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STAFF STUDIES

CENTRAL BANK OF SRI LANKA

මාණ්ඩලික පත්‍රිකා
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Intra Day Liquidity Facility
Does it have an impact on Monetary Policy?

Dr. D.S. Wijesinghe*

Abstract

The Central Bank provides an intra day liquidity facility (ILF) free of charge to commercial banks and primary dealers to ensure smooth operations of the RTGS system. This paper examines whether the availability of ILF would have an impact on the conduct of monetary policy. It points out that, even before the introduction of the RTGS, intra day liquidity through the Central Bank was available in the form of an implicit intra day overdraft facility and hence, ILF would not have enhanced the liquidity available in the financial system. The paper observes no evidence in the settlement accounts of commercial banks and primary dealers at the Central Bank that the availability of ILF has enabled them to finance a higher volume of transactions. ILF is provided under stringent conditions with heavy penalties for defaults which ensures that the facility is not converted into an overnight credit. Accordingly, the release of funds under the ILF is unlikely to create an adverse impact on the conduct of monetary policy as funds flow back to the Central Bank on the same business day. (JEL E52 E58)

I. Introduction

In order to ensure smooth operations of the Real Time Gross Settlement (RTGS) system established in Sri Lanka on 8 September, 2003, the Central Bank of Sri Lanka provides an intra day liquidity facility (ILF) to its participating institutions, which are commercial banks and primary dealers in government securities. The facility is available free of charge against eligible securities. As the provision of ILF amounts to a release of funds by the Central Bank, one might presume that it would result in an enhancement in the volume of liquidity available in the financial system, and hence, would have an impact on the conduct of monetary policy. Therefore, a closer examination of the facility and its utilization by the participating institutions is warranted. Accordingly, this paper outlines the importance of intra day liquidity in a RTGS system, and the main features of the intra day liquidity facility

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available in Sri Lanka and examines whether it would have an impact on the conduct of monetary policy.

II. Importance of Intra day Liquidity in a RTGS System

The most significant feature of a RTGS system is the settlement of a transaction as soon as the payment instruction is received by the system. Such immediate settlements, while important for time critical payments, eliminate the exposure of participants of a payment system to a risk of a payment being defaulted in a deferred in particular, end of day settlement system. In an end of day settlement system, if a participant defaults a payment, i.e. does not have sufficient funds to meet the payment, not only the recipient of the payment suffers a loss but it may also lead to a systemic impact on the system, as the recipient himself may become unable to honour his payment obligations. As the Central Bank may not wish to allow the payment system of the country to collapse, it would eventually be compelled to assume the risk of such defaults and loses arising out of them.

However, in order to reap the benefits of a RTGS system, its participants should have sufficient funds in their settlement accounts at the Central Bank at all time to meet their payment obligations. This is because, unlike in a differed settlement system, in a RTGS system in general, payments out of an account can not be netted off against receipts and an account is debited only if funds are available in the account to cover the payment in full. Otherwise, payments would be held up in queues without being settled. As payments and receipts are not always synchronized and one participant's payment is a receipt of another, the system could not be operated efficiently without liquidity being provided to finance payments until receipts are forthcoming during the course of a day. Hence, intra day liquidity is essential for smooth operations of a RTGS System.

A main source of intra day liquidity available for commercial banks in Sri Lanka is the balances maintained by them in their settlement accounts with the Central Bank in order to fulfill their obligations under the Statutory Reserve Requirement (SRR). Usually, balances under SRR are required to be maintained at the end of the day and hence, during the day, these balances could be utilized to meet intra day liquidity requirements. Normally, a large volume of intra day liquidity requirements of commercial banks is covered by SRR. However, when transactions of a bank is relatively large compared with its deposit base, the balance available under SRR may not be sufficient to meet its intra day liquidity requirement. Moreover, this source of intra day liquidity is not available to primary dealers as they are not subject to SRR. Therefore, it is essential that intra day liquidity is provided to the members of RTGS to ensure that it is operated smoothly.

III. Salient Features of ILF

In Sri Lanka, ILF is granted free of charge on request to commercial banks and primary dealers against eligible securities. At present, eligible securities are government Treasury bills and Treasury bonds. The participants who wish to obtain ILF at the beginning of the day is required to reposition, before the close of business on the previous business day, an adequate volume of eligible securities from their own accounts to their ILF accounts in the scripless securities settlement system, LankaSecure, which is an integral part of the RTGS system in Sri Lanka, which is code named, LankaSettle. During the business day also, participants could draw ILF at three designated times by repositioning eligible securities into their ILF accounts, after informing the Central Bank their wish to obtain ILF and the required amount. The Central Bank is prepared to accommodate requests for ILF even in between the designated times, if there happens to be an urgent requirement.

The provision of ILF is in the form of a repurchase agreement to repurchase by the participant the securities against which ILF is provided by repaying the outstanding ILF on or before the time specified for the repayment. Accordingly, the provision of ILF is governed by an ILF agreement between the Central Bank and each participating institution signed by the Monetary Board of the Central Bank and the Chief Executive Officer of each participating institution.

ILF is provided for the current market value, subject to a 'hair cut' as determined by the Central Bank, of the securities against which ILF is sought. The Central Bank daily updates, based on current market prices and taking into account market developments, a list of official prices of Treasury bills and Treasury bonds of each remaining days to maturity and records it in LankaSettle. The 'hair cuts', have been determined by studying daily variations in prices of these securities in the secondary market and are imposed to eliminate the exposure of the Central Bank to any losses in the value of securities it purchased due to variations in prices. In exceptional circumstances, the Central Bank has the right to revise the official prices during the business day and revalue the securities provided as collateral on the revised official prices. Participants may be required to make a replenishment of securities on the basis of such a revaluation.

Participants are not permitted to make substitutions for securities against which ILF is granted but are allowed to regain whole or a part of them before the specified time for the repayment by returning the funds borrowed under ILF fully or partially. Such reversals would be on a prior agreement with the Central Bank and allowed only once during each business day.

The process of reversal of ILF is initiated at a specified time and participants must ensure that funds are available in their settlement accounts to settle in full all outstanding ILF balances. Strong measures are in place to ensure that participants will settle their ILF

balances on time. If a participant fails to settle in full the outstanding ILF balance, he will become liable to pay a default interest on the full amount. The default interest would be at a rate equivalent to the Bank Rate at the first occasion of such a default. On each successive occasion of defaults during a calendar year, default interest rate will be increased by 100 bps. The Bank Rate is a penal rate (at present 15 per cent) which is substantially higher than the reverse repurchase rate of the Central Bank (at present 12 per cent), the rate at which participants could borrow from the Central Bank on overnight basis. Accordingly, this default interest in fact is an effective deterrent to the overnight use of the intra day facility.

The defaults are further discouraged by imposing a condition that the Central Bank will retain the securities against which such funds were provided and deal with them in its own rights in an event if a participant fails to settle in full the amount in default before the end of business on the next business day. The securities will be retained in a similar manner if a participant defaults more than once in a month, in addition to charging default interests on the full amount. In the event of repeated defaults, the Central Bank may withdraw the availability of ILF to the participant for a period of time determined by the Central Bank. Notwithstanding any of these provisions, the Central Bank may at its sole discretion, taking into consideration the circumstances of a default, withdraw the availability of ILF to a participant permanently or for a period of time determined by the Central Bank.

Accordingly, the terms and conditions against which ILF is granted ensure that the Central Bank is not exposed to a risk on account of the provision of ILF and ILF is not converted into an overnight credit.

IV. Impact of ILF on Liquidity Available in Financial System

Under the end of day settlement system that existed before the introduction of RTGS, transactions among commercial banks and primary dealers were effected by Central Bank cheques drawn against their settlement accounts maintained at the Central Bank. These cheques were processed and settled at the end of the day. Under this system, banks and primary dealers could have made payments by issuing Central Bank cheques, even if they did not have sufficient funds in their settlement accounts at the time of effecting the payments. This implies that they were permitted to overdraw their accounts during the day and accordingly provided with intra day liquidity, implicitly without a limit and without any collateral. In other words, instead of ILF, under the end of day settlement system, there existed, an intra day overdraft facility implicitly provided by the Central Bank. Therefore, the provision of ILF under RTGS would not in principle have led to an increase in the overall liquidity in the financial system. In fact, overall liquidity might have been declined, as participants may economise on the use of ILF as it is available only against the eligible securities.

An estimate on the maximum level of ILF that could have been implicitly utilized by commercial banks and primary dealers could be made by comparing the opening balances in their settlement accounts with total debits and credits to the settlement accounts under certain assumptions. If it were assumed that all credits to accounts were at the end of the day, then they would have implicitly utilized ILF to cover the differences between total debits and the value of the opening balances. Alternatively, a more conservative estimate could be made by assuming that one half of the credits were made at the beginning of the day. These estimates have to be made for each institution, and not for the system as a whole in aggregate. An institution with an opening balance which is higher than total debits to its account would have not obtained ILF, and hence, at the aggregate level ILF requirements might not be observable. Accordingly, estimates were made only for the heavy users of ILF during the first two months of operations of RTGS (*i.e.,* September and October 2003) and are shown in Table 1a and 1b. The estimates highlight the potential ILF requirements of these users of ILF and could be compared with their actual drawings of ILF during the first two months. These estimates provide evidence that in general ILF drawings during the first two months were substantially lower than the maximum intra day credit they might have obtained implicitly under the end of day settlement system.

V. Monetary Policy Implications of ILF

It was argued in the previous section that the overall liquidity under the RTGS system with ILF provided by the Central Bank could not in principle be higher than that existed under the end of day settlement system. If ILF under RTGS has had an expansionary impact, it should have enabled banks and primary dealers,

(*a*) to finance a larger volume of transactions as indicated by a larger volume of debits to their accounts and/or

(*b*) to maintain smaller working balances in their settlement accounts.

