contemporaneous Correlations

Residuals correlation matrices show that domestic variables are contemporaneously correlated mainly in the "AFTER" period in case of Turkey (Table 12). The degree of correlation among the Turkish fundamentals becomes significant after the full liberalization of Turkish economy. Furthermore, the Turkish interest rate and exchange rate become significantly correlated with foreign fundamentals after 1989. In contrast, for India, there is no significant contemporaneous link between the system variables in neither period.

Table 12. Contemporaneous Correlation Matrix

I. Turkey					
1. 1980:01 – 1989:12					
	ln(FIPI)	**FIR**	**ln(DIPI)**	**DIR**	**ln(EX)**
ln(FIPI)	1.00				
FIR	0.024	1.00			
ln(DIPI)	0.12	0.13	1.00		
DIR	0.016	-0.04	0.12	1.00	
ln(EX)	0.13	-0.13	0.14	0.26	1.00
2. 1990:01 – 2003:09					
	ln(FIPI)	**FIR**	**ln(DIPI)**	**DIR**	**ln(EX)**
ln(FIPI)	1.00				
FIR	0.028	1.00			
ln(DIPI)	-0.02	-0.05	1.00		
DIR	0.11	0.41	-0.22	1.00	
ln(EX)	0.05	0.23	-0.38	0.28	1.00
II. India					
1. 1980:01 – 1994:07					
	ln(FIPI)	**FIR**	**ln(DIPI)**	**DIR**	**ln(EX)**
ln(FIPI)	1.00				
FIR	0.23	1.00			
ln(DIPI)	0.01	-0.09	1.00		
DIR	0.01	0.04	-0.29	1.00	
ln(EX)	0.06	0.08	0.15	-0.07	1.00
2. 1994:08 – 2003:09					
	ln(FIPI)	**FIR**	**ln(DIPI)**	**DIR**	**ln(EX)**
ln(FIPI)	1.00				
FIR	0.32	1.00			
ln(DIPI)	0.08	0.17	1.00		
DIR	-0.18	0.07	0.04	1.00	
ln(EX)	-0.20	-0.08	-0.08	-0.01	1.00

2.3.4. Long-Run Equilibrium Relations

Table 13 shows the evidence on long-run equilibrium relations. This is based on the statistical significance of the error-correction coefficients of the error-correction terms. The error-correction coefficients are generally interpreted as the speed of adjustment parameters to the long-run equilibrium (Enders, 1995). In both countries, the response of the dependent variable to the deviation from the long-run equilibrium in the previous period increases as the EC coefficient gets larger. In Turkey, in the "AFTER" period, there is significant response of fundamentals to the EC term. The signs of speed of adjustment are in accord with convergence toward the long-run equilibrium. In response to a rise in the deviation from the long-run equilibrium, DIPI and the domestic interest rate tend to decrease while the real exchange rate tends to increase. The large interest rate coefficient is likely to reflect the drastic monetary measures implemented by the central bank following each crisis[6]. The positive exchange rate coefficient in Turkey is consistent with the unstable root in the Dornbusch (1976) overshooting model and represents the saddle-path stability of the system. In India, significant responses of the interest rate and the real exchange rate to the error-correction term compensate for the lack of contemporaneous correlation. However, the magnitudes of coefficients are relatively small. Overall, evidence on long-run effects in the "AFTER" period is consistent with increased degree of financial liberalization for both countries. According to Jones and Joulfaian (1991), while the error-correction term introduces the long-run effect, the changes of the lagged independent variable describe the short-run causal

[6] Due to distinctive characteristic of Turkish interest rate series in terms of scaling, this series has been downscaled by dividing it by 10.

impact. In the next section, short-run causal characteristics of both domestic and foreign variables will be discussed.

Table 13. Long-run Equilibrium Relations

	Turkey		**India**	
	1980:01-1989:12	**1990:01-2003:09**	**1980:01-1994:07**	**1994:08-2003:9**
EC_{DIPI}	EC_1: 0.036 EC_2: 3.33e-06	-0.032*	-0.039*	-0.042
EC_{DIR}	EC_1: 1.344 EC_2: 0.051	-27.8***	0.217	-1.115**
EC_{EX}	EC_1: -0.160 EC_2: -0.004	0.566***	0.132	-0.042**

Notes:
1. Table reports the estimated coefficients of error-correction terms for each SUR system.
2. EC is the error-correction term.
3. *, ** and *** denote the significance at 10, 5 and 1% respectively.

2.3.5. Short-Run Effects and Block-Exogeneity Tests

Tables 14 and 15 contain the SUR estimates for Turkey and India. The complete set of results is not reported here due to space considerations. Instead, linear combinations of coefficients are reported to see the net effect of lagged variables. Table 14 shows that in the post liberalization, there is an increased interdependency among the Turkish fundamentals. For instance, while the domestic industrial production index, DIPI, only responds to its own lagged values in the pre-liberalization period, in the "AFTER" period, it responds to the exchange rate as well. While this response reflects the export-oriented policies of Turkey in the "AFTER" period, the negative response of the IP index to the depreciation of Turkish Lira points out the relative size of the import volume on intermediate products. Domestic interest rate also follows the same pattern. In the "BEFORE" period, it is only affected by its own lagged values and DIPI. However, in the post liberalization, along with DIPI, the exchange rate also becomes significant with a large non-zero coefficient. The real exchange rate presents a more obvious picture of the

changing dynamics. While in the first period DIPI is the only domestic variable that has an impact on the real exchange rate, after 1989, all the domestic variables become significantly effective. The negative sign of interest rate coefficient is consistent with capital inflow-currency appreciation phenomena. When interest rates rise, the currency is expected to appreciate due to the inflow of foreign capital. The positive IP index coefficient seems surprising, however, it may reflect the political power of exporters on the government for an undervalued currency in an export-oriented industry environment. For India, the evidence on the increasing response of domestic variables in the second period supports the changing dynamics among the fundamentals (Table 15). As India moves toward liberalization, both DIPI and the real exchange rate become more responsive to each other. The IP response to exchange rate is similar to the Turkish case. However, appreciating currency due to an increase in IP is just the opposite of Turkish currency response although it is consistent with the standard trade-currency relationship.

In the second period, data also confirms the short-run effects of foreign variables. For Turkey, lagged values of FIPI and foreign interest rate are statistically important in all equations. However, in terms of their combined effect, the foreign interest rate seems to be effective only on domestic interest rate (Table 14). For India, the results clearly indicate the increasing impact of foreign variables along with financial liberalization. While none of the Indian variables are affected by foreign fundamentals in the first period, after the liberalization of current account, in the "AFTER" period, both FIPI and the foreign interest rate become effective on Indian fundamentals. However, the short-run causal impact of foreign variables will be fully discovered after conducting the Wald Tests.

Table 14. SUR results: Turkey

	Dynamics of Domestic Fundamentals										
	constant	EC	$\Sigma FIPI_{1-6}$	ΣFIR_{1-6}	$\Sigma DIPI_{1-6}$	ΣDIR_{1-6}	ΣEX_{1-6}	Dummy 80-98	russian crisis	twin crises	frgpolicy
DIPI											
BEFORE 1980-1989	0.006† (6.3)	EC_1: 0.04 (1.39) EC_2: 0.00 (0.005)	0.03 (0.03)	-0.002 (0.14)	0.30† (10.6)	-6.93e-04 (2.32)	-0.022 (0.16)	-0.008† (-4.25)			
AFTER 1990-2003	0.003† (4.57)	-0.032* (-1.86)	-0.104 (0.32)	-0.005 (0.72)	0.38† (14.55)	5e-05 (0.15)	-0.016* (3.64)	-0.007† (-4.1)	-0.006† (-2.3)	-0.007† (-3.43)	5.04e-05 (0.06)
DIR											
BEFORE 1980-1989	-0.14 (-1.86)	EC_1: 1.34 (0.63) EC_2: 0.05 (0.93)	17.54 (0.14)	-0.13 (0.14)	12.6* (2.88)	-0.75¬ (4.1)	1.64 (0.14)	0.04† (2.79)			
AFTER 1990-2003	-0.11 (-0.4)	-27.8† (-4.44)	50.1 (0.55)	-3.74* (3.14)	-105.4† (8.1)	0.67 (1.77)	-51.53† (18.7)	1.11¬ (1.97)	1.48* (1.89)	2.16† (2.85)	-0.57* (-1.72)
EX											
BEFORE 1980-1989	0.004 (0.91)	EC_1: -0.16 (-1.29) EC_2: -0.004 (-1.27)	-0.68 (0.65)	-0.006 (0.1)	-0.79* (3.54)	0.003 (2.49)	0.004 (0.0002)	0.002 (0.25)			
AFTER 1990-2003	-0.016† (-2.9)	0.57† (4.56)	1.77 (1.75)	-0.02 (0.33)	2.62† (12.8)	-0.002¬ (5.3)	0.68† (8.38)	0.018 (1.52)	0.017 (1.08)	0.034¬ (2.17)	-0.008 (-1.25)

Notes:

1. *, ¬ and † denote the significance at 10, 5 and 1% respectively.
2. The figures in parentheses are;
   the t-values for the constant, EC term and the dummies,
   the chi-square statistics for the combined coefficient of lagged variables.

Table 15. SUR results: India

	Dynamics of Domestic Fundamentals in India							
	constant	EC	$\Sigma FIPI_{1-6}$	ΣFIR_{1-6}	$\Sigma DIPI_{1-6}$	ΣDIR_{1-6}	ΣEX_{1-6}	Dummy(BOPcrisis)
DIPI								
BEFORE	0.011†	0.39†	0.31	-0.02	-1.30†	0.02	-0.47¬	0.01
1980-1994	(3.4)	(2.8)	(0.15)	(1.52)	(14.6)	(1.11)	(5.6)	(1.02)
AFTER	0.006	-0.04	3.63¬	0.04¬	-2.43†	0.06¬	-1.56†	0.036¬
1994-2003	(1.11)	(-0.86)	(4.10)	(4.36)	(22.0)	(4.3)	(10.0)	(2.52)
DIR								
BEFORE	-0.018	-0.22	-1.20	-0.018	2.13	0.44†	1.00	-0.003
1980-1994	(-0.74)	(-0.20)	(0.04)	(0.03)	(0.64)	(10.55)	(0.40)	(-0.04)
AFTER	0.05	-1.12¬	-43.0¬	0.92*	4.94	-0.31	14.0	0.0004
1994-2003	(0.76)	(-2.12)	(5.10)	(2.84)	(0.80)	(1.06)	(1.06)	(0.003)
EX								
BEFORE	0.002	0.13	-0.26	-0.005	0.26	-0.015	-0.16	0.04†
1980-1994	(-0.60)	(1.22)	(0.18)	(0.24)	(1.00)	(1.24)	(1.09)	(5.10)
AFTER	-0.005¬	-0.04¬	2.14†	-0.06†	-0.54¬	0.016	-0.22	0.03†
1994-2003	(-2.03)	(-2.02)	(8.12)	(8.14)	(6.05)	(1.78)	(1.11)	(4.62)

Notes:

3. *, ¬ and † denote the significance at 10, 5 and 1% respectively.
4. The figures in parentheses are;
   the t-values for the constant, EC term and the dummy,
   the chi-square statistics for the combined coefficient of lagged variables.

Block-Exogeneity Test - Wald Test for Granger Causality:

In this section, I perform the Granger causality test, using Wald test which is a block-exogeneity test (multivariate version of the Granger-causality test). In line with the increasing level of financial liberalization, it is expected to see foreign variables to Granger-cause domestic variables in the "AFTER" period.

Chi-square statistics (p-values) for the joint significance of lagged foreign variables are reported in Table 16. Wald test results support the evidence that foreign fundamentals are effective on the change of the fundamentals of Turkey and India once the countries enter into a more liberalized financial environment.

Test results indicate that in the pre-liberalization period, domestic fundamentals are not Granger-caused by foreign fundamentals (with the exception of Turkish real exchange rate which is affected by foreign interest rate). Evidence suggests that the dynamics of domestic variables are determined internally in both countries. On the contrary, the impact of foreign variables becomes obvious after liberalization. According to the test results, Turkey's interest rate and exchange rate are Granger-caused by foreign interest rate. Foreign interest rate also Granger-causes Indian DIPI. The other foreign variable, FIPI, Granger-causes only Indian variables, DIPI and EX but it has no impact on Turkish variables. One interesting finding is that there is no causality running from foreign variables to domestic industrial production index in case of Turkey and to domestic interest rate in the case of India.

In summary, our findings support the causal impact of foreign fundamentals on domestic variables for both countries after countries move into a more liberalized financial environment. However, the hypothesis on increasing international

interdependency in the post liberalization period is rejected for Turkish industrial production index and Indian interest rate due to the lack of causality going from foreign variables to these variables.

Table 16. Wald Tests for Granger-Causality (p values)

I. Turkey			
1. 1980:01 – 1989:12			
	ln(DIPI)	**DIR**	**ln(EX)**
ln(FIPI)	0.81	0.56	0.16
FIR	0.43	0.43	0.00
2. 1990:01 – 2003:09			
	ln(DIPI)	**DIR**	**ln(EX)**
ln(FIPI)	0.5	0.49	0.33
FIR	0.12	0.001	0.026
II. India			
1. 1980:01 – 1994:07			
	ln(DIPI)	**DIR**	**ln(EX)**
ln(FIPI)	0.95	0.74	0.43
FIR	0.72	0.87	0.40
2. 1994:08 – 2003:09			
	ln(DIPI)	**DIR**	**ln(EX)**
ln(FIPI)	0.044	0.17	0.005
FIR	0.046	0.63	0.134

Note: Table shows the marginal probabilities associated with the Granger-causality tests. The format is such that the rows reflect the Granger-causal impact of the row-variable on the column-variable.

2.3.6. Forecast Performance

In order to assess the performance of the model developed for this section, the models that are generated from each SUR system are solved and the forecasts for the sample period are computed. Forecasting performance is evaluated on the basis of the

Theil Inequality Coefficient (TIC) statistics since root mean squared error (RMSE) statistic is used as a relative measure to compare the forecasts across different models[1].

A visual diagnostic of the model gives the impression that model's fit is satisfactory especially for Turkey's second period. In general, while the model's fit is acceptable for the domestic industrial production index data for all periods, it consistently under-predicts the exchange rate, except Turkey in the second period. For India, while the model does a good job in the second period until 1996, after that year, it over-predicts the interest rate. The model seems to have a hard time fitting the first period for both countries. Capital controls and ongoing policy changes, which likely create structural breaks during this period, might be the reason of the model's poor performance. To test this hypothesis, forecasts excluding the control periods are computed again. The result was an improvement in the model's performance for Turkey. Since Indian liberalization experience has been a continuous process followed on a slower path with more restrictions, our modification of the sample period did not help to improve the model's forecasting performance. In catching the fluctuations, the model's performance can be observed by looking at Turkey's second period since the country experienced a number of crises episodes in that period. While model is satisfactory catching the boom-bust cycles, it under-predicts the peak periods.

Table 17 reports the forecast error statistics. In addition to Theil inequality coefficients, decomposition of mean squared forecast errors in the form of bias proportion, variance proportion and covariance proportion will also help to evaluate the forecast performance. Small bias and variance proportions indicate that most of the bias

[1] The Theil inequality coefficient always lies between zero and one, where zero indicates a perfect fit.

is concentrated on covariance proportions and the forecast is satisfactory in tracking the mean and variance of the actual series.

Table 17. Forecast Error Statistics

I. Turkey			
1. 1980:01 – 1989:12			
	ln(DIPI)	**DIR**	**ln(EX)**
TIC	0.0026	0.11	0.007
MSFE	0.0005	0.93	0.01
Bias	0.014	0.33	0.40
var	0.08	0.02	0.21
cov	0.91	0.65	0.37
2. 1990:01 – 2003:09			
	ln(DIPI)	**DIR**	**ln(EX)**
TIC	0.0031	0.2076	0.0068
MSFE	0.0008	7.74	0.0066
Bias	0.0007	0.2135	0.0266
var	0.1621	0.1757	0.1328
cov	0.8372	0.6108	0.8406
II. India			
1. 1980:01 – 1994:07			
	ln(DIPI)	**DIR**	**ln(EX)**
TIC	0.0046	0.0411	0.0353
MSFE	0.0014	1.8196	0.0082
Bias	0.0040	0.2024	0.5782
var	0.0159	0.0460	0.0037
cov	0.9801	0.7516	0.4181
2. 1994:08 – 2003:09			
	ln(DIPI)	**DIR**	**ln(EX)**
TIC	0.0033	0.0312	0.0313
MSFE	0.001	0.7323	0.0046
Bias	0.0065	0.5367	0.2760
var	0.0920	0.0571	0.0071
cov	0.9014	0.40623	0.7170

TICs close to zero and small bias and variance proportions in case of domestic industrial production index support the model's good fitting performance for that variable. The model also does a good job in fitting Turkish exchange rate in both periods (TIC_1= 0.007 & TIC_2= 0.0068).

2.4. Conclusion

In this chapter, I apply SUR model with ECM approach to analyze the changing dynamics of domestic fundamentals as the country moves toward the financial liberalization procedure. Two fast growing economies following somewhat different approaches for liberalization, Turkey and India, are considered as the sample countries and the analysis is conducted for the time period 1980:01-2003:09.

Findings of this chapter support the hypothesis on the anticipated impact of financial liberalization on countries' macroeconomic variables. There is a strong evidence for the long-run equilibrium relation between the foreign fundamentals and Turkish IP index, interest rate and exchange rate. In the case of India, long-run equilibrium coefficient is significant only in interest rate and real exchange rate regressions. Moreover, as compared to Turkish fundamentals, Indian fundamentals respond only slightly to a deviation from the long-run equilibrium. Considering the different degrees of liberalization in Turkey (fully liberalized) and India (limited liberalization), this finding justifies the positive relation between the degree of liberalization and increasing interdependency. Results also suggest the increasing impact of foreign variables in the short-run. While, initially, there is no significant impact of foreign fundamentals, in the second stage, both foreign IP index and foreign interest rate become effective on the dynamics of domestic fundamentals. Following liberalization,

Indian IP index and exchange rate become responsive to both foreign fundamentals. In the case of Turkey, however, only foreign interest rate seems to be effective on Turkish fundamentals. In this period, lack of causality from foreign variables to Turkish industrial production index and Indian interest rate suggests that these two variables are insulated from the effect of foreign fundamentals and more likely to be determined by internal factors.

Further analysis of short-run dynamics of domestic variables has shown that the interdependency among the domestic variables increases in the second stage of liberalization. In both countries, the response of fundamentals to each other is higher in the second period. Results also suggest the increased monetary policy effectiveness following liberalization. The higher response of Turkish exchange rate and the Indian IP index to the interest rate, which is considered as the monetary policy instrument, supports the hypothesis that the effectiveness of monetary policy is improved as the two economies integrate with global markets.

In sum, while dynamics of Turkish fundamentals are clearly more responsive to the foreign fundamentals in the long-run, international interdependence is more evident in the short-run dynamics of Indian fundamentals. Finally, the possible policy prescription would be that in economies highly vulnerable to crises such as Turkey, it may be more prudent to follow a gradual liberalization path like India. However, since my results are episode-specific, further analysis of different liberalization episodes from other emerging countries is required to generate any kind of stylized facts. Especially, a deeper analysis of the differences in the application of financial reform policies and the related

institutional environment in each episode would provide a further insight into the impact of financial liberalization on emerging countries.

CHAPTER III

THE DEGREE OF FINANCIAL LIBERALIZATION AND VOLATILITY IN EMERGING STOCK MARKETS

3.1. Introduction

By the late 1980's and the early 1990's, many developing countries undertook a series of economic reforms, mainly to achieve an export led economic growth through a market based system. In this framework, financial liberalization has been the major component of these reforms. As a reform instrument, financial liberalization has been an important issue specifically for the emerging markets and early studies have shown that these markets are characterized by high volatility. Even though, the recent studies have searched the relation between liberalization and volatility, the effect of the extent and evolution of liberalization reforms on volatility has not been subject to detailed analysis yet. In this chapter, it is aimed to address the question whether the volatility pattern varies with the degree of liberalization. An analytic examination of volatility pattern in emerging markets would provide useful information for policymakers as well as financial investors interested in these markets.

A large body of recent research has shown that financial liberalization is positively related to long-run economic growth. Decrease in the cost of capital after the access of foreign investors increases the aggregate domestic investment which potentially

stimulates economic growth (Bekaert and Harvey, 2000; Henry, 2000; Bekaert, Harvey and Lundblad, 2002). Furthermore, other channels through which liberalization promotes economic growth are found as: deeper financial markets and banking structure (King and Levine, 1993; Levine and Zervos, 1998), increased liquidity (Bekaert, Harvey and Lundblad, 2002) and reduced cost of external finance (Rajan and Zingales, 1998).

Although the liberalization and its growth effect have occupied a central place in most studies, uncertainties associated with the opening of markets have also been analyzed. One major issue that has been continuously studied in the literature is the consequences of the movement of free capital (Stiglitz, 2000; Edison and Reinhart, 2000). Given the unstable nature of freely flowing international funds, a small shock to the economy can lead to a volatile change in the flow of funds that accelerates the shock and destabilizes the economy. Volatility contagion has been another issue having been debated along with liberalization, which opens another debate on whether to impose capital restrictions. Several studies have demonstrated that capital controls are effective in reducing the spillover across the emerging markets at some degree (Edwards, 1998; Edison and Reinhart, 2001), though there is no agreement on the desirability of restrictions on capital flows.

Two recent papers, Bekaert and Harvey (1997) and de Santis and Imrohoroglu (1997), have examined the changes in stock return volatility around liberalization. While de Santis and Imrohoroglu (1997) do not find any evidence of an effect of market liberalization on stock return volatility, Bekaert and Harvey (1997) find an overall decrease in volatility.