In Sri Lanka, (*b*) is not possible for banks, as they have to maintain the Statutory Reserve Requirement in their settlement accounts, which at 10 per cent of deposit liabilities is likely to well exceed usual working balance requirements. Even before the introduction of RTGS, primary dealers had maintained only small balances in their settlement accounts and it is hardly possible to reduce them further.

For major drawers of ILF, comparable data on their average as well as maximum and minimum opening balances, debits and credits to their accounts during pre-RTGS and post-RTGS periods together with the implicit ILF and during the post RTGS period, ILF drawings are shown in Table 1a and 1b. Data for one state bank (State Bank A), one foreign bank (Foreign Bank A) and two domestic private banks (Domestic Private Bank A and Domestic Private Bank B) which accounted for around 85 per cent of the ILF drawings

Table 1a

Implicit ILF under End of Day Settlement and ILF Drawings under RTGS
Selected Commercial Banks

Period	Bank	Opening Balance (1)	Debits (2)	Credits (3)	ILF1 (4)=(2-1) If > 0	ILF2 (5)=2-(1+0.5*3) If > 0	ILF Under RTGS
	State Bank A						
July 03	Avg.	8,704	4,914	4,895	0	0	
	Min.	8,262	2,883	4,753	0	0	
	Max.	8,206	13,876	18,321	5,670	0	
Aug 03	Avg.	8,585	5,368	5,409	0	0	
	Min.	8,404	2,462	2,673	0	0	
	Max.	7,466	16,435	18,399	8,969	0	
Sept. 03	Avg.	8,824	8,690	8,862	0	0	
(01-05)	Min.	8,067	6,104	6,262	0	0	
	Max.	8,296	13,111	15,792	4,815	0	
Post-RTGS							
Sept. 03	Avg.	8,184	6,703	6,700	0		3,000
(08-30)	Min.	7,735	4,552	4,953	0		3,000
	Max.	8,907	11,182	100,094	2,275		3,000
Oct. 03	Avg.	8,392	6,209	6,114	0		1,571
	Min.	8,147	2,718	4,193	0		0
	Max.	8,614	14,044	12,760	5,430		3,000
	Foreign Bank A						
July 03	Avg.	1,317	4,908	4,118	2,781	722	
	Min.	1,290	1,945	1,902	655	0	
	Max.	1,581	8,331	7,925	6,750	2,788	
Aug. 03	Avg.	1,371	2,174	2,156	803	0	
	Min.	1,208	979	1,270	0	0	
	Max.	1,366	3,983	3,843	2,617	696	
Sept. 03	Avg.	1,326	3,048	3,024	1,723	211	
(01-05)	Min.	1,226	2,634	2,867	1,408	0	
	Max.	1,459	3,677	3,463	2,218	487	
Post-RTGS							
Sept. 03	Avg.	1,378	2,901	3,101	1,523		
(08-30 Sept.)	Min.	1,386	2,110	2,246	724		
	Max.	1,386	5,159	3,087	3,773		
Oct. 03	Avg.	1,378	2,919	2,843	1,541		
	Min.	1,203	1,037	1,030	0		
	Max.	1,305	6,320	3,419	5,015		

Table 1a (Contd.)

Period	Bank	Opening Balance (1)	Debits (2)	Credits (3)	ILF1 (4)=(2-1) If > 0	ILF2 (5)=2-(1+0.5*3) If > 0	ILF Under RTGS
	Domestic Private Bank A						
July 03	Avg.	357	1,583	1,584	1,226	434	
	Min.	378	464	448	86	0	
	Max.	363	2,451	2,476	2,088	850	
Aug 03	Avg.	398	1,981	1,923	1,520	558	
	Min.	380	1,163	1,202	783	182	
	Max.	452	2,702	2,765	2,250	868	
Sept. 03	Avg.	390	2,385	2,407	1,995	791	
	Min.	441	1,943	1,884	1,502	560	
	Max.	392	2,727	2,889	2,335	891	
Post-RTGS							
Sept. 03	Avg.	380	3,475	3,548	3,095		2,187
(08-30)	Min.	171	2,456	2,729	2,285		1,800
	Max.	361	4,706	4,840	4,345		2,700
Oct. 03	Avg.	8,392	6,209	6,114	3,686		1,571
	Min.	8,147	2,718	4,193	1,756		0
	Max.	8,614	14,044	12,760	5,737		3,000
	Domestic Private Bank B						
July 03	Avg.	334	2,171	2,174	1,838	751	
	Min.	301	1,391	1,458	1,090	361	
	Max.	315	4,128	4,114	3,813	1,756	
Aug. 03	Avg.	352	2,193	2,194	1,841	743	
	Min.	80	304	313	224	68	
	Max.	393	4,163	4,130	3,770	1,705	
Sept. 03	Avg.	362	4,125	4,125	3,763	1,701	
	Min.	335	3,287	3,283	2,92	1,311	
	Max.	360	4,464	4,483	4,104	1,863	
Post-RTGS							
Sept. 03	Avg.	361	3,256	3,269	2,895		725
(08-30 Sept.)	Min.	362	2,257	2,253	1,865		115
	Max.	442	4,652	4,574	4,210		850
Oct. 03	Avg.	374	3,421	3,426	3,047		825
	Min.	379	1,812	1,995	1,433		270
	Max.	377	5,837	5,848	5,460		920

ILF 1 = Implicit ILF under the assumption that all credits were at the end of the day
ILF 2 = Implicit ILF under the assumption that a half of credits were at the start of the day

Min. Max. refer to the minimum and maximum of debits during the month and corresponding opening balance and credit realized on the same day.

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Table 1b

**Implicit ILF under End of Day Settlement and ILF Drawings under RTGS
Selected Primary Dealers**

Period	Primary Dealer	Opening Balance (1)	Debits (2)	Credits (3)	ILF1 (4)=(2-1) If > 0	ILF2 (5)=2-(1+0.5*3) If > 0	ILF Under RTGS
	PD 1						
July 03	Avg.	2.5	579	579	576	287	
	Min.	2.0	189	189	187	93	
	Max.	2.0	1,098	1,097	1,096	548	
Aug 03	Avg.	1.2	471	471	470	235	
	Min.	0.0	32	32	32	16	
	Max.	2.0	1,314	1,314	1,313	656	
Sept. 03 (01-05)	Avg.	1.4	668	668	667	333	
	Min.	1.0	287	287	286	143	
	Max.	2.0	1,186	1,185	1,184	592	
Post-RTGS							
Sept. 03 (08-30)	Avg.	1.3	540	540	539		110
	Min.	6.0	205	199	199		110
	Max.	0.0	988	990	988		110
Oct. 03	Avg.	0.7	391	391	390		110
	Min.	0.0	109	110	109		110
	Max.	1.0	927	926	926		110
	PD 2						
July 03	Avg.	0.5	1,032	1,032	1,032	515	
	Min.	0.0	226	226	226	113	
	Max.	0.0	2,217	2,217	2,217	1,109	
Aug. 03	Avg.	1.3	1,390	1,390	1,389	694	
	Min.	1.0	257	257	256	128	
	Max.	1.0	2,451	2,451	2,450	1,225	
Sept. 03 (01-05)	Avg.	1.0	1,032	1,035	1,032	515	
	Min.	1.0	479	482	478	237	
	Max.	0.0	1,822	1,823	1,822	911	
Post-RTGS							
Sept. 03 (08-30 Sept.)	Avg.	70.2	1,409	1,407	1,339		551
	Min.	14.0	102	90	88		250
	Max.	2.0	3,499	2,630	3,497		1,120
Oct. 03	Avg.	2.8	779	779	776		250
	Min.	1.0	366	356	354		250
	Max.	9.0	1,383	1,377	1,374		250

Table 1b (Contd.)

Period	Bank	Opening Balance (1)	Debits (2)	Credits (3)	ILF1 (4)=(2-1) If > 0	ILF2 (5)=2-(1+0.5*3) If > 0	ILF Under RTGS
	PD 3						
July 03	Avg.	6.0	1,070	1,070	1,064	529	
	Min.	19.0	439	424	420	208	
	Max.	25.0	2,487	2,482	2,462	1,221	
Aug 03	Avg.	2.0	811	811	809	404	
	Min.	0.0	59	59	59	30	
	Max.	0.0	2,330	233	2,330	1,165	
Sept. 03 (01-05)	Avg.	3.0	1,504	1,505	1,501	749	
	Min.	0.0	668	680	668	328	
	Max.	0.0	2,627	2,627	2,627	1,314	
Post-RTGS							
Sept. 03 (08-30)	Avg.	13.5	1,155	1,160	1,142		106
	Min.	100.0	248	148	148		130
	Max.	0.0	2,045	2,221	2,045		345
Oct. 03	Avg.	0.3	639	640	639		62
	Min.	0.1	91	91	91		100
	Max.	0.7	1,870	1,970	1,869		200
	PD 4						
July 03	Avg.	4.0	449	450	445	220	
	Min.	4.0	122	118	118	59	
	Max.	2.0	743	761	741	361	
Aug. 03	Avg.	1.0	471	471	470	235	
	Min.	1.0	179	178	178	89	
	Max.	1.0	913	913	912	456	
Sept. 03	Avg.	5.0	473	473	468	232	
	Min.	1.0	280	280	279	139	
	Max.	19.0	709	691	690	345	
Post-RTGS							
Sept. 03 (08-30 Sept.)	Avg.	0.7	260	270	259		116
	Min.	0.0	22	73	22		50
	Max.	1.0	602	602	601		205
Oct. 03	Avg.	1.0	240	242	239		154
	Min.	0.3	0	0	0		147
	Max.	0.0	669	669	669		155

ILF 1 = Implicit ILF under the assumption that all credits were at the end of the day

ILF 2 = Implicit ILF under the assumption that a half of credits were at the start of the day

Min. Max. refer to the minimum and maximum of debits during the month and corresponding opening balance and credit realized on the same day.

during the first two months are shown, together with comparable data for a few primary dealers (PD1, PD2 and PD3). The following observations were drawn from these data.