Most studies analyzing the effect of liberalization on volatility compare the before-and-after volatility patterns for liberalizing markets, following an event-study or structural break analysis approach. However, they tend to ignore the potential impact of liberalization after the liberalization reforms have taken place. For example, in a recent study, Kim and Singal (2000) found that following market openings, stock market returns significantly increase without a simultaneous increase in volatility, which provides evidence supporting the advocates of the free capital flow. Their argument is that market liberalization would not be responsible for the Asian crisis by pointing out that the liberalization of most of the emerging markets took place more than five years before the Asian crisis began. This reasoning seems to overlook the fact that liberalization results with a permanent change in the financial environment -more openness, less control, which possibly increases the markets' vulnerability to financial fluctuations. Given the fact that financial liberalization can be a gradual process, its extent and evolution over time should also be considered in the country analysis. In addition, while liberalization has a reducing effect on volatility on the average, it might cause extreme deviations during times of a local or global turbulence.

The purpose of this chapter is to evaluate in some detail the volatility pattern in ten emerging stock markets during the last two decades. Although the liberalization and volatility relation has been tested previously, I examine the volatility changes following a different approach. First, I classify the selected countries based on the degree of their liberalization. Then, following Aggarwal, Inclan and Leal (1999) and by using stock market data, I detect the shifts in the volatility endogenously. Then I confirm the shifts by checking the political, social and economic events that took place around that time

period. My main goal is to relate the changes in the volatility to the degree of liberalization. Even though the selected ten emerging markets have been open to foreign investors during the period under study, they follow different liberalization policies. Grouping these countries allows us to analyze the behavior of stock market returns under alternative policy applications, which is a departure from previous studies in examining liberalization and volatility link. After finding the periods of increased volatility, I examine whether these events are global or local and also whether there is a link between the nature of these events and the degree of liberalization. I also attempt to address the contagion effect associated with liberalization. In addition to grouping the countries by the level of liberalization, I also group them by geographical proximity to examine the effectiveness of contagion.

I find that the volatility pattern in emerging markets varies by the country and by the type of the event. However, there seems to be a link between the liberalization degree and the volatility shifts. While I observe increased volatility in the early periods of liberalization episodes, it appears that in the long-run, liberalization has a stabilizing effect on the equity markets. In this context, my results strongly support the findings of Kaminsky and Schmukler (2003). While the volatility shifts are mostly associated with local events, Thaliand's devaluation, Hong Kong stock market fall and the Russian crisis are the three global events that resulted with volatility contagion in fully liberalized countries. Augmenting the standard GARCH model with detected volatility shifts shows that the volatility persistence in stock index returns is not as high as it is previously believed. Reduced volatility persistence together with non synchronous shifts in

volatility; shifts being country-specific and depending on the degree of liberalization, has an important financial implication that diversification across emerging markets matters.

3.2. Liberalization Efforts

Countries are grouped based on their degree of liberalization using the criteria introduced by Kaminsky and Schmukler (2003) for equity market liberalization. There are three groups reflecting the degree of liberalization in my sample: “fully liberalized”, “liberalized and capital controls” and “partially liberalized”. For full liberalization, foreign investors should be allowed to hold domestic equity without restrictions and capital, dividends, and interest can be repatriated freely within two years of the initial investment. The second group includes countries that experienced liberalization reversals or used capital controls in certain period of time. The criteria for partial liberalization are that foreign investors are allowed to hold up to 49 percent of each company's outstanding equity or there might be restrictions to participate in certain sectors or capital, dividends, and interest can be repatriated, but typically not before two and not after five years of the initial investment. Table 18 reports the countries in each group, market opening date and the information relating to the liberalization process in each country.

Table 18. Classifying Liberalization Degrees

Country	Market Opening Date*	Details
Fully Liberalized		
Argentina	November 1989	All limits on foreign capital were abolished by December 1989. After all exchange and capital controls were abolished in 1991, Argentina had been completely open till re-imposing of capital controls in January 2002.**
Mexico	May 1989	No restrictions on the foreign holdings of domestic equity. Foreign portfolio investment by residents was freely allowed prior to January 1976.
South Africa	1996	Restrictions on foreign membership in the Johannesburg Stock Exchange lifted. In 1995, country relaxed the exchange controls and abolished the financial rand, a second exchange rate that applied only to nonresident capital account transactions.
Turkey	August 1989	The market is considered 100% open since August 1989.
Liberalized + Capital Controls		
Brazil	May 1991	Since May 1991, foreign institutions were allowed to own 100% of nonvoting stock under Resolution 1832, Annex IV. Brazil introduced a variety of measures since the mid-1990s; mostly designed to control the surge of capital inflows. In 1999, following January crisis, controls restricting the capital outflows were came into effect.
Chile	October 1989	The measures Chile instituted in the mid-1990s were against short-term flows and favored longer term flows with the use of unremunerated reserve requirement (URR). URR system was eliminated by September 1998. The market is considered 100% open since January 1995.

Table 18. continued

Country	Market Opening Date*	Details
Malaysia	December 1988	Malaysia imposed foreign ownership restrictions only on bank and finance company stocks. While the other Asian countries have eliminated the restrictions, Malaysia temporarily re-imposed controls in 1998, which were relaxed again in 2003. Foreign portfolio investment by residents has been freely allowed since 1984.
Thailand	August 1988	In 1988, a Foreign Board was established as a parallel stock exchange for trading shares to be held by foreign investors. Thailand greatly reduced the controls during the 1997/98 Asian financial crisis
Partially Liberalized		
China	July 1993***	In 1991, the "B" share which can be owned by foreign investors only, came into existence. Beginning early 1990s, China gradually increased the number of Chinese H-shares (stocks listed abroad but not included in a country's IFCI index) listed in Hong Kong. After 2000, opening of the B-share market to domestic investors and granting two foreign investors the right to trade in renmimbi dominated securities for the first time in May 2003 were the two leading events through the development of China's capital market.
India	November 1992	There is an overall limit of 24% foreign investment per company. Foreign portfolio investment for residents is not allowed.

Notes: * There are different indicators for market opening dates such as introduction of American Depositary Receipts (ADRs) and country funds, actual lifting of foreign investment restrictions (see Bekeart and Harvey, 2000)

** Argentina is considered fully liberalized since the sample period covers 1990-April 2005 and capital controls were introduced in the last two years.

*** the date of first ADR issuance

3.3. Methodology and Data

The statistical analysis used in this section to test for the behavior of stock market volatility under different liberalization regimes can be best described as a two-step procedure. In the first step, sudden change points in the variance of stock market returns are detected by using the ICSS algorithm introduced by Inclan and Tiao (1994). These change points denote the time at which discrete shifts in variance occur in time series. After analyzing the events surrounding the periods of changes in volatility, the second step involves calculating the volatility persistence in the presence of these breaks.

3.3.1. Detection of Sudden Changes in Variance

The iterated cumulative sums of squares algorithm, developed by Inclan and Tiao (1994), is used to detect the occurrence of sudden discrete changes in variance in time series data. The method assumes that the variance of a time series is stationary over an initial period of time until disturbed by an exogenous shock, thus resulting in a sudden change in variance. The variance remains constant at its new level for a time until the occurrence of a new shock. This process is repeated through time, producing a series of observations with an unknown number of variance change points. Let ε_t be a series with a mean of zero and unconditional variance σ^2_t. Assume the variance within each interval is given as σ^2_j, j=0, 1… N_T, where N_T is the total number of variance changes over T observations, and $1 < \kappa_1 < \kappa_2 < \ldots < \kappa_{NT} < T$ are the corresponding change points,

$$\begin{aligned} \sigma^2_t &= \tau^2_0 \quad 1 < t < \kappa_1 \qquad (1) \\ &= \tau^2_1 \quad \kappa_1 < t < \kappa_2 \\ &\ldots \\ &= \tau^2_{NT} \quad \kappa_{NT} < t < N_T \end{aligned}$$

Denote C_k, as the cumulative sum of squared observations from the first observation to the k^{th} point in time. Define D_k statistic as:

$$D_k = (C_k / C_t) - k/T \qquad k=1,\ldots, T \text{ with } D_0 = D_t = 0 \qquad (2)$$

For a series with constant variance, D_k will look like a horizontal line when plotted against k. However, if there is a sudden change in variance, the D_k value will show a positive or negative drift away from zero. Significant changes in variance are determined by the critical values obtained from the distribution of D_k under the null hypothesis of no change in variance. If the maximum absolute value of D_k is greater than the critical value, then the null hypothesis of no change in variance is rejected. Assume that k* is the value at which $\max_k \text{sqrt}(T/2)| D_k |$ is attained. If the maximum of $\text{sqrt}(T/2)| D_k |$ is larger than the critical value of ±1.358 at the 5% level, then k* is taken as the time point of a variance change. The factor sqrt(T/2) standardizes the distribution.

If a series has multiple change points, the usefulness of the D_k function becomes doubtful because of the masking effect. Inclan and Tiao (1994) developed an iterative algorithm based on repeated applications of D_k on different segments of the series, dividing consecutively after a change point is identified[2]. After the change points have been detected, the next step analyzes the corresponding events during the periods of change in volatility.

3.3.2. ICSS-GARCH Combined Model

The modeling of the dynamics of the variance of stock returns by an ARCH specification has become very popular since its introduction by Engle (1982). Since the interest here is to investigate the dynamics of stock market volatility, I continue the

[2] The Java code of the ICSS algorithm is given in the appendix.

analysis in a GARCH framework. In estimation of a standard GARCH model, GARCH (1,1) can be written as

$$Y_t = \mu + \varepsilon_t, \qquad e_t|I_{t-1} \sim N(0,h_t) \tag{3}$$

$$h_t = \omega + \alpha\varepsilon^2_{t-1} + \beta h_{t-1} \tag{4}$$

where N is the conditional normal density with a zero mean and variance h_t and I_{t-1} is the information set available at time t-1.

However, in their extensive study on the volatility of emerging equity markets, Bekaert and Harvey (1997) argue that standard implementation of ARCH models are unlikely to provide adequate outcome because of the nonnormalities in the emerging equity market returns (see Harvey, 1995). Moreover, these markets are subject to important structural economic changes like the liberalization of financial systems and frequently, to political instability. In this context, Bekaert and Harvey (1997) find the volatility difficult to model since each country exhibits a specific behavior. Similarly, Lamoureux and Lastrapes (1990) show that volatility persistence is overestimated when standard GARCH models are applied to series with underlying sudden changes in variance caused by political, social, or economic events which is likely to occur in emerging markets. Then the standard GARCH model should be augmented with regime shifts to get reliable parameter estimates of the conditional variance equation. Susmel (1998) proposes a switching ARCH (SWARCH) model involving regime changes. However, the number of regimes must be pre-specified, which is a hard task for emerging markets, given the possibility of unknown structural breaks.

In this chapter, the method involves combining the GARCH model with endogenous shifts in the volatility. Following the detection of sudden change points in

variance by ICSS algorithm, dummy variables are introduced into the variance equation of the GARCH model to account for the sudden changes in stock return variance. Then the ICSS-GARCH combined model is given by

$$Y_t = \mu + \varepsilon_t, \qquad \varepsilon_t | I_{t-1} \sim N(0, h_t) \tag{5}$$

$$h_t = \omega + \sum_{i=1}^{n} d_i D_i + \alpha \varepsilon^2_{t-1} + \beta h_{t-1} \tag{6}$$

where D_i is the dummy variable taking the value of one if the ICSS algorithm detects a shift in the underlying volatility in stock returns and 0 otherwise, and n is the number of volatility regimes as identified by the ICSS procedure. Additionally, an autoregressive process of order one, AR(1), specification for mean equation is used if a series shows significant autocorrelation as detected by the Ljung-Box Q-statistic.

3.3.3. Data

For the analysis, I chose ten emerging markets which are at different degrees of liberalization. Except India (partially liberalized) and China (tightly controlled), all the selected countries completed the liberalization of their financial markets in the last decade. From those markets, Brazil, Chile, Malaysia and Thailand used also capital controls periodically. Of the selected countries, South Africa and Turkey are the only emerging markets in their own geographical area; the other eight countries cluster around two main regions; Asia and Latin America.

All data used in this section are obtained from Global Financial Database. They consist of daily closing values for the Buenos Aires SE General (Argentina), BOVESPA Sao Paulo Stock Exchange Index (Brazil), Santiago Stock Exchange Indic GPA (Chile), The Shanghai A Share Index (China), The Shanghai B Share Index (China- for only

foreign investors), Bombay SE Sensitivity Index (India), Kuala Lumpur Composite Index (Malaysia), IPC Index (Mexico), Johannesburg Stock Exchange A Share 40 Index (South Africa), Thailand SET Index (Thailand), IMKB National 100 (Turkey).

Data cover the 15-year period January 1990-April 2005. However, China A- and B-share indices were not covered at the beginning of sample period, therefore the sample periods begin on January 1991 and March 1992, respectively.

The analysis used weekly rather than daily data as they have less potential bias due to bid-ask effect, non-trading, etc. Each country's returns were expressed only in local currency terms due to the fact that exchange rates add another volatility component in the variance of stock returns.

3.4. Empirical Results

3.4.1. Descriptive Statistics

Table 19 presents the descriptive statistics for all weekly return series used in the analysis. The statistics include the average arithmetic returns, standard deviations, skewness, kurtosis, the Jarque-Bera statistics and the Ljung-Box Q statistics. The highest mean weekly returns are in Brazil (0.018), and the lowest are in China B-shares (-0.0006). As expected, volatility is high in emerging markets. Brazil and Turkey have the largest standard deviation (0.076 and 0.071, respectively). Chile and South Africa are the least volatile markets during the sample period with standard deviations of 0.024 and 0.026, respectively.

Table 19. Descriptive Statistics

	Argentina	Brazil	Chile	China_A	China_B	India	Malaysia	Mexico	S. Africa	Thailand	Turkey
Mean	0.006	0.018	0.003	0.003	-0.0006	0.003	0.0004	0.004	0.002	-0.0003	0.009
Median	0.002	0.0148	0.002	0.0004	-0.004	0.003	0.00	0.004	0.003	-0.001	0.009
Maximum	0.440	0.361	0.086	0.800	0.216	0.332	0.373	0.175	0.083	0.278	0.316
Minimum	-0.450	-0.681	-0.086	-0.363	-0.178	-0.231	-0.181	-0.130	-0.155	-0.190	-0.254
Std. Dev.	0.059	0.076	0.024	0.068	0.051	0.045	0.041	0.038	0.026	0.045	0.071
Skewness	0.552	-0.520	0.193	3.116	0.482	0.418	1.124	-0.013	-0.738	0.266	-0.038
Kurtosis	12.82	12.92	4.30	39.70	5.420	8.466	16.028	4.418	6.524	6.498	4.237
Jarque-Bera	3252.684	3317.887	61.10	42605.87	191.4404	1010.115	5826.522	67.01110	486.7166	417.1927	51.163
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Q(16)	33.0	131.0	82.9	30.5	53.1	30.8	28.5	25.7	16.97	22.4	18.3
	(0.007)	(0.00)	(0.00)	(0.015)	(0.00)	(0.014)	(0.028)	(0.058)	(0.387)	(0.131)	(0.307)
Observations	800	800	800	738	677	793	800	800	800	800	800

Notes: All statistics are for weekly returns. Q(16) is the Ljung-Box statistic and p-values are given in parentheses.

As usual, weekly index returns are not normally distributed. The Jarque-Bera test provides evidence against the hypothesis of normality in all countries (the null hypothesis of Skewness = 0 and Kurtosis = 3). Significant autocorrelation is detected by the Ljung-Box statistic in most cases, except South Africa, Thailand and Turkey.

3.4.2. Sudden Changes in Variance

Table 20 reports the number of sudden changes in variance detected by the ICSS algorithm. From the weekly returns, Argentina has 16 change points with the highest number of change points. Argentina is followed by China A-shares which has 12 change points. From rest of the weekly returns, India has nine change points; Chile and Malaysia have eight each; Mexico has six; Brazil has five; China-B, Thailand and Turkey have four each and South Africa has three. Table 20 also provides the level of standard deviation for each period of changed volatility and the corresponding political, social or economic events. The nature of the events and the level of change in volatility and the duration of the changes differ by each sample index.

Results suggest that the country-specific factors affect more the level of volatility in each country. There were only two international events affecting more than one country: drop in Hong Kong's stock market in October 1997 and Thailand's devaluation in July 1997. Heavy selling in Hong Kong stock market caused a domino effect and resulted in high volatility in two Latin American countries, Argentina and Mexico but had no effect on any of the Asian emerging markets. The devaluation of Thai Baht caused periods of high volatility in another Latin America country, Brazil and a neighbor country, Malaysia together with, of course, Thailand.

Argentina which has the highest variance in the level of volatility during the sample period has 16 change points. The most volatile period in Argentina was at the beginning of sample period, from the week of January 9, 1990 to the week of February 20, 1990, with a standard deviation of 0.28. This period coincides with the period of hyperinflation and the anti-inflationary programs. In this period, interest payments on external debt were stopped, currency depreciated and the banking crises affected all the banks and 50% of the deposits. Following the highest volatility period of 1990s, the introduction of law of convertibility, which made the foreign portfolio investment by residents possible, and a series of privatization programs had a stabilizing effect on the markets. The second most volatile period, December 20, 1994 to April 26, 1995, is related to the withdrawal of foreign investors from the country, which led to the baking crises again. In October 2001, S&P lowered Argentina's sovereign rating to default status. Even though, the government responded by imposing restrictions on deposit outflows and capital flight, the volatility increased to 0.10 in December 4, 2001. The drop in Hong Kong stock market in 1997 and the disputes with IMF on debt payments scheduling in 2003 were the other two events that caused increase in volatility in the stock market.

Similar to Argentina, the most volatile period in Brazil was at the beginning of sample period, January 5, 1990 to April 13, 1990, which corresponds to anti-inflation programs. While the new currency and heavy taxation of stock market transactions brought stability to the Brazilian markets in the mid-1990s, Thailand's devaluation has increased concerns on Brazilian real devaluation and the volatility rose from 0.05 to 0.08 in July 11, 1997.

Table 20. Sudden Changes in Volatility

Country	# of Change Points	Time Period	St. Dev.	Events
Liberalized				
Argentina	16	01/09/1990 - 02/20/1990	0.280	Hyperinflation, currency & banking crises
		02/27/1990 - 11/26/1991	0.090	Currency made fully convertible making foreign portfolio investment by residents possible.
		12/03/1991 - 06/09/1992	0.040	
		06/16/1992 - 12/01/1992	0.072	
		12/07/1992 - 12/13/1994	0.040	
		12/20/1994 - 06/25/1995	0.103	Devaluation followed by withdrawal of foreign investors, banking crises
		05/02/1995 - 08/06/1996	0.040	Announcement of plan to accelerate the privatization
		08/13/1996 - 10/14/1997	0.026	
		10/21/1997 - 05/17/1999	0.052	Heavy selling in Hong Kong caused a domino effect in other emerging market
		05/24/1999 - 09/26/2000	0.028	
		10/03/2000 - 11/27/2001	0.040	S&P lowered Argentina's local and foreign currency sovereign credit ratings
		12/04/2001 - 01/15/2002	0.100	S&P lowered Argentina's sovereign rating to default status
		01/22/2002 - 07/09/2002	0.080	Capital controls imposed
		07/16/2002 - 12/09/2002	0.030	
		12/16/2003 - 06/15/2004	0.060	Disagreement with IMF on debt payments
		06/22/2004 - 01/18/2005	0.030	
		01/25/2005 - 05/03/2005	0.050	
Mexico	6	01/03/1990 – 02/09/1994	0.036	
		02/16/1994 - 12/27/1995	0.054	Presidential candidate assassinated, peso crisis
		01/03/1996 - 10/15/1997	0.027	
		10/22/1997 - 01/07/1998	0.06	Drop in HK's Hang Seng index
		01/14/1998 - 05/16/2001	0.045	
		05/23/2001 - 11/20/2002	0.033	The peso gained about 6% over the U.S. dollar
		11/27/2002 - 05/04/2005	0.022	The Free Trade Agreement (FTA) with Japan
South Africa	3	01/03/1990 – 06/22/1994	0.024	
		06/29/1994 - 10/15/1997	0.017	International rating companies upgraded country's credit rating with positive outlook
		10/22/1997 - 06/18/2003	0.032	
		06/25/2003 - 04/27/2005	0.02	

Table 20. continued

Country	# of Change Points	Time Period	Std. Dev.	Events
Liberalized				
Turkey	4	01/02/1990 – 06/14/1994	0.08	Banking crisis
		06/21/1994 - 07/28/1998	0.06	Government announced a three-month economic austerity program to lower inflation and to reduce the budget deficit.
		08/04/1998 - 11/13/2001	0.087	Russian crisis
		11/20/2001 - 11/25/2005	0.057	Turkey agreed to strengthen its banking system, accelerate privatization
		12/02/2003 - 05/03/2005	0.036	petroleum market reform bill was passed by the parliament, announcement to privatize Turkey's major oil refineries corp. and oil product retailer
Liberalized + Capital Controls				
Brazil	5	01/05/1990 - 04/13/1990	0.25	Anti-inflation plan,
		04/20/1990 - 07/01/1994	0.09	New currency, taxed stock market transactions heavily
		07/08/1994 - 07/04/1997	0.05	
		07/11/1997 - 03/12/1999	0.08	Thailand's devaluation, concerns on Brazilian real devaluation
		03/19/1999 - 10/18/2002	0.048	A 21% appreciation of the real in March. Internet trading begun on March 29.
		10/25/2002 - 05/03/2005	0.036	Presidential elections
Chile	8	01/02/1990 – 05/29/1990	0.03	
		06/05/1990 - 11/06/1990	0.018	
		11/13/1990 - 12/10/1991	0.038	Chile refused the renewal of Andean pact (Bolivia, Colombia, Ecuador, Peru and Venezuela)
		12/17/1991 - 11/30/1993	0.02	20% reserve requirement imposed
		12/07/1993 - 05/16/1995	0.03	
		05/23/1995 - 12/02/1997	0.017	Moody's and Standard and Poor's upgrade Chilean credit ratings
		12/09/1997 - 01/04/2000	0.03	High bond yields depressed the stock market
		01/11/2000 - 05/16/2000	0.028	
		05/23/2000 - 05/03/2005	0.015	The central bank lifted the one-year holding period for foreign investors. The government also removed the capital gains tax of 15% for foreigners.
Malaysia	8	01/08/1990 – 08/26/1991	0.035	
		09/02/1991 - 09/27/1993	0.021	
		10/04/1993 - 02/20/1997	0.047	
		02/27/1995 - 08/18/1997	0.024	
		08/25/1997 - 09/07/1998	0.10	Devaluation of Thai Baht, Ringgit drops to 36-month lowest against dollar. KLSE imposed trading controls
		09/14/1998 - 04/10/2000	0.053	Ringgit is fixed against dollar, capital controls instituted
		04/17/2000 - 09/03/2001	0.033	MSCI reinstated Malaysia into the Emerging Markets Free and All Country Free Indices
		09/10/2001 - 05/10/2004	0.024	Gov. announces a new aid package to help boost economic growth
		05/17/2004 - 05/02/2005	0.015	Elections