(i) State Bank A

State Bank A has drawn ILF amounting to Rs.3 billion on each business day until 16 October, 2003. However, except for a few days, total debits to its settlement account have not exceeded its opening balance. Therefore, though obtained at the start of the day, ILF has not been utilized as the balance in its settlement account has been sufficient to cover total debits in most of the day (Chart 1). Only on four days (out of a total of 33 days) total debits did exceed the opening balance. But as some credits to its account were available in the early part of the day, it could have conducted its transactions without ILF.

Chart 1

**Settlement Account of State Bank A
Opening Balance, Total Debits and ILF**
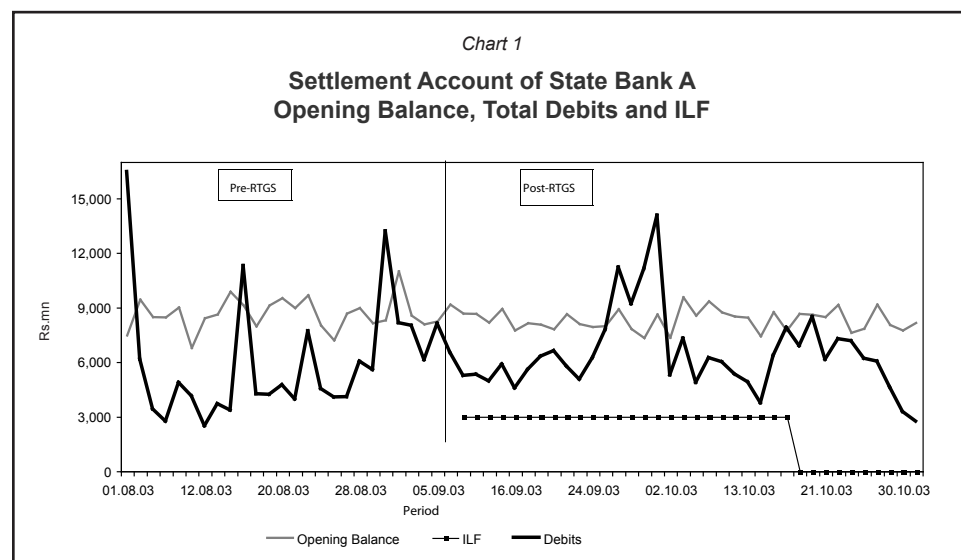
Accordingly, ILF has been obtained only as a precautionary measure and has not been utilized. On the realization of its ability to operate without ILF, the bank has terminated drawing ILF since 16 October 2003. There has not been an observable difference in total value of debits and credits to its settlement account during the immediately preceding and post RTGS periods.

(ii) Foreign Bank A

Total debits and credits to the settlement account of this foreign bank have always been quite high, around 2-3 times its average reserve balance, indicating the potential need for ILF. Nevertheless, it managed without ILF till 24 September 2003. Between 24 September and

3 October 2003, it had drawn ILF amounting to Rs.2 billion to 2.9 billion as it had to make relatively large payments on maturing SWAP agreements through which it had generated a relatively large volume of rupee funds. Since 3 October 2003, it has reduced its ILF drawings to Rs.1.25 billion (Chart 2). Total debits to its settlement account during September and October were comparable with those during the pre-RTGS period.

Chart 2

**Settlement Account of Foreign Bank A
Opening Balance, Total Debits and ILF**
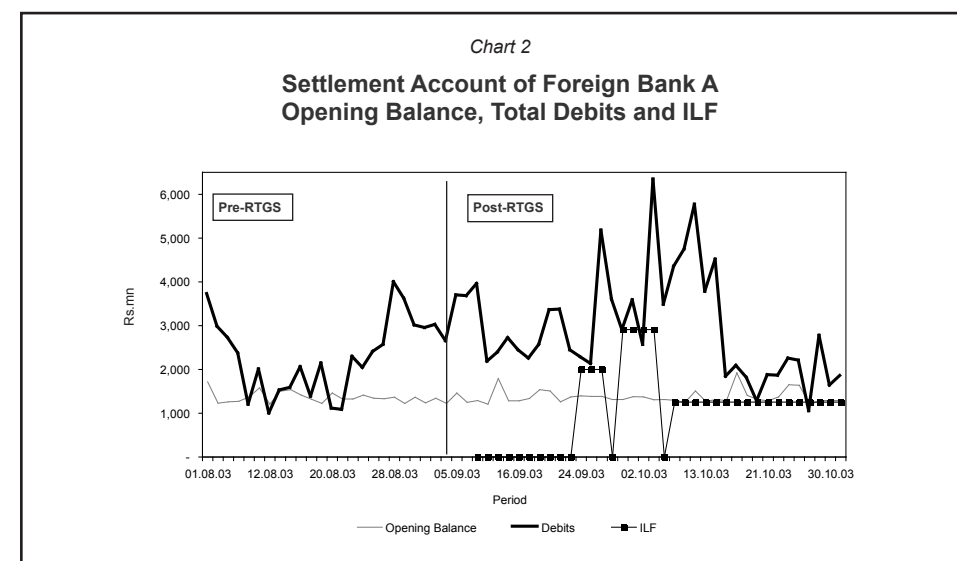
(iii) Domestic Private Bank A

Inter bank transactions of this domestic private bank have always been quite high with total debits to its settlement account amounting to 5-6 times the average balance in its settlement account. Since the first day of the establishment of RTGS, it has drawn ILF to the value of Rs 1.7 bn. – Rs.2.6 bn. (Chart 3) during the first two months. This drawing has been to cover a single transaction of a licensed specialised bank, the account of which has been with the domestic private bank A. This licensed specialised bank had a funding arrangement (overnight) with another licensed specialised bank which maintains its account with another commercial bank. The lender had insisted that the borrower repays its borrowings first before borrowing again. This created a gridlock situation which was resolved by drawing ILF. This bank subsequently managed to reduce its ILF requirements by breaking the funding arrangement into a number of small loans.

Excluding the debit arising from this funding arrangement, total debits to the settlement account of this bank since the establishment of RTGS has been comparable with those during the pre-RTGS period.

Chart 3

**Settlement Account of Domestic Private Bank A
Opening Balance, Total Debits and ILF**
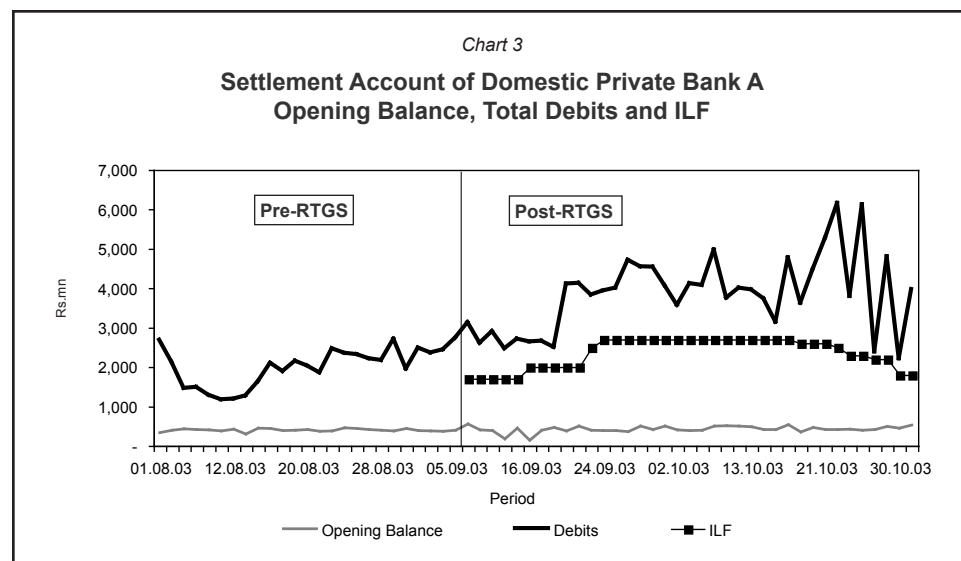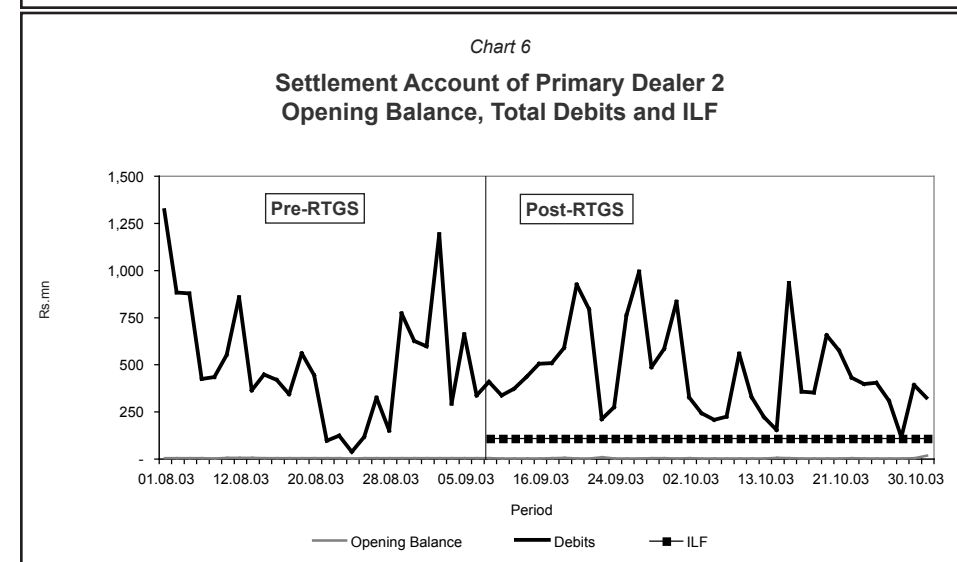
(iv) Domestic Private Bank B