Table 20. continued

Country	# of Change Points	Time Period	Std. Dev.	Events
Liberalized + Capital Controls				
Thailand	4	01/02/1990 – 08/27/1991	0.057	
		09/03/1991 - 06/17/1997	0.036	
		06/24/1997 - 04/27/1999	0.07	Devaluation of Thai Baht, controls on capital inflows
		05/04/1999 - 09/11/2001	0.046	
		09/18/2001 - 05/03/2005	0.033	Government announces a new economic stimulus plan
Partially Liberalized				
China A	12	12/31/1990 – 04/28/1992	0.026	
		05/05/1992 - 10/13/1992	0.19	The "B" share came into existence
		10/20/1992 - 11/24/1992	0.176	
		12/01/1992 - 06/29/1993	0.146	
		07/06/1993 - 07/19/1994	0.056	
		07/26/1994 - 08/30/1994	0.19	
		09/06/1994 - 05/16/1995	0.08	
		05/23/1995 - 10/22/1996	0.05	
		10/29/1996 - 12/10/1996	0.08	The CSRC issued a circular prohibiting Chinese from opening up stock trading accounts in the name of their work units.
		12/17/1996 - 09/23/1997	0.073	The CSRC tightened restrictions on Chinese residents opening B-share accounts, which are reserved for foreign investors.
		09/30/1997 - 04/13/1999	0.03	
		04/20/1999 - 06/29/1999	0.066	
		07/06/1999 - 04/29/2005	0.03	Controls on credit operations were eased
China B	4	02/27/1992 – 01/13/1994	0.061	
		01/20/1994 - 02/09/1995	0.04	
		02/16/1995 - 11/07/1996	0.027	
		11/14/1996 - 07/26/2001	0.064	The CSRC tightened restrictions on Chinese residents opening B-share accounts, which are reserved for foreign investors.
		08/02/2001 - 04/28/2005	0.033	
India	9	01/02/1990 – 07/13/1990	0.028	
		07/20/1990 - 02/12/1991	0.075	Credit rating on Indian debt downgraded from Baa3 to Ba2
		02/19/1991 - 02/17/1992	0.04	
		02/24/1992 - 05/19/1992	0.144	Stock market scandal
		05/26/1992 - 03/01/1994	0.046	
		03/08/1994 - 11/12/1996	0.033	
		11/19/1996 - 12/21/1999	0.042	
		12/28/1999 - 05/30/2000	0.074	Elections
		06/06/2000 - 10/09/2001	0.043	
		10/16/2001 - 05/03/2005	0.03	

In Chile, the increase in volatility up to 0.38 in November 13, 1990 coincides with Chile's refusal to Andean Pact which was renewed between Bolivia, Colombia, Ecuador, Peru and Venezuela. In 1997, high bond yields depressing the stock market also caused volatility to increase. On the other hand, upgrading Chilean credit ratings by Moody's and Standard and Poor's had a calming effect and volatility decreased to 0.017 during May 23, 1995 to December 2, 1997. In May 2000, lifting of one-year holding period and reducing the capital gains tax for the foreign investors had the same stabilizing effect in Chile. The most volatile period in Mexico, from October 22, 1997 to January 7, 1998, was around the time of drop in Hong Kong stock market. The second most volatile period for Mexico was the February 1994-January 1996 period, when the Mexican peso was devalued and one of the presidential candidates was assassinated.

In China, the changes in the volatility and the corresponding events vary by the index. The largest shock for the Chinese A-share, beginning from May 1990, with a standard deviation of 0.19, corresponds to the introduction of B-share index. A-share index had continued to follow this highly volatile pattern until the end of 1999 while B-share index entered its highest volatility period, with a standard deviation of 0.066, when the China Securities Regulatory Commission (CSRC) tightened the restrictions on Chinese residents opening B-share accounts in December 1996. In India, there were three major shocks increasing the stock market volatility. The largest shock, from February 24, 1992 to May 26, 1992, was the stock market scandal with a standard deviation of 0.144. The second largest shock in India was the July 1990-February 1991 period, when the credit rating on Indian debt was downgraded. Political instability during the time of elections had also the same disrupting effect on Indian stock market at the end of 1999. In

Malaysia, the highest level of volatility had occurred during the period between August 25, 1997 and September 7, 1998, and started with the devaluation of Thai Baht and drop of Ringgit to 36-months lowest against U.S. dollar. Since then, the volatility in Malaysian stock market has been decreasing gradually by the impact of a number of economic and political events (see Table 20). In Thailand, devaluation of Thai baht coincides with the increased standard deviation during the period June 24, 1997 to April 28, 1999. The last change in variance in Thai stock returns was on September 2001 when the government announced a new economic stimulus plan, which had a stabilizing effect as decreasing the volatility from 0.046 to 0.033.

In South Africa, the only event that has a clear effect on the stock market was upgrading of country's credit rating with a positive outlook by a number of international rating agencies. Following this, in June 1994, volatility decreased from 0.024 to 0.017. In Turkey, the most volatile period, August 4, 1998 to November 11, 2001, had a standard deviation of 0.087 and was associated with a series of economic crises during which heavy surge of capital outflows occurred. The time of Russian crisis coincides with the beginning of this period. Turkish government's announcements on an economic austerity program to lower inflation and to reduce the budget deficit, in June 1994, and on acceleration of privatization and strengthening of banking system, in November 2001, had stabilizing effects on the stock market volatility.

The question that needs to be addressed is whether the degree of liberalization is related with the volatility behavior in these markets. An evaluation of the events causing variance changes suggests that the majority of the shocks in volatility are driven by country-specific events rather than international factors. However, increased volatility in

Argentina, Brazil, Malaysia, Mexico and Turkey are the only cases of volatility shift that were caused by international factors: Thailand's devaluation, drop in Hong Kong stock market and Russian crisis. From this group, Argentina and Mexico are not only in the same geographical region but they are also fully liberalized economies. The contagion effect of Russian crisis was only observed in Turkey which is another fully liberalized market case and also in the same geographical region with Russia. Although Brazil and Malaysia are in the group of countries using capital controls in my classification, controls became effective in the post-crisis periods, suggesting that all of the countries that were affected by the contagion effects of international disturbances were fully liberalized economies. One common characteristic of these events is that they are all economic. It is surprising that I find no effect of Iraq War or September 11 attack on the volatility of selected emerging markets. As a matter of fact, in India, Malaysia, Thailand and Turkey, volatility decreased following 9/11, suggesting that precautions may have been taken place to wave the expected adverse effects of the event on the international markets.

From the country-specific factors, the most common effective factor seems to be the change in the credit rating of the countries. While in India and Argentina, downgrading of credit ratings led to severe fluctuations in the markets, positive outlook given by international rating agencies for Chile and South Africa had a considerable smoothing effect on their market volatility. Another event that caused decreased volatility in the markets was the announcements by the governments. Privatization announcements, in particular, and the promise on the new economic reform packages had been somewhat effective on the change of variance.

Another interesting point that needs to be pointed out is the volatility pattern observed in two different Chinese stock indices. Given the property of Chinese B-share index which can be owned by foreign investors only, one can expect a highly volatile pattern with more sudden changes in B-share returns due to the unstable nature of foreign capital flows. However, the results suggest the opposite case that A-share index of China presents a more volatile pattern with 12 sudden change points whereas for B-share index, volatility of volatility was insignificant with only four sudden changes in variance.

Aggarwal, Inclan and Leal (1999) examined the pattern of sudden changes in variance following stock market liberalizations and found no change points corresponding to the initiation of market liberalization policies. In my study, however, the examination of the post-liberalization period showed that the changes in the scope of liberalization such as the change in the status of capital controls do have an effect on the volatility changes. Results on the sudden changes in variance showed that the imposition of capital controls right after the crisis periods or high volatility periods, in general, had a stabilizing effect on market volatility in the next period (Argentina in 2002, Brazil in 1990, Chile in 1991, see Table 20). Whereas, bringing extra restrictions on the financial markets during decreased volatility periods disturbed the markets as it happened in China B-shares in 1996. In Chile, removal of controls during the non-crisis period, in 2000, also caused decreased volatility suggesting that while a backward move on the liberalization path would cause disturbances in the markets, a forward move would bring confidence and be more appreciated by the market participants. Since the sample period starts from 1990 and most of the emerging countries completed the liberalization of their financial markets in the early 1990s, I did not make a pre- and post-liberalization

comparison for the sample countries. However, there is a clear pattern observed in the countries which fully liberalized their financial systems in the late 1980s or beginning 1990s. Upon liberalization of their financial systems, the countries experienced financial disturbances at certain levels; Argentina's banking crises in 1990, Brazil's devaluation in 1991, Mexico's currency crisis in 1994 and Turkey's banking crises in 1990, each was associated with increased volatility. One last implication of the results is that there is no sudden change points increasing the volatility after 1999 and volatility has been decreasing in all markets since 1999, except Argentina where the disputes with IMF on debt payments increased the market volatility at the end of 1999 for a six months period.

Overall, increased volatility following each of the full liberalization episodes and decreased volatility in the last five years for almost all sample emerging markets may suggest that there is a link between liberalization and volatility and the pattern described here is consistent with the findings of Kaminsky and Schmukler (2003). In their study on financial integration in the short- and the long-run, they provide evidence that as the liberalization process matures, it may have a stabilizing effect on the asset markets. They find that one of the long-term benefits of liberalization is to reduce the boom-bust cycles in equity markets. While the uncontrolled capital flows deteriorated the financial markets in the early period of liberalization process, 10-15 years after the liberalization of emerging markets, highly volatile feature of emerging markets appears to be changing into a more stable pattern.

3.4.3. GARCH Estimation

The next step involves adding the volatility shift to the variance equations in the standard GARCH framework. The dummy variables capture sudden and discrete shifts in

market volatility in addition to any existing ARCH and GARCH effects. Table 21 reports the conditional variance estimates from fitting a GARCH model with and without dummy variables. Results show that in all countries, the volatility persistence (i.e. $\alpha+\beta=1$) is significantly reduced, which is consistent with the earlier findings of Lastrapes (1989) and Aggarwal, Inclan, and Leal (1999). Among all countries, Malaysia shows the largest decline in volatility persistence (0.56), and Thailand shows the smallest decline (0.13). Also, in the original model without dummy variables, all ARCH and GARCH parameters were significant at the 5 percent level. However, when the dummy variables were introduced, in half of the series, both parameters were significant and the null hypothesis that $\alpha+\beta=1$ was not rejected for three series, suggesting that the time-varying volatility may be a sign of volatility or regime shifts. Results from the Ljung-Box statistic on standardized residuals ($\varepsilon_t/sqrt(h_t)$) from both models reveal no autocorrelation in all cases, except China-B shares in the standard GARCH model and Brazil in the ICSS-combined model.