The volume of transactions handled by this bank has been quite high relative to its deposit base. Total debits to its settlement account has been as high as 6-11 times its opening balance (Chart 4). Accordingly, it was unlikely that it could have operated without ILF. On average total debits to its settlement account in September and October seem to be higher than those during July and August, the pre-RTGS period. However, an increase in debits was observed

Chart 4

**Settlement Account of Domestic Private Bank B
Opening Balance, Total Debits and ILF**
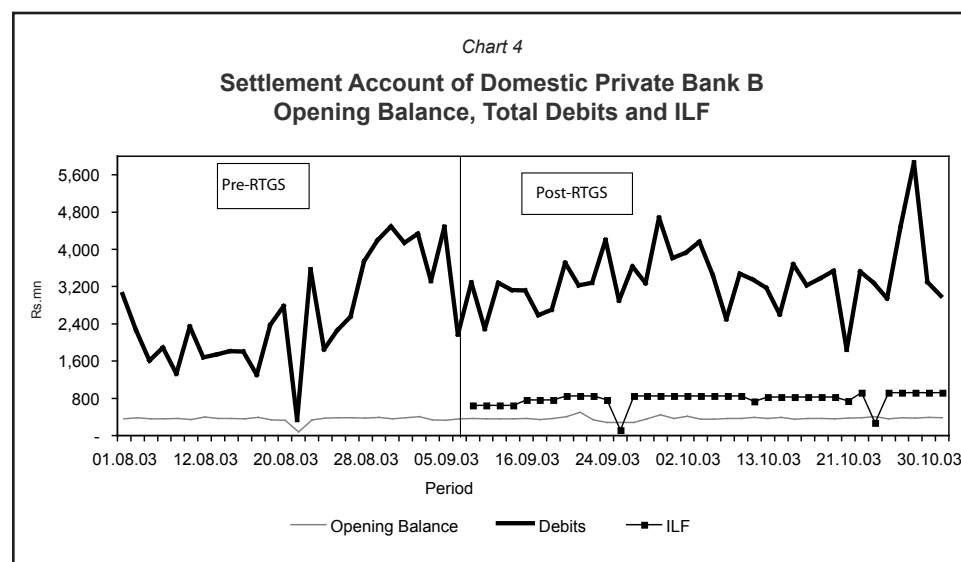
from the latter part of August, which continued into September. Accordingly, the increase in debits cannot be definitely attributed to ILF under RTGS.

(v) Primary Dealers

The value of debits to each primary dealer's settlement account has been in the range of Rs.0.5 bn. to more than Rs.2.5 bn. Primarily dealers usually maintain a balance closer to zero as they could invest any excess money in overnight repos (Chart 5 & 6). Therefore,

Chart 5

**Settlement Account of Primary Dealer 1
Opening Balance, Total Debits and ILF**

Chart 6

**Settlement Account of Primary Dealer 2
Opening Balance, Total Debits and ILF**

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Intra Day Liquidity Facility: Does it have an impact on Monetary Policy?
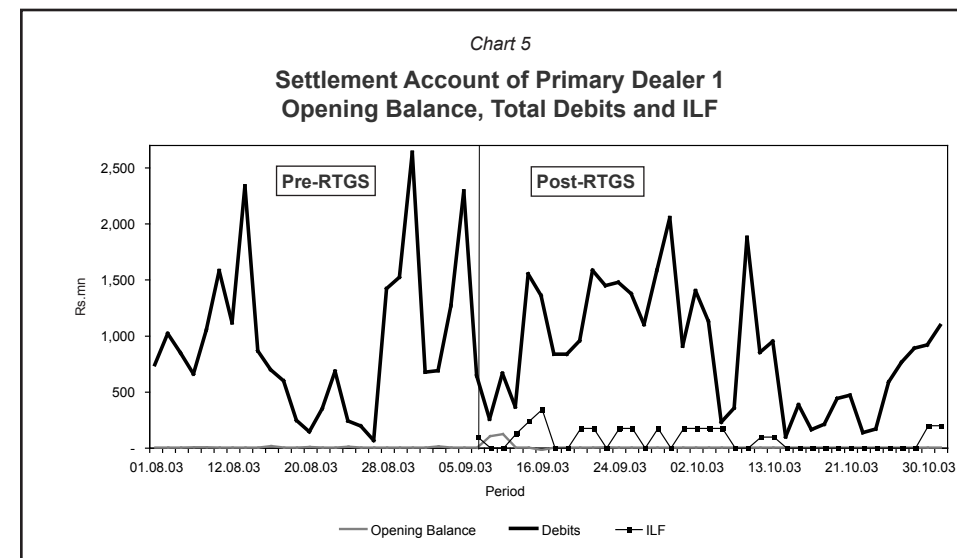
they need ILF for smooth operations. However, their ability to raise ILF is constrained by the lack of securities owned by them as they usually raised funds against their securities. Accordingly, their drawings of ILF have been relatively small (8.5 per cent on 31 October 2003) compared with total debits. A significant change has not been observed in total debits after the introduction of ILF.

VI. ILF Drawings and Utilisation

In the previous section, the focus was on the first two months under the RTGS, so as to examine whether ILF drawings were comparable with the implicit ILF during immediately preceding months. This section examines ILF drawings and their utilization during the entire period from September 2003 to the end December 2004 (Chart 7) with a view to identifying whether there had been an excessive use of ILF by participating institutions.

Until the scripless securities settlement system was established on 2 February 2004, the provision of ILF was against securities in scrip form through a cumbersome procedure, which involved participants endorsing each security in favour of the Central Bank and handing over them to the Central Bank as well as gather them, re-endorsed by the Central Bank whenever, they wish to gain the ownership of securities, after returning ILF. In view of this and the fact that the system was new and participants did not want to face the risk of not having sufficient volume of liquidity to meet payment obligations on real time, relatively a large volume of ILF was drawn at the early stage. In September 2003, the average drawings were around Rs.8.4 billion per day.

Chart 7

ILF Drawn and Utilised (Max)
2003 – 2004
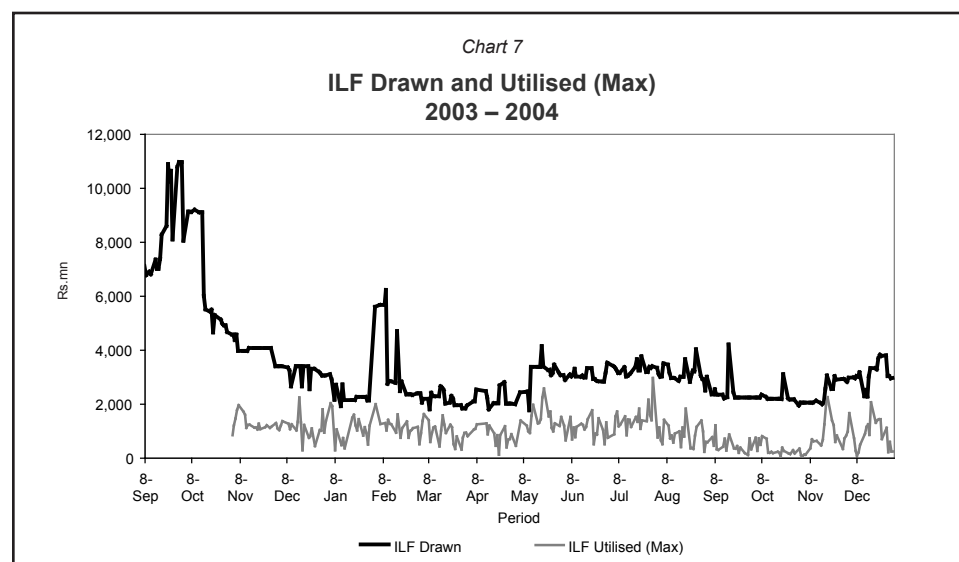
However, with the participants gaining experience, ILF drawings declined to Rs.3.2 bn per day, on average in December 2003. The actual utilization was even lower around 35 per cent (Rs.1 bn) in December 2003. The balance remained unutilized in the participants settlement account at the Central Bank.

Once again in February 2004, there was a sharp increase in ILF as participants drew a large volume of ILF as a precautionary measure to face any unforeseen development with the establishment of a scripless securities settlement system. However, the actual utilization remained relatively low around its normal level. During the year as a whole, ILF drawings were around Rs.2.7 billion per day on average but fluctuated with a standard deviation of Rs.0.6 billion. The actual utilization was about 33 per cent of the drawings, and amounted to Rs.0.9 billion per day on average with a standard deviation of Rs.0.5 billion. The relatively high standard deviation is an indication that participants have not been resorting to heavy use of ILF continuously.

During the year 2004, 14 participants obtained ILF. However, on average, on a day only eight participants have obtained ILF. Out of these average number of participants, five were commercial banks while the balance three were primary dealers. Since the inception of ILF, there had been only two occasions of ILF defaults. The measures in place, including penalty interest at the Bank Rate and the suspension of the facility for repeated defaults have ensured the prompt reversal of ILF before the close of Lankasettle on each business day.