In summary, the results provide evidence on the stabilizing effect of financial liberalization on the equity markets in the long-run. Results also suggest that an immature liberalization episode would lead to an increased volatility unless there is a control mechanism effective on equity markets. While the countries with a limited liberalization and/or capital controls were successful in insulating their equity markets from external disturbances, fully liberalized markets were subject to volatility contagion arising from international markets. Another finding is that geographical proximity does matter. South Africa, which is geographically isolated from other emerging markets, was

the only country that was spared from the contagion effects of major international disturbances.

The results have also important financial implications especially for the investors interested in emerging stock markets. Investors should be interested in knowing how the volatility of emerging market indices changes over time and what leads to these volatility changes. This information is useful in order to make optimal portfolio allocation decisions. In the light of previous findings, it may be prudent for investors to re-examine the composition of a portfolio consisting of emerging market indices by considering their liberalization degrees, particularly after major events.

Table 21. GARCH (1,1) Parameters with and without Dummy Variables for Sudden Changes in Variance

	Standard GARCH Model					ICSS Extended GARCH Model (with Dummy Variables)				
	α	β	α + β	Wald Test χ^2	Q(16)	α	β	α + β	Wald Test χ^2	Q(16)
Argentina	0.16* (4.30)	0.78* (18.9)	0.94	5.66	12.67	-0.00 (-0.01)	0.48* (3.67)	0.48	17.85	15.89
Brazil	0.08* (3.90)	0.90* (35.4)	0.98	1.61*	12.31	0.07* (2.74)	0.75* (9.75)	0.83	6.61	81.5*
Chile	0.15* (3.90)	0.81* (17.3)	0.96	3.4	15.63	0.12* (2.90)	0.50* (3.71)	0.62	10.14	10.922
China A	0.35 (1.92)	0.71* (7.30)	1.06	0.36*	10.84	0.01 (0.12)	0.68* (5.93)	0.68	14.67	17.47
China B	0.06* (2.49)	0.91* (22.7)	0.97	1.22*	29.03*	0.05 (1.12)	0.40 (0.95)	0.44	1.89	19.73
India	0.10* (2.64)	0.83* (15.6)	0.93	5.7	7.98	0.00 (0.23)	0.40 (1.68)	0.39	6.85	8.99
Malaysia	0.11* (4.00)	0.90* (38.3)	1.01	0.01*	8.97	0.02 (0.661)	0.43* (3.23)	0.45	18.34	6.75
Mexico	0.09* (3.55)	0.90* (33.8)	0.99	1.52*	16.2	0.03 (0.89)	0.58* (2.28)	0.61	2.76	14.70
South Africa	0.04* (2.09)	0.92* (17.4)	0.96	0.91*	4.67	0.15* (2.05)	0.60* (2.34)	0.75	1.24	24.22
Thailand	0.12* (3.01)	0.86* (20.2)	0.98	1.98*	10.74	0.09* (2.58)	0.76* (10.11)	0.85	7.56	9.13
Turkey	0.11* (3.39)	0.85* (20.4)	0.96	3.97	11.52	0.08* (2.03)	0.61* (3.34)	0.69	3.83	12.18

Notes: z-statistics in parentheses. Wald Test tests the hypothesis that $\alpha + \beta = 1$. Q (16) is the Ljung-Box statistic. * denotes significance at 5%

3.5. Conclusion

This chapter considers the impact of sudden shifts in volatility by using iterated cumulated sums of squares algorithm (ICSS) for ten emerging stock markets. Major events corresponding to these shifts are examined to see whether there is a relation between the degree of financial liberalization and the volatility shifts. The large changes in volatility are usually driven by country-specific factors. Credit ratings and government announcements seem to be the most common local factors while the occurrence of economic crises is the most effective one. The drop in Hong Kong stock market, Thailand's devaluation and the Russian crisis are the global events affecting the volatility of a number of emerging markets. Capital controls seem to have a stabilizing effect on stock market volatility, if they are imposed after the high disturbance periods. However, increased restrictions during standard volatility periods are perceived as a disturbance and results in increased volatility in the next period. Volatility contagion has been a matter for the fully liberalized economies, whereas countries that have not liberalized completely yet or used capital controls during the time of international shocks were successful in escaping the contagion. The early period of liberalization is usually associated with increased volatility in stock markets. However, in the last five years, these markets have not experienced a severe volatility shift suggesting that a maturing liberalization process may decrease the occurrence of fluctuations in the stock markets.

In the last step of the analysis, the standard GARCH model is extended by the volatility break points. The inclusion of break points reduces the significance and the persistence of ARCH and GARCH effects in most cases. The results suggest that some of the ARCH and GARCH effects captured by the basic GARCH model can actually be

attributed to sudden shifts in volatility. This finding, together with the derived link between liberalization and volatility change suggest that the diversification across emerging markets matters, as the main shifts in volatility arise from country-specific factors and also depend on the degree of liberalization, which make them non synchronous.