VII. ILF and Short term Interest Rates

Usually central banks implement monetary policy by influencing short term interest rates. One may argue that the provision of ILF free of charge could have an impact on short term interest rates and hence, on the ability of a central bank to implement monetary policy via its control over interest rates. Dale and Rossi (1996) examined this and concluded that as long as official intra day loans have to be repaid at some point during the business day, the terms on which intra day liquidity is provided would not affect a central bank's ability to control short term interest rates. In particular, they emphasized that the provision of intra day liquidity free of charge and in unlimited quantity by the Bank of England in the United Kingdom RTGS System would not impair the Bank's control on short term interest rates. This conclusion is equally valid in the case of Sri Lanka as well, as there is a strict restriction that ILF should be repaid within the business day and hence, it is impossible for a bank or a primary dealer to substitute ILF for an overnight facility without facing severe penalties. Accordingly, the market for intra day liquidity is completely separated from the market for overnight liquidity and the Central Bank could set the terms of ILF independently of the current monetary policy stance.

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However, this segmentation between intra day and overnight loans may not hold strictly if a parallel inter bank market for intra day liquidity emerges, as the restriction preventing the overnight use of intra day liquidity would not hold in the private inter bank market. However, as in the case of England as pointed out in Dale and Rossi (1996), there would be little incentive for an inter bank market for intra day liquidity to emerge, as banks usually hold a sufficient volume of eligible securities to raise ILF from the Central Bank. Though there could be a few participants, in particular some primary dealers who do not have eligible securities in a sufficient volume to raise ILF, their intra day liquidity requirements are unlikely to be large enough to induce a development of a significant market.

As far as the implementation of the monetary policy is concerned, the present practice of providing ILF free of charge in unlimited quantity with strong measures to ensure the reversal within the same business day is quite appropriate, as any other restrictions may provide incentives for an emergence of a private market for intra day liquidity, developments of which may spill over into the overnight market, impacting on the ability of the Bank to control short term interest rates. In this regard it is interesting to note the conclusion of VanHoose (1990) which examined certain proposals for pricing, either explicitly or implicitly, daylight reserve account overdrafts of banks, which is the form in which intra day liquidity is provided by the Federal Reserve System. The paper has demonstrated that the proposals for pricing would have the potential to affect the volatility of 24 hour and longer term interest rates of concern to the Federal Reserve in its role as the monetary authority.

VIII. Conclusion

The paper highlighted the importance of ILF in a RTGS system and examined the impact of ILF on the volume of liquidity available in the financial system. It argued that the volume of liquidity available under the present RTGS system with ILF provided by the Central Bank could not be higher than that available under the end of the day settlement system prevailed in the country. In fact, there is a possibility that it could be even less as ILF is available only against eligible securities whereas, under the end of day settlement system there existed an implicit unrestricted overdraft facility. ILF is provided under stringent conditions with heavy penalties for defaults which ensure that the facility is not converted into an overnight credit. Accordingly, ILF is strictly separated from the market for overnight liquidity and hence, the Central Bank could set terms on ILF independently of the current monetary policy stance. There is no evidence that the availability of ILF has enabled the banks and primary dealers to finance a higher volume of transactions. Accordingly, the release of funds under the ILF is unlikely to create an adverse impact on the conduct of monetary policy as funds flow back to the Central Bank on the same business day.

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Regulatory Practices of Money Broking Business in Selected Countries

Rupa Dheerasinghe[1]

Abstract

Since 1980 Money Brokers (MBs) have been operating in Sri Lanka as key players in the inter bank call money market, government securities market and foreign exchange market. Money broking firms start operation after obtaining a 'no objection' letter from the Central Bank of Sri Lanka (CBSL). Currently, neither the CBSL nor any other regulatory authority regulate or supervise these institutions. Therefore, this paper intends to examine regulatory practices of money broking companies in selected countries with the view of assessing the need for and the scope of regulating money broking firms in Sri Lanka. This study is based on the information collected from 21 Central Banks/Monitory Authorities in various countries of the world, where responses were obtained through an e-mail survey conducted in late 2004. The study clearly indicates that whenever, the firms are only involved in traditional money broking activities i.e., act as an agent between lender and borrower for a commission, authorities do not regulate or supervise their activities mainly because they do not hold public funds and therefore, no systemic risk is involved. However, majority of the countries in the sample issue license or other form of approval mainly for maintaining the professional standards and monitoring the developments in this sector. In many countries, self regulatory organizations hold the responsibility of supervising and regulating money broking activities. The paper concludes that the money broking industry in Sri Lanka too needs to develop a self regulatory framework to persuade firms to maintain self discipline within the industry preferably through the existing Money Brokers Association and that the Association should endeavour to enhance its reputation by introducing quality services and practice to its members and to the market and eventually achieve the recognition of the authorities. (JEL G28)

I. Introduction

Money Brokers have been in operation in Sri Lanka since 1980 and they are key players in the inter bank call money market, government securities market and foreign exchange market.

Currently, ten money broking companies are operating in Sri Lanka. Except one firm[2], all the other companies are registered as private limited liability companies. The CBSL or any other regulatory authority do not regulate or supervise these institutions. Money broking firms start operation after obtaining a 'no objection' letter issued by the CBSL which is preceded by the application made by the prospective money broking company. Sri Lanka Money Brokers' Association (SLMBA) was set up in 1995 with the membership of all seven MBs then operating in Sri Lanka[3].

This paper intends to examine regulatory practices of money broking companies in selected countries with the view of assessing the need for and scope of regulating money broking firms in Sri Lanka. The study is mainly based on the outcome of an e-mail survey conducted in late 2004 to collect information in selected economies. Section II of the paper examines recent trends in the money broking business in Sri Lanka and its importance to the Sri Lankan economy. Section III provides existing legal and regulatory framework for money brokers. Section IV analyses the survey results and examines the legal and regulatory frameworks in selected economies. Section V discusses the concerns of Sri Lanka's money broking industry and examines the justifications for regulating or not regulating money broking firms in Sri Lanka. Section VI concludes the paper with observations and recommendations.

II. Role of the Money Broking Business in Sri Lanka

Until the first money broking company was established in Sri Lanka in early 1980, in collaboration with India, commercial banks dealt directly with each other to conclude their foreign exchange transactions and adjust their rupee liquidity positions by borrowing and lending in the call money market. With the rapid development in the financial sector, in terms of institutions, activities, new instruments as well as the trade volumes, the importance of the presence of intermediaries such as MBs was felt for conducting the foreign exchange and money market transactions more effectively and efficiently, than it would have otherwise been carried out by the commercial banks among themselves through direct communications for each and every transaction.

Money broker[4] acts as a mediator to bring suppliers of funds (lenders) and users of funds (borrowers) together enabling them to enter into a contract for money market transactions such as short term loans, foreign exchange dealings, repurchase (Repo) and reverse repurchase (Reverse Repo) agreements *etc*. They arrange these transactions particularly, between corporate customers such as banks, primary dealers, discount houses and dealers

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2/ Pigott & Chapman Company which operates as a partnership.

3/ The membership has increased to 10 in 2005.

4/ Broker is an agent who brings two parties together, enabling them to enter into a contract to which he is not a principal party. His remuneration consists of brokerage, which is usually calculated as a percentage of the sum involved in the contract but may be fixed according to a tariff. Services of the brokers are used because they have specialised knowledge of certain markets or to conceal the identity of a principal, in addition to introducing buyers to sellers.

in government securities. MBs do not themselves lend or borrow money. They work for a commission for arranging contracts, often for short term loans on overnight basis.

It may be argued that direct dealing between market participants (*i.e.*, a bank with another bank) is useful for them as they do not have to pay brokerage. However, brokers have specialized knowledge of the market they operate and therefore, are able to provide a comprehensive and efficient service to their clients at a competitive price. Since the brokers disseminate current prices across the market, prices determined in such a market would be more competitive and well representative. When the brokers are active in the market, large percentage of the total volume of transactions is passed through them and therefore, they have access to the most updated market information than the individual institutions. The presence of a broker, conceals the identity of a principal, in addition to the use of their expertise to arrange the transactions. Therefore, brokers can play an important role in the development of the market while minimizing the transaction cost. They improve the market efficiency and make the task of banks and other financial dealers much easier as there is no need for them to search for another party to carry out their deals.

The first money broking company, Bartleet, Macklai & Roy Ltd., was established in Sri Lanka on 06 February 1980 in collaboration with India. From the inception, the CBSL which felt the need for developing the money market has always been cooperative in promoting this business in Sri Lanka. Within the next 4 years another 7 companies commenced money broking business in Sri Lanka of which 2 institutions were closed down later. Most of these early MBs are collaborations either with Singapore or India. One of those companies,

Table 1 – List of Money Brokers in Sri Lanka

Name of the Company	Date of issuing 'no objection' letters
Bartleet Mecklai and Roy Ltd.	18-12-1979
Pigott Chapman & Company	11-02-1980
Forbs MBs Ltd. (Since 18-07-1994 Vanik Money Brokers Ltd.)	18-02-1980
MB Financial Services (Pvt) Ltd. (Since 01-05-2000 First capital Money Brokers Ltd.)	20-05-1980
Mercantile Finance Brokers Ltd.	05-05-1981
Ceylinco Sec. & Financial Services (Since 09-06-1996 CSF Money Broking Company)	11-01-1983
Seylan Merchant Bank Ltd. (Since 01-10-1996 SMB Money Brokers (Pvt) Ltd.	13-10-1994
Capital Alliance Money Brokers Ltd.	05-01-2004
Taprobane Investments (Pvt) Ltd.	27-09-2004
George Steuart Financial Services Ltd.	10-08-2005

Source : Domestic Operations Department, Central Bank of Sri Lanka

George Steuart Financial Services Ltd. which was affected by the bomb attack at the CBSL in 1996, recommenced its business in October 2005. Including this company and another three companies that entered the market recently, ten money broking companies are currently operating in Sri Lanka. However, Mercantile Finance Brokers Ltd. which had been operated since 1981 is temporally out of business since 31 January 2006 due to lack of professional skills. MBs in Sri Lanka carry out their transactions mainly through 'voice broking' *i.e.*, a transaction is concluded over the telephone. The other popular method of dealing, *i.e.*, 'electronic broking', is not widely used in Sri Lanka as yet. All transactions concluded verbally over the telephone are confirmed immediately to counterparties through facsimile or telex.
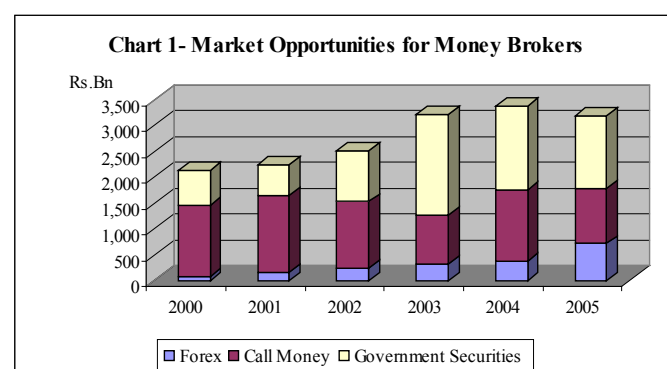
The market trade volumes have increased gradually over the past few years, except 2005 (Chart 1). Developments in the foreign exchange market, government securities market and the progressive private sector involvement in the market created more business opportunities expanding the trade volumes in the market. Similarly, trade volumes[5] of MBs too increased over the last several years. However, a large share of existing government securities market, foreign exchange market and call money market is yet to be harnessed by the brokers (Table 2).

In Sri Lanka most of the money broking firms provide broking services on (*a*) inter bank call money, (*b*) foreign exchange and (*c*) trading in government securities. MBs services in the inter bank call money market are to facilitate borrowing and lending transactions between the commercial banks. Currently, 23 commercial banks operating in Sri Lanka are the prospective customers of the MBs. As the trade volumes of the inter bank call money

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5/ Based on trade volumes reported by all money brokers who operated in respective years.

Table 2 - Market Share of Money Brokers[6]
(Values are given in Rs. million)

Activity	2004			2005		
	Total Market	Brokers	Market Share (%)	Total Market	Brokers	Market Share (%)
Forex	380,613	234,264	61.5	708,905	476,216	67.2
Call Money	1,363,490	1,042,186	76.4	1,057,238	873,204	82.6
Government Securities	1,622,740	385,947	23.8	1,429,831	533,326	37.3
Total	3,366,843	1,662,397	49.4	3,195,973	1,882,746	58.9

Sources: Money Brokers, Central Bank of Sri Lanka
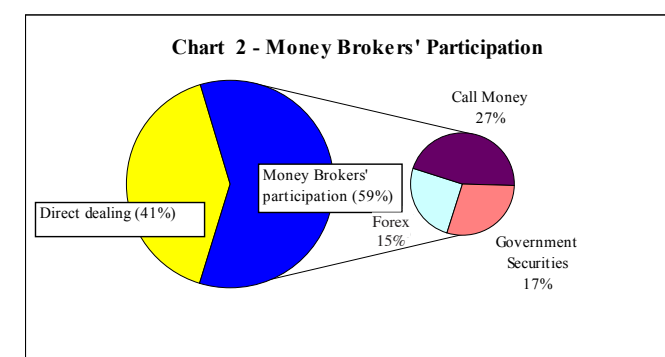
market is increasing, opportunities for money brokers in the call money market are expanding every year. More than 80 per cent of the call money market transactions are now carried out through MBs.

6/ Explanatory Notes for data used in Table 1:

o MBs trade volumes : Rupee equivalent of total volume of transactions (turnover) reported by 10 MBs under different business categories for reference year.

o Market Forex Volume : Rupee equivalent of total inter bank forex transactions excluding transactions with the CBSL.

o Market Call Money Volume : Total amount of call money transactions took place during the year.

o Government Securities : Total value of transactions where a primary dealer is one party of the transaction. To avoid the under estimation of MBs participation resulted purely due to the nature of the market (as discussed in the text) 75 per cent of the Repo and reverse Repo transactions are excluded from the total market volume.

A. Inter-bank Foreign Exchange Market

In the foreign exchange market, MBs act as an intermediary for financial institutions in arranging spot or forward foreign exchange transactions, dealing with foreign currency banking units of the commercial banks, arranging swaps, cross currency transactions and deposits. The foreign exchange transactions in the country have increased over the last several years enhancing the opportunities for MBs to expand their activities. Similarly, activities in this market expanded significantly in 2005, due to large foreign currency inflows to the government and the private sector relating to tsunami relief and rehabilitation work, increased export proceeds and private remittances and the benefits of debt moratorium. As a result, the total turnover of MBs on foreign exchange transactions more than doubled during 2005. Around 67 per cent of the total foreign exchange transactions in the county are now carried out through MBs.

B. Call Money Market

MBs services in the inter bank call money market are to facilitate borrowing and lending transactions among the commercial banks. Currently, 23 commercial banks operating in Sri Lanka are the prospective customers of the MBs. The inter-bank call money market remained liquid in 2005. Market liquidity was high at the beginning of the year as the CBSL discontinued, for a short period, the absorption through auctions under open market operations and maintained the market well liquid to ensure smooth operations of the financial system following the tsunami disaster. Even though, later, CBSL conducted OMOs aggressively to absorb the excess liquidity, in general the market remained liquid throughout the year. As a result of comfortable liquidity conditions in the market during most of the year, the total call market transactions declined by 22 per cent in 2005.

Chart 2a- Money Brokers' Activities
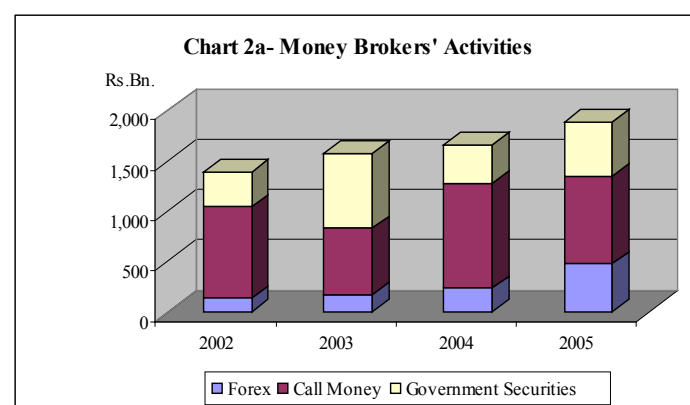
Following the slow down in overall activities, MBs participation in call money market declined by 16 per cent. However, their market share increased from 76 per cent in 2004 to 83 per cent in 2005. In addition to overnight call money transactions reported in this Table 1, MBs provide facilities to term money as well.

C. Government Securities Market

In the securities market, MBs are involved in making arrangements between two parties for discounting government securities in the secondary market and arranging repo/reverse repo transactions. The relatively lower involvement of MBs in government security market is partly due to the nature of the activities in the market.

More than 75 per cent of the secondary market for government securities consists of short term repurchasing (Repo) and reverse repurchasing (Reverse Repo) agreements. As most of the market players continue to hold the funds in their position for a longer period, though their overnight Repo agreements are renewed daily, the number of new arrangements for such agreements are considerably lower than the number of Repo transactions recorded as the total market volumes. Therefore, opportunities for MBs to arrange Repo/Reverse Repo agreements are lower than total market volumes. Similarly, the commission that the broker can earn by arranging a Repo/Reverse Repo transaction is insignificant compared to their transactions in other markets. This fact also makes the MBs participation in Repo/Reverse Repo market to remain at a lower level.

In 2005, total secondary market transactions based on Treasury bills increased by 15 per cent while similar transactions on Treasury bonds declined by 24 per cent, reflecting the increased appetite for short term instruments. This trend was reflected in both repo and reverse Repo transactions as well as the outright transactions as primary dealers have continued to take a position of risk aversion, leading to an increase in short-end market transactions. As a result the overall volume of secondary market transactions declined by 12 per cent in 2005 compared to available opportunities in the previous year.

Despite the trends in overall volume of secondary market transactions, MBs participation in both outright and Repo/Revers Repo markets increased by 38 per cent in 2005 over the that of 2004. MBs market share too increased from 24 per cent in 2004 to 37 per cent in 2005 though their participation in the government securities market is still low.

In addition to these key areas, MBs active in Sri Lanka, effectively participate in term money transactions and also act as an intermediary for meeting short term funding requirements of the non- bank financial institutions such as finance companies, merchant banks, and specialized banks. They also provide brokerage services on financial derivatives, corporate bonds *etc*. Some companies provide services such as financial market research, advisory services and training facilities in addition to its core activity of money broking

activities. Opportunities for MBs to expand their services to savings banks, insurance companies, provident funds and other financial institutions and offer facilities on a wide range of instruments are expanding with the evolution of the money and capital markets.

D. Money Brokers' Income

Table 3 – Money Brokers Income (Rs. million)

Activity	2004	2005
Forex	39.6	68.8
Call Money	4.5	8.4
Government Securities	38.9	40.9
Total	82.9	118.1

Income received by MBs only through participation in foreign exchange, call money and government securities market increased by 42 per cent in 2005. More than 58 per cent of their income was from the brokering services in foreign exchange market and the next highest source of income was for services provided in the government securities market. Even though, trade volumes handled in the call market was relatively large, the income was small as these transactions are for very short period, *i.e.*, overnight.