APPENDIX

Java code for `ChangeOfVariance.java file.`

```
/*
 * created on MAY 2005
 * by EKIN TOKAT- ekintokat@hotmail.com
 * for ASSAYS ON FINANCIAL LIBERALIZATION
 * ICSS ALGORITHM
 *
 * FILE Name: ChangeOfVariance.java
 *
 */

import java.io.BufferedReader;
import java.io.FileNotFoundException;
import java.io.FileReader;
import java.io.IOException;
import java.util.ArrayList;
import java.util.Collections;
import java.util.Hashtable;


public class ChangeOfVariance {

      public ArrayList input = new ArrayList();
      public ArrayList outputValues = new ArrayList();
      public Hashtable outputDkValues = new Hashtable();
      public ArrayList outputFinalValues = new ArrayList();
//    public ArrayList removeValues = new ArrayList();

      public static double criticalValue = 1.358;
      public int tempIndex = 0;
      public double tempValue = 0;
      public Bean b;
      public int finalMin = 0;
      public int finalMax = 0;

      public int numberOfObservations = 0;

      public boolean doStep3Again = false;

      /**
       *
       */

      public void checkBeansForAnyChange(){
            int currentJ = 0;
            for (currentJ = 0; currentJ < outputValues.size();
currentJ++)
            {
```

```
//                Change Point Value (1 good, 0 change, -1 delete):


/*
                  System.out.println();
                  System.out.println("******************************");
                  System.out.println("1) CurrentJ: " + currentJ);
                  System.out.println("******************************");
                  System.out.println();
*/

                  if ( ( ( (Bean) outputValues.get(currentJ)
).changePointRemoveFlag ) == -1)
                  {
/*
                        System.out.println();

      System.out.println("******************************");
                        System.out.println("2) Remove index: " +
currentJ);

      System.out.println("******************************");
                        System.out.println();
*/

                        removeChangePoint(currentJ);
                        currentJ = currentJ - 1;
                        doStep3Again = true;
                  }
                  else if ( ( ( (Bean) outputValues.get(currentJ)
).changePointRemoveFlag ) == 0)
                  {

/*
                        System.out.println();

      System.out.println("******************************");
                        System.out.println("11) Change Index: " +
currentJ);

      System.out.println("******************************");
                        System.out.println();
*/

                        updateChangePoint(currentJ);
                        doStep3Again = false;

      ((Bean)outputValues.get(currentJ)).setChangePointRemoveFlag(1);
//                      currentJ = currentJ - 1;
                  }

            }
//    doStep3Again = false;

      }

      public  void doStep3(int min, int max, int expectedIndex, int
beanIndexOfExpected, boolean bRecur)
      //true if we need to do Step3 again, otherwise false.
      {
//          checkBeansForAnyChange();
            int currentIndex = 0;
```

```
            double newMax = 0;

            populateDKArray(min, max);
            currentIndex = getMaxDK(min, max);
/*
            System.out.println();

      System.out.println("**********************************************
****");
            System.out.println("MIN: " + min + " MAX: " + max);

      System.out.println("**********************************************
****");
            System.out.println();
*/
            if (isChangePoint(tempValue, min, max, currentIndex))
            {
                  if (expectedIndex == currentIndex)
                  {

      ((Bean)outputValues.get(beanIndexOfExpected)).setChangePointRemove
Flag(1);
                  }

                  if (Math.abs(expectedIndex - currentIndex) <= 2)
                  {

/*

                        System.out.println();

      System.out.println("**********************************************
******");
                        System.out.println("TempIndex that is set to
Found Exchange within 2 " + tempIndex);

      System.out.println("**********************************************
******");
                        System.out.println();
*/


      ((Bean)outputValues.get(beanIndexOfExpected)).setIndexValueFoundTo
Exchange(tempIndex);

      ((Bean)outputValues.get(beanIndexOfExpected)).setDkValueFoundToExc
hange(tempValue);

      ((Bean)outputValues.get(beanIndexOfExpected)).setChangePointRemove
Flag(0);
                  }
                  else
                  {

/*
                        System.out.println();

      System.out.println("**********************************************
******");
                        System.out.println("TempIndex that is set to
Found Exchange far away " + tempIndex);
```

```
      System.out.println("*****************************************
******");
                        System.out.println();
*/


      ((Bean)outputValues.get(beanIndexOfExpected)).setIndexValueFoundTo
Exchange(tempIndex);

      ((Bean)outputValues.get(beanIndexOfExpected)).setDkValueFoundToExc
hange(tempValue);

      ((Bean)outputValues.get(beanIndexOfExpected)).setChangePointRemove
Flag(0);
                  }
            }
            else
            {

      ((Bean)outputValues.get(beanIndexOfExpected)).setChangePointRemove
Flag(-1);
            }
//          checkBeansForAnyChange();
      }


      public void updateChangePoint(int beanIndexValue){

            Bean b = (Bean) outputValues.get(beanIndexValue);
/*
            System.out.println();
            System.out.println("*****************************");
            System.out.println("12) Updated Value for Index " +
beanIndexValue + " is " + b.index + " before Changed");
            System.out.println("*****************************");
            System.out.println();
*/

            b.index = b.indexValueFoundToExchange;
            b.value = b.dkValueFoundToExchange;

/*
            System.out.println();
            System.out.println("*****************************");
            System.out.println("13) Updated Value for Index " +
beanIndexValue + " is " + b.index + " after Changed");
            System.out.println("*****************************");
            System.out.println();
*/
      }


      public void removeChangePoint(int beanIndexValue){
            Bean b = (Bean) outputValues.get(beanIndexValue);
/*
            System.out.println();
            System.out.println("*****************************");
            System.out.println("3) Removed Value for Index " +
beanIndexValue + " is " + b.index + " before Removed");
            System.out.println("*****************************");
            System.out.println();
*/
```

```
            outputValues.remove(beanIndexValue);


            Bean b2 = (Bean) outputValues.get(beanIndexValue);
/*
            System.out.println();
            System.out.println("*****************************");
            System.out.println("4) Removed Value for Index " +
beanIndexValue + " is " + b2.index + " after Removed");
            System.out.println("*****************************");
            System.out.println();
*/
      }


      public void getFinalChangePoint()
      {
            int currentIndex = 0;
            int min = 0;
            int max = 0;
            int currentI = 0;

            for (currentI = 0; currentI < outputValues.size();
currentI++)
            {
                  if (currentI < (outputValues.size() - 2))
                  {
                        doStep3(((Bean)outputValues.get(currentI)).index
+ 1, ((Bean)outputValues.get(currentI+2)).index,
((Bean)outputValues.get(currentI+1)).index, currentI + 1, false);
                  }

                  if ( currentI+1 < outputValues.size()){

                  }

            }

            checkBeansForAnyChange();
            if (doStep3Again){
                  getFinalChangePoint();
            }
      }

      public void getFinalChangePointFinalArray()
      {
            int currentIndex = 0;
            int min = 0;
            int max = 0;
            int currentI = 0;

            for (currentI = 0; currentI < outputFinalValues.size();
currentI++)
            {
                  if (currentI < (outputFinalValues.size() - 2))
                  {

      doStep3(((Bean)outputFinalValues.get(currentI)).index + 1,
((Bean)outputFinalValues.get(currentI+2)).index,
((Bean)outputFinalValues.get(currentI+1)).index, currentI + 1, false);
                  }
```

```
                  if ( currentI+1 < outputFinalValues.size()){

                  }

            }

            checkBeansForAnyChange();
            if (doStep3Again){
                  getFinalChangePointFinalArray();
            }
      }

      public void getChangeValuesStep1AndStep2(int startIndex, int
endIndex){

            if (startIndex == endIndex){
                  return;
            }
            //STEP 1
            getChangePoint(startIndex,endIndex);
            getFinalRanges();

            if ((finalMin+1) == startIndex && finalMax == endIndex){
                  return;
            }


            //STEP 2
//          outputFinalValues.add( new Bean (  finalMin, 0) );
//          outputFinalValues.add( new Bean (  finalMax, 0) );


            //****************
            //****************
            //NEW CODE

            outputFinalValues.addAll(outputValues);

            //****************
            //****************

            outputValues.removeAll(outputValues);

            if (finalMin+1 < finalMax){
                  getChangeValuesStep1AndStep2(finalMin+1, finalMax);
            }
//          getChangePoint(finalMin+1, finalMax);


            sortFinalOutputArray();

      }

      public static void main(String arg[])
      {
            ChangeOfVariance c = new ChangeOfVariance();
            System.out.println("MERT VE DENIZ BURADALAR.");
            c.getChangeValuesStep1AndStep2(1,c.numberOfObservations);

            c.outputFinalValues.add(new Bean (0,0));
            c.outputFinalValues.add(new Bean
(c.numberOfObservations,0));
```

```
            c.outputValues.removeAll(c.outputValues);

            c.outputValues = c.outputFinalValues;

            c.printOutput();
            c.printFinalOutput();

            c.sortOutputArray();

            c.uniqueOutputArray();

            //STEP 3
            System.out.println("");
            System.out.println();
            System.out.println();
            System.out.println("Step 3");
            System.out.println("**************************");
            c.getFinalChangePoint();
            c.printOutput();
            System.out.println("Done");



/*
//STEP 3
            c.outputFinalValues.add(new Bean (0,0));
            c.outputFinalValues.add(new Bean
(c.numberOfObservations,0));

            c.sortFinalOutputArray();

            c.uniqueFinalOutputArray();


            c.printFinalOutput();

            c.getFinalChangePoint();
            c.printOutput();

            System.out.println("Done");
            c.printFinalOutput();
*/



      }


      /*c.outputValues.add((Object)new Bean(5,.2));
      c.outputValues.add((Object)new Bean(5,.2));
      c.outputValues.add((Object)new Bean(2,.2));
      c.outputValues.add((Object)new Bean(11,.2));
      c.outputValues.add((Object)new Bean(687,.2));
      c.outputValues.add((Object)new Bean(490,.2));
      c.outputValues.add((Object)new Bean(500,.2));
      */
```

```
	public void getChangePoint(int min, int max)
	{
		getChangePoint(min, max, true);
	}

	public void getChangePoint(int min, int max, boolean bRecur)
	{
		int currentIndex = 0;

		if(min >= max)
		return;

//		System.out.println("\t\tmin: " + min + " max: " + max);
		double newMax = 0;

		populateDKArray(min, max);

		currentIndex = getMaxDK(min, max);

		if (isChangePoint(tempValue, min, max, currentIndex))
		{
//			System.out.println("*****Max Index: " + tempIndex +
"*****Max Value: " + tempValue + "\tadded");
			outputValues.add(new Bean(tempIndex, tempValue));

			if (!bRecur)
				return;

			getChangePoint(min, tempIndex);
			tempIndex++;
			getChangePoint(tempIndex, max);
		}
	}


	public ChangeOfVariance()
	{
//		loadData("/data/Ekin.txt");
		loadData("e:/projects/ekin/data/Ekin.txt");

		/*		for(int i =0; i < input.size(); i++)
		{
			System.out.println("array" + input.get(i));

		}*/
	}



	public int getMaxDK(int min, int max)
	{
		double value = 0;
		int index = min;
		double calculatedValue = 0;
```

```
            for(int i = min; i <= max; i++)
            {
                  calculatedValue = Math.abs(((Double)
outputDkValues.get(new Integer(i))).doubleValue());

                  if (value < calculatedValue)
                  {
                        value = calculatedValue;
                        index = i;

                  }
            }

            tempValue = value;

            return index;
      }

      public boolean isChangePoint(double maxDk, int startIndex, int
endIndex, int currentIndex)
      {
            boolean blnChangePointExists;
            double mValue = calculate_M_function(maxDk, startIndex,
endIndex);

//          System.out.println("Val: " + mValue);

            if ( mValue > criticalValue )
            {

/*
                  System.out.println();

      System.out.println("**********************************************
******************");
                  System.out.println("Start Index: " + startIndex + "
End Index: " + endIndex + " Max Index: " + currentIndex);

      System.out.println("**********************************************
******************");
                  System.out.println();

*/

                  blnChangePointExists = true;
                  tempIndex = currentIndex;
            }
            else
                  blnChangePointExists = false;

            return blnChangePointExists;
      }

//    public double get_Ck(int endIndex)
      public double get_Ck(int startIndex, int endIndex)
      {
              double Ck = 0;
//            int startIndex = 1;

              for(int i=startIndex; i <= endIndex; i++)
              {
                    Ck = Ck + (((((Double)input.get(i)).doubleValue())
```

```
                        * (((Double)input.get(i)).doubleValue())));

                }
                return Ck;
        }

        public double get_Dk(double inputCk, double inputCT, int k, int T)
        {
                double Dk = ((inputCk/inputCT) - ((double)k/(double)T));
                return Dk;
        }

        public void populateDKArray(int startIndex, int endIndex)
        {
                double Ck_max = 0;

                /**********
                Ekin
                ***********/
                int localIndexValue;
                int localIndexStart;
                int localIndexEnd;

                localIndexStart = 1;
                localIndexEnd = endIndex - startIndex + 1;
                localIndexValue = 1;

                /**********
                Ekin End
                ***********/

//              Ck max = get Ck(endIndex); // this is CT
                Ck_max = get_Ck(startIndex, endIndex);

                double Ck real = 0;
                double Dk real = 0;
                outputDkValues = new Hashtable();

                for (int i=startIndex; i <= endIndex; i++)
                {
                        Ck real = get Ck(startIndex,i);
//                      Dk_real = get_Dk(Ck_real, Ck_max, i, endIndex);

                /**********
                Ekin
                ***********/
                        Dk_real = get_Dk(Ck_real, Ck_max, localIndexValue,
localIndexEnd);
                        localIndexValue = localIndexValue + 1;
                        /**********
                Ekin End
                ***********/

                        outputDkValues.put(new Integer(i), new
Double(Dk real));
                }
        }
/*
        public double calculate_M_function(double maxDkValue, int
startIndex, int endIndex)
        {
                double mValue = 0;
```

```
            mValue =  Math.sqrt((endIndex - startIndex + 1) / 2) *
Math.abs(maxDkValue);

            return mValue;
      }
*/

public double calculate_M_function(double maxDkValue, int startIndex,
int endIndex)
{

            /**********
            Ekin
            ***********/
            int localIndexValue;
            int localIndexStart;
            int localIndexEnd;

            localIndexStart = 1;
            localIndexEnd = endIndex - startIndex + 1;
            localIndexValue = 1;

            /**********
            Ekin End
            ***********/

      double mValue = 0;
//    mValue =  Math.sqrt((endIndex - startIndex + 1) / 2) *
Math.abs(maxDkValue);
            mValue =  Math.sqrt((localIndexEnd - localIndexStart + 1) /
2) * Math.abs(maxDkValue);

      //mValue =  maxDkValue;


/*
            System.out.println("****************");
            System.out.println("Start Index: " + startIndex);
            System.out.println("End Index: " + endIndex);
            System.out.println("**");
            System.out.println("Local Start Index: " + localIndexStart);
            System.out.println("Local End Index: " + localIndexEnd);
            System.out.println("M_Value: " + mValue);

            System.out.println("");
            System.out.println("");
            System.out.println("****************");
*/

      return mValue;
}


      public void loadData(String strPath)
      {
            try {
                        BufferedReader myInput = new BufferedReader(new
FileReader(strPath));
                        String thisLine = new String();
                        String value[];
                        input.add(0, new Double(0));

                        while ((thisLine = myInput.readLine()) != null)
```

```
                        {
                              value = thisLine.split(",");

      input.add(Integer.valueOf(value[0]).intValue(),
Double.valueOf(value[1]));
                              numberOfObservations++;
                        }
            }
            catch (FileNotFoundException e) {
                  // TODO Auto-generated catch block
                  e.printStackTrace();
            }
             catch (IOException e) {
                  // TODO Auto-generated catch block
                  e.printStackTrace();
            }
      }

      public void printOutput()
      {
            /*for (Enumeration e = outputValues.elements() ;
e.hasMoreElements() ;)
            {
             System.out.println("Final Array Value" +
((Double)((Object)e.nextElement())).doubleValue()
                  + " / index: " + e);
            }*/
            Bean b;
            System.out.println("**************************");
            for(int x = 0; x < outputValues.size(); x++)
            {
                  b = (Bean) outputValues.get(x);
                  //System.out.println("x: " + x + " / DKInd: " +
b.index + " / DKVal: " + b.value);
                  System.out.println("*****Max Index: " + b.index +
"*****Max Value: " + b.value);
            }
      }

      public void printFinalOutput()
      {
            Bean b;
            System.out.println("**************************");
            for(int x = 0; x < outputFinalValues.size(); x++)
            {
                  b = (Bean) outputFinalValues.get(x);

                  System.out.println("*****Max Index: " + b.index +
"*****Max Value: " + b.value);
            }
      }

/*
      public void getFinalChangePoint()
      {
            int currentIndex = 0;
            int min = 0;
            int max = 0;
            int currentI = 0;
            //if(min >= max)
            //return;
```

```
            for (currentI = 0; currentI < outputValues.size();
currentI++)
            {
                  //System.out.print("currentI - " + currentI + " \t
size - " + outputValues.size());
                  if (currentI < (outputValues.size() - 2))
                  {
                        //``````rintln
(((Bean)outputValues.get(currentI)).index + 1 +   "," +
((Bean)outputValues.get(currentI+2)).index);
//
      verifyChangePointsStep3(((Bean)outputValues.get(currentI)).index +
1, ((Bean)outputValues.get(currentI+2)).index, false);
                        doStep3Again =
verifyChangePointsStep3(((Bean)outputValues.get(currentI)).index + 1,
((Bean)outputValues.get(currentI+2)).index,
((Bean)outputValues.get(currentI+1)).index, currentI, false);
                  }
            }
            if (doStep3Again){
                  getFinalChangePoint();
            }
      }
*/
      public void getFinalRanges()
      {
            if (outputValues.size() <= 0)
                  return;
            finalMin = ((Bean)outputValues.get(0)).index;
            finalMax = ((Bean)outputValues.get(outputValues.size()-
1)).index;

            System.out.println("*****************************");
            System.out.println("final min: " + finalMin + "final max: "
+ finalMax);
            System.out.println("*****************************");
      }

      public void sortOutputArray()
      {
            Collections.sort(outputValues);
      }

      public void sortFinalOutputArray()
      {
            Collections.sort(outputFinalValues);
      }

      public void uniqueOutputArray()
      {
            if (outputValues.size() < 1)
                  return;

            ArrayList newOutputArray = new ArrayList();

            Bean b = (Bean) outputValues.get(0);

            Bean c;
            newOutputArray.add(b);
            for(int x = 1; x < outputValues.size(); x++)
            {
                  c = (Bean) outputValues.get(x);
                  if (b.equals(c))
```

```
                {
                        continue;
                }
                b = c;
                newOutputArray.add(c);
        }

        outputValues = newOutputArray;
    }

    public void uniqueFinalOutputArray()
    {
        if (outputFinalValues.size() < 1)
            return;

        ArrayList newOutputArray = new ArrayList();

        Bean b = (Bean) outputFinalValues.get(0);

        Bean c;
        newOutputArray.add(b);
        for(int x = 1; x < outputFinalValues.size(); x++)
        {
            c = (Bean) outputFinalValues.get(x);
            if (b.equals(c))
            {
                continue;
            }
            b = c;
            newOutputArray.add(c);
        }

        outputFinalValues = newOutputArray;
    }




}
```