III. Existing Legal and Regulatory Framework for Money Broking Business in Sri Lanka

There is no legal framework for regulating money broking business in Sri Lanka[7]. Furthermore there is no accepted Code of Ethics and Professional Conduct[8] at present to prevent malpractices or guidelines or operational instructions to regulate and supervise the activities of money broking business. Even though, there is no statutory provision in the Monetary Law Act for the CBSL to grant or refuse permission for institutions to function as MBs, the past practice and the normal procedure was to issue 'no objection' letters to firms to engage in money and foreign exchange businesses. Accordingly, then Banking Department and later Domestic Operations Department of the CBSL have issued 'no objection' letters

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7/ The Securities and Exchange Commission of Sri Lanka (SEC) which was established by the Securities Council Act, No.36 of 1987 for the purpose of regulating the securities market in Sri Lanka has expanded its scope of activities by the subsequent amendments to the Act to register market intermediaries. The SEC now issues licenses to the Stock Exchange, stock brokers/dealers, unit trust management companies and registers underwriters, margin providers, credit rating agencies, investment managers and securities clearing houses but does not include money broking activities.

8/ Code of Conduct and Constitution is being drafted by the SLMBA and is in the process of being finalized.

to successful applicants after reviewing money and foreign exchange market conditions prevailing at that time and track records of the institutions and their principal officers.

In the past, the CBSL has issued 'no objection' letters to 10 firms currently in business to engage in money broking business in Sri Lanka (Table 1).

It seems that money broking companies were not established during January 1983 to October 1995. This was due to some applications been turned down during this period by the CBSL as it was considered that excessive competition would lead to unhealthy practices and threaten the operations of some MBs on a profitable basis.

Historical records show that several requests by private companies, had been rejected by the CBSL in 1986 and thereafter. It was considered that a further increase in the number of money broking firms would lead to unhealthy competition among them as the banking businesses in the economy and business activities of the existing MBs had declined during the period under review.

The CBSL has rejected the issuance of 'no objection' letters due to other reasons too. A request by an another company had been rejected in July 1995 as the Memorandum and Articles of Association of the company did not contain specific provisions for carrying out money broking activities.

Since MBs are not regulated by any authority and have no official recognition, some MBs, (particularly, SLMBA), are of the view that, money broking business in Sri Lanka should be brought under the preview of a regulating authority, probably, the CBSL. Though, there is no procedure or criteria laid down with regards to granting permission or issuing 'no objection' letter to operate money broking activities in Sri Lanka, common criteria has been practiced in the past. The procedure followed by the CBSL can be summarized as follows.

- ♦ Receive a request from a company who wishes to engage in money broking business.

- ♦ The Domestic Operations Department (then Banking Department) process the application. For this purpose they obtain the following documents from the proposed company.

  - ● A copy of Memorandum and Articles of Association of the proposed company.

  - ● A copy of the feasibility report.

  - ● A copy of the Code of Conduct of the entity.

  - ● Details relating to the qualifications and experience of their officers who will be in-charge of proposed money broking activities.

♦ Obtain the observations of Director/Legal Department with respect to the legality of the company.

♦ Evaluate feasibility study, Code of Conduct and the suitability of key officers in the company.

♦ Evaluate the current market conditions and the future prospects of the money broking business.

♦ Make recommendation to the Deputy Governor for his approval.

♦ With the concurrence of the Deputy Governor, documents are forwarded to the Governor for his approval to issue a 'no objection letter'.

♦ After obtaining the Governor's approval, the Director of the Domestic Operations Department issues the 'no objection' letter to the proposed company.

♦ The company is expected to inform commencement of its activities to the CBSL.

♦ The Director of the Domestic Operations Department is the contact person for any matter relating to money brokers in the Central Bank of Sri Lanka.

Out of 11 MBs which received 'no objection' letters, Keels T & R Ltd. (09 May 1980) was closed down due to non viability of the firm. The George Steuart Financial Services (Pvt.) Ltd. was destroyed at the bomb explosion at the CBSL in 1996[9]. This company has re-commenced its business on 18 August 2005. In today's context the all MBs operating in the market are firmly established and operate profitably. Some of them engage in other financial businesses in addition to money broking.

IV. Legal and Regulatory Practices in Selected Countries

A. Methodology and Limitations

Over the last several years, the CBSL has been requested by the SLMBA to give some nature of recognition to MBs through regulating and/or supervising their business in Sri Lanka. To give due justice to their request and to make the CBSL stand clear and strong, it was

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9/ George Steuart & Company Ltd. which had been in the money broking business since 1980, has been issued with a 'no objection' letter on 10 June 1994 to cease its money broking activities and commence the same with its fully owned subsidiary George Steuart Financial Services (Pvt.) Ltd. However, the company did not start operations as it was affected by the CBSL bomb blast in 1996. Following the request by the parent company, the CBSL has given it's consent to re-commence the activities of the George Steuart Financial Services (Pvt.) Ltd. on 10 August 2005.

decided to carry out a survey to examine regulatory practices of money broking business in other countries. This exercise was carried out through an e-mail survey conducted in late 2004. Originally, a questionnaire was sent to the SAARCFINANCE coordinators and Central Banks/Monitory Authorities of East Asian Countries. Only Central Bank of Pakistan responded to the questionnaire. Due to lack of response, it was decided to obtain information from any possible destination, regardless of geographical locations, using personal contacts. Therefore, the study is based on the information collected from Central Banks/Monitory Authorities in various parts of the world, where responses were obtained through personal contacts. Some information were collected through internet, wherever, respondents did not answer the questionnaire but provided with the addresses of relevant websites. The questionnaire is given in Annex 1.

However, the comparison of examining regulations and supervisory framework of the MBs in various countries was found difficult due to the following constraints.

♦ Even if there is a common and widely used definition for MBs, in some countries, MBs are identified with additional features while others use different names to recognize the same business making it difficult to compare with the MBs discussed in this study and to identify the reasons for regulating/supervising such industry.

♦ In some countries, it was difficult to distinguish MBs from capital market brokers such as stock brokers, mortgage brokers etc., as the same company deals in one or more such activities.

♦ In some countries MBs are defined as brokers/dealers. In such instances, albeit those brokers carry out the same functions as the MBs in other countries, it is not possible to distinguish them for comparative purposes. As some brokers are involved in dealers' activities too, such countries use same set of regulations for brokers and dealers. Even though, some companies function purely as brokers, they are covered by the regulations applied to dealers as well (i.e., USA). In such countries it was difficult to distinguish whether the regulations are applied due to the involvement of broking activities or dealer activities.

♦ In some countries, definitions for MBs are rather complicated and subject to regulations and supervision of more than one regulator. For example in Japan MBs are identified as 'tanshi' companies[10]. They are divided into two types, money market broker-cum-dealers and foreign exchange brokers. Money market broker-cum-dealers provide intermediary services in money markets. They perform both dealer and broker factions and also are able to use the borrowing facilities of the Bank of Japan. However, other type of tanshi companies called foreign exchange brokers provide only brokerage services for inter-bank transactions in

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10/ Please refer Table 6 for details.

Table 4 – Summary

Category	No. of Countries in the sample	License Required	Regulate/ supervise		Do not need licenses	Do not regulate or take lenient approach on regulations
			By government	By SRO		
Countries which do not have MBs explicitly, but broking take place in small magnitude.	5	0	0	0	5	5
Developing or Newly Developed Countries where, MBs carry out explicitly similar functions as in Sri Lanka	9	5	2	0	4	7
Developing or Newly Developed Countries where, MBs carry out additional businesses or legal framework covers additional activities	3	3	3	0	0	0
Developed countries where, MBs carry out additional businesses or legal framework covers additional activities	4	4	3	1	0	0
Total	21	12	8	1	9	12

the foreign exchange market. Accordingly in Japan some tanshi companies are subject to the regulations of both the Bank of Japan and the Financial Services Agency.

♦ In many countries money broker activities are not distinguished from other financial services (*i.e*., Uganda, Moldova). In those countries money broking activities are undertaken in small scale by other financial institutions. If a commercial bank or other financial institution is carrying out broking services as a part of their business, such institutions are subject to regulations and the supervision of government authorities because of their other activities which involves commitments to depositors *etc*.

B. Survey Results

Out of 22 countries to whom the questionnaire was sent, 21 countries responded by sending either required information or addresses of relevant websites. Summary of the regulatory practices of MBs in different countries is given in Table 4 while detailed analysis is given in Table 6.

♦ Five countries in the sample, Nigeria, Uganda, Sierra Leone, Nepal and Moldova indicated that in those countries, MBs cannot be identified explicitly as the broking business is not yet developed to a significant level. Therefore, licensing or regulatory framework is not yet available. However, the respondents are not in a position to comment whether licensing or regulatory framework would be implemented eventually.

Nine developing/newly developed countries who have significant contribution from some form of money broking businesses, use similar definitions and carry out almost similar functions carried out by the MBs in Sri Lanka.

♦ Money Brokers in India, Pakistan, Thailand and Slovak Republic do not require licenses to operate their business. In those countries no legislation is available for supervising or regulating money broking business. However, recently, Pakistan and Thailand have shown interest in some form of supervision/regulation with the expansion in this sector. Pakistan is in the process of introducing legislative framework to issue license, regulate and supervise MBs. However, in Pakistan, a self regulatory organization (SRO) is expected to undertake the supervisory and regulation functions while Securities and Exchange Commission of Pakistan will issue licenses. The Bank of Thailand believes that MBs might have a significant role to play with the new innovations in the financial sector. Therefore, a study is being carried out to decide the functions of MBs and to see whether any form of regulation or supervision is needed.