Java code for `Bean.java file`.

```
/*
 * created on MAY 2005
 * by EKIN TOKAT- ekintokat@hotmail.com
 * for ASSAYS ON FINANCIAL LIBERALIZATION
 * ICSS ALGORITHM
 *
 * FILE NAME: Bean.java
 *
 */

public class Bean implements Comparable
{
      int index;
      double value;
      int changePointRemoveFlag = 1;
      /* This changePointRemoveFlag can be only 3 values:
       * 1 = good, keep the change point
       * 0 = keep the point but change with the close value (close by
2), or with itself
       * -1 = delete the change point
       */

       int  indexValueFoundToExchange;
       /*
        * If this value is 0, that means
        * there is nothing to change
        *
        */

       double  dkValueFoundToExchange;
       /*
        * If this value is 0, that means
        * there is nothing to change
        *
        */

      /**
       *
       */
      public Bean(int i, double d)
```

```
	{
		index = i;
		value = d;
		changePointRemoveFlag = 1;
		indexValueFoundToExchange = 0;
	}

	public void setChangePointRemoveFlag(int inputFlag){
		changePointRemoveFlag = inputFlag;

	}

	public int getChangePointRemoveFlag(){
		return changePointRemoveFlag;

	}

	public void setIndexValueFoundToExchange(int inputNewIndexValue){
		indexValueFoundToExchange = inputNewIndexValue;

	}

	public void setDkValueFoundToExchange(double inputDkNewValue){
		dkValueFoundToExchange = inputDkNewValue;

	}

	public void setIndex(int inputIndex){
		index = inputIndex;

	}

	public int compareTo(Object o)
	{
		Bean b = (Bean) o;
		return (this.index > b.index ? 1 : this.index == b.index ? 0
: -1);
	}

	public boolean equals(Object o)
	{
		return (this.index == ((Bean)o).index);
	}
}
```

BIBLIOGRAPHY

Aggarwal, R., C. Inclan and R. Leal, “Volatility in Emerging Stock Markets”, Journal of Financial and Quantitative Analysis, (1999), 34, 33-55.

Bekaert, Geert and Campbell R. Harvey, “Emerging Equity Market Volatility”, Journal of Financial Economics, Vol. 43 No. 1 (1997), pp. 27-77.

_____, “Foreign Speculators and Emerging Equity Markets”, Journal of Finance 55 (2000), 565-614.

Bekaert, G., C. R. Harvey and C. Lundblad, “Does Financial Liberalization Spur Growth?”, NBER Working Paper No. W8245 (2001).

Borensztein, E., J.De Giorgio,and J-W Lee “How does Foreign Investment Affect Growth?”, Journal of International Economics, Vol. 45 (June) (1998), pp.115-35.

Breusch, T. S., and A. R. Pagan “The LaGrange Multiplier Test and Its Applications to Model Specification in Econometrics,” Review of Economic Studies, 47, (1980) 239-25

De Santis G. and Imrohoroglu S. , “Stock Returns and Volatility in Emerging Financial Markets.” Journal of International Money and Finance Vol. 16 (4) (1997), 561-579.

Demirgüç-Kunt, Asli and Enrica Detragiache, "Financial Liberalization and Financial Fragility", IMF Working Paper (1998).

Dornbusch, R., “Expectations and Exchange Rate Dynamics”, Journal of Political Economy 84 (1976), 1161 - 1176

Edison, H. J. and C. M. Reinhart, “Capital Controls During Financial Crises: The Case of Malaysia and Thailand”, Board of Governors of the Federal Reserve System International Finance Discussion s. No. 662. Washington, D.C. March 2000.

Edison, H. J. and C. M. Reinhart , “Stopping Hot Money”, Journal of Development Economics, 66 (2001), pp. 533-553.

Edison, H., R. Levine, L. Ricci, and T. Slok, “Capital Account Liberalization and Economic Performance: Survey and Synthesis”, IMF Working Paper (2002), 02/120.

Edwards, Sebastian, “Interest Rate Volatility, Contagion and Convergence: An Empirical Investigation of the Cases of Argentina, Chile and Mexico”, Journal of Applied Economics, Vol. I, No. 1 (1998), pp.55-86

Enders, W., Applied Econometric Time Series, New York: Wiley, (1995).

Engle, R.F., and C.W.J. Granger, “Cointegration and Error-Correction: Representation, Estimation and Testing,” Econometrica, Vol. 55 (1987), 251-276.

Fischer, S., “Capital Account Liberalization and the Role of the IMF," presented at the seminar Asia and the IMF, held in Hong Kong, China, on September 19, 1997. IMF, September 1997

Granger, C.W.J., “ Developments in the study of cointegrated economic variables”, Oxford Bulletin of Economics and Statistics, 48 (1986), 213-228.

Harvey, C., “Predictable risk and returns in emerging markets”, Review of Financial Studies 8 (1995), 773–816.

Henry, P., “Stock Market Liberalization, Economic Reform and Emerging Market Equity Prices,” Journal of Finance, 55 (2000), 529-564.

Honohan, Patrick, "How Interest Rates Changed under Financial Liberalization: A Cross-Country Review ", World Bank Policy Research Working Paper No. 2313 (April 2000)
http://ssrn.com/abstract=630685

Inclan, C and Tiao, G. C, "Use of Cumulative Sums of Squares for Retrospective Detection of Changes of Variance", Journal of the American Statistical Association 89 (1994), 913-923.

Johansen, S., "Statistical Analysis of Cointegration Vectors," Journal of Economic Dynamics and Control, Vol. 12 (1988), 231-254.

Jones, J.D. and D. Joulfaian, "Federal Government Expenditures and Revenues in the Early Years of the American Republic: Evidence from 1792 and 1860", Journal of Macroeconomics, Vol 13(1) (1991).

Judge G.G., R.C. Hill, W.E. Griffiths, H. Lutkepohl and T. Lee, Introduction to the Theory and Practice of Econometrics (Second Edition). New York: John Wiley & Sons (1988).

Kaminsky, Graciela, and Sergio Schmukler, "Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization," NBER Working Papers 9787 (2003), National Bureau of Economic Research, Inc.

Khanna , S., "The Financial Reforms and Industrial Sector in India", Economic & Political Weekly Nov. 7 (1999), Bombay

Kim, E.H., and V. Singal. "Stock Market Openings: Experience of Emerging Economies", Journal of Business, 73(1) (2000), pp. 25-66.

King, R. G., and R. Levine, "Finance and Growth: Schumpeter Might be Right", Quarterly Journal of Economics; V.108-#3 (1993), pp. 717-737.

Lamoureux, C., and Lastrapes, W., "Heteroskedasticity in Stock Return Data: Volume versus GARCH Effects", Journal of Finance, 45 (1990), 221-229.

Levine, R. and Zervos, S., “Stock markets, banks, and economic growth”, American Economic Review, 88 (1998), 537–558.

Marangos, J., “A Political Economy Approach to the Neoclassical Gradualist Model of Transition”, American Journal of Economics and Sociology, Jan. 2002

McKinnon, R. I., Money and Capital in Economic Development. Washington, D.C.: Brookings Institution, (1973).

McKinnon, Ronald and Huw Pill, Exchange-Rate Regimes for Emerging Markets: Moral Hazard and International Overborrowing, Oxford Review of Economic Policy, 15(3) (1999), 19-39.

Mody, A., and A. P. Murshid, “Growing up with capital flows”, IMF Working Paper, No. 02/75 (2002).

Nayar, Baldev Raj, “Political Structure and India's Economic Reforms of the 1990s", Pacific Affairs, vol.71, no. 3 (Fall 1998), pp. 337-360.

Rajan, Raghuram and Luigi Zingales, “Financial Dependence and Growth,” American Economic Review, 88 (3) (1998), 559—86.

Reddy , Y.V. , “Monetary and Financial Sector Reforms in India: A Practitioner's Perspective” presented at the Indian Economy Conference, Program on Comparative Economic Development (PCED) at Cornell University, USA, on April 19-20, 2002.

Reinhart, C.M. and I. Tokatlidis , "Before and After Financial Liberalisation", World Bank Conference on Financial Globalisation, (2001) http://www.worldbank.org/research/conferences/financial_globalization.htm

Rossi, Nicola, "Government Spending, the Real Interest Rate and the Behavior of Liquidity Constrained Consumers in Developing Countries," Staff s, International Monetary Fund, Vol. 35 (1988), pp. 104-40.

Shaw, E., Financial Deepening in Economic Development. New York: Oxford University Press (1973).

Singh, A., “Capital account liberalization, free long-term capital flows, financial crises and economic development”, CBR Working Paper, No. 245 (2002).

Stiglitz, J., “Capital market liberalization, economic growth, and instability” World Development, 28, 1075-1086, (2000).

Summers, L., "International Financial Crises: Causes, Prevention and Cures", American Economics Review s and Proceedings. 90 (2) (2000), 1-16.

Susmel R., “Switching Volatility in Latin American Emerging Markets”, Emerging Markets Quarterly, 2 (1998), 44-56.

Vaidyanathan, G., "Consumption, Liquidity Constraints and Economic Development," Journal of Macroeconomics, Vol. 15 (1993), 591-610.

Williamson, J., and Z. Drabek," Whether and When to Liberalize Capital Account and Financial Services." Staff Working Paper ERAD-99-03. World Trade Organization, Economic Research and Analysis Division (1999).