♦ In Singapore and Hong Kong licenses are issued by the Monetary Authority/Central Bank while in the Philippines this function is carried out by Securities and Exchange Commission after reviewing the credentials of the company, promoters/brokers and other professionals and the viability of the company. However, these three countries, take very lenient approach in supervision and regulation of MBs but hold the authority to impose any restrictions at the time of issuing licenses.

The underlining argument for this lenient approach on supervision/regulation is that MBs are only agents working for commissions by arranging transactions as a mediator and do not deal with customers' funds and therefore, enforcing the tight regulations by government authorities is not required.

♦   In the case of Taiwan, regulations are used mainly to monitor the level of activities of the MBs. However, MBs are requested to hold reserves to meet any losses to customers, caused due to incorrect decisions made by the brokers in their day to day business activities.

♦   The Bahrain Monitory Agency (BMA), the Central Bank of Bahrain is responsible for licensing, supervising and regulating of all banks and financial institutions. The BMA Law requires anyone wishing to operate as 'a Banking firm' to hold a license. However, the existing law does not define the banking services. Instead, the BMA currently issues licenses to money brokers and covers them under the regulatory framework. However, this situation will be changed with the implementation of the already finalized amendments to the law. Under the new legislation money broking business which is categorized under the providers of ancillary services to financial sector is identified as a non regulating business. However, these institutions are permitted to carry out distinct self contained activities and not permitted to carry out any other activity identified as 'regulated' activity *i.e.*, conventional and Islamic banking business, insurance or investment business.

♦   Regulatory framework for MBs are well established in Malaysia, Malawi and Brazil. MBs are required to obtain licenses from the Ministry of Finance/Central Bank and come under the regulatory and supervisory framework of respective Central Banks.

    ● In Malaysia and Malawi same regulations cover money brokers as well as stock brokers/dealers while in these countries some money broking firms carry out other financial activities in addition to broking business. Therefore, licensing and regulating framework are to ensure that the activities of the MBs would not be contrary to any other provisions of the legislation which cover banking and financial institution and their actions would not be detrimental to the soundness of the financial system.

    ● In Brazil, activities of foreign exchange brokers are more similar to Sri Lanka and they are subject to licensing of the Brazilian Central Bank (BCB). Some MBs carry out normal broking functions but most of them are involved in various other activities which may cause systemic risk. However, they cannot engage in stock broking or dealing business. Owing to the complexity in the nature of business, MBs in Brazil are supervised and regulated by the BCB and the Securities Commission of Brazil.

♦   The 4 developed countries in the sample have well established regulatory framework for issuing license, regulation and supervising of MBs. In these countries and a State of USA, *i.e.*, USA, Japan, Australia, the UK and North Dakota (a State of USA), MBs are identified together with various other activities. These countries do not distinguish money broking activities separately. In many cases the legal framework is for both dealers and brokers where one cannot decide whether the regulations are applied due to dealer or broker activities.

● In the case of the USA, general purpose brokers/dealers are required to register with the Security Exchange Commission. They are all required to register with an approved SRO simultaneously. Though, the Security Exchange Commission issues the license to function as a money broker/dealer, supervisory and regulatory functions are carried out by the SRO. However, all MBs/dealers are subject to the regulations of the particular state. Firms dealing in government securities are required to adhere to the regulations imposed by the Ministry of Finance as well. Even to become a primary dealer, the firm should be either a commercial bank or a money broker/dealer licensed by the Security Exchange Commission. Accordingly, broker/dealers are considered as the most regulated entities in the USA. However, regulations imposed by the States vary across the USA. For example, in the case of North Dakota, Department of Financial Services is responsible for licensing, regulation and supervision of MBs in that State. However, Alaska does not impose any state regulations on brokers/dealers. This is mainly due to the fact that in the USA, legislation which cover both dealer and broker activities include a wide range of activities such as stock market dealers/brokers, mortgage brokers/dealers, MBs/dealers, government bond market brokers/dealers *etc*. In the Federal Fund market, most of the transactions are arranged by the money brokers. The total volume of transactions per day only in the federal fund market has ranged between US dollars 60-80 billion.

● In Japan, brokers known as 'tanshi companies' cover both dealer-cum-brokers and foreign exchange brokers. The Ministry of Finance has authority to license the brokers and the Financial Services Authority (FSA) has the mandate to supervise and regulate them. However, broker-cum-dealers are supervised by the Bank of Japan (BOJ) as these companies are privileged to borrow from BOJ. However, the BOJ has no administrative power to regulate them and acts based on the agreement signed with the company at the beginning of the business.

● In the UK, all financial institutions are supervised and regulated by the FSA. Agency brokers/dealers who act as agents between lenders and borrowers play a similar role as MBs in other countries.

● Australia uses similar definition for MBs as in Sri Lanka and has well documented rules and regulations to supervise and regulate MBs. Some of those broking firms are involved in other financial activities in addition to broker's activities. Therefore, all financial brokers must hold a current business certificate and a license obtained from Finance Broker Supervisory Board (FBSB), a legal entity established under the Finance Brokers Control Act of 1975 (amended 2003). Their activities are regularly supervised by the FBSB.

Table 5 – Credentials Considered for Issuing License to Money Brokers

Credentials needed for obtaining License	Countries
1. Registered as a limited liability company under relevant Law	Slovak Republic Singapore, Hong Kong, Philippines Malaysia, Taiwan, Malawi, Brazil, Bahrain, (Requires letter of comfort from share holders), USA (some states allow proprietorships and partnerships), Australia (allows proprietorships and partnerships), Japan and UK.
2. Minimum capital requirement to be met	Singapore (S$ 3 million), Hong Kong (HK$ 5 million), Taiwan (T$ 100 million), USA (some States required minimum capital i.e., North Dakota (US$ 25,000 surety bond), Bahrain (BD 100,000), Brazil (R$350,000-1,500,000 depending on activities) Pakistan (proposed P.Rs.5-20 million depending on activities)
3. Required to comply with Company constitution/Code of Conduct or specific Code of Conduct approved by the licensing Authority	Singapore, Hong Kong, Philippines Malaysia, Taiwan, Malawi, Brazil, Bahrain, USA (some States), Australia, Japan and UK
4. The credentials of all share holders and key officials	
5. Qualifications of the Staff ° Minimum / satisfactory professional qualification for CEO and key officials ° Properly designated / trained supporting staff for dealing and settlement ° Working experience of brokers and staff ° Conditions on providing required training facilities to brokers.	Singapore (Need to get approval of MAS to appoint / change chief broker and provide training to staff), Hong Kong (needs to prove the suitability of CEO and other key officers and give written notice before changing key officials), Philippines (credential of CEO and staff), Malaysia (professional qualifications), Taiwan (working experience), Pakistan (proposed to have minimum educational qualifications), USA, Japan and Australia.
6. Providing financial statements (for existing companies) or business plan/feasibility study any other information required to decide the suitability	Singapore, Hong Kong, Philippines, Malaysia, Taiwan, Malawi, Brazil, Bahrain, USA (some States only), Australia, Japan and UK.
7. Brokers to register with the relevant government authority / SRO / professional body	USA (some States), Australia, Pakistan (proposed)
8. Infrastructure requirements ° Office premises ° Other accessories such as hotlines / telephones, voice recording system, facsmile and e-mail accounts etc.	Bahrain (suitable premises), Pakistan (proposed - premises and other accessories), Malaysia (location)
9. Restrictions on activities	Only money broking: Singapore, Hong Kong, Philippines, Bahrain and Taiwan Confidentiality of information, Slovak Republic, Pakistan and India Additional activities are allowed. Conditions varied with activities : USA, UK, Japan, Australia, Brazil, Malaysia and Malawi.
10. Condition to adhere any future guidelines, rules or procedures to be adopted by the authorizing authority	Singapore, Hong Kong, Philippines, Malaysia, Taiwan, Malawi, Brazil, Bahrain, USA (some states only), Australia, Japan and UK.
11. Required to maintain adequate accounting and control systems and provide financial statements and statistics to authorities	Singapore, Hong Kong, Philippines Malaysia, Taiwan, Malawi, Brazil, Bahrain, USA (some states only), Australia, Japan and UK.
12. Holds the authority to revoke or void the license	Singapore, Hong Kong, Philippines, Malaysia, Taiwan, Malawi, Brazil, Bahrain, USA, Australia, Japan and UK.
13. Compulsory to become a member of a SRO	USA and Pakistan (proposed)
14. Time frame for commence business is applied	USA (vary with activities involved and the State), Taiwan

In the majority of the countries in the sample, the credentials considered for registering as money broker are similar to those required in Sri Lanka. Some countries have enacted the procedures and they use somewhat similar practices followed by Sri Lanka. Most common feature in their licensing procedure is that the applicant should be a limited liability company registered under the respective laws. They issue the license after careful evaluation of the credentials of the company, promoter/brokers and other professionals and the viability of the company. The credentials commonly considered for granting license are given in Table 5.

This study revealed that in many occasions, when MBs purely play a role of an agent by bringing two parties together to effect any transaction, authorities do not impose strict rules and regulations to control them. Wherever, strict regulations are in place, brokers are involved in extra activities which involve handling moneys of other parties. In some cases legislation are common for a wide range of activities some of which are carried out by MBs as well.

Furthermore, the Chart 3 indicates that no clear relationship exists between level of supervisory/regulatory activities and economic development. However, in developed markets, activities of the MBs are much more complex than in developing countries and therefore, in those countries supervisory and regulatory frameworks are strengthened.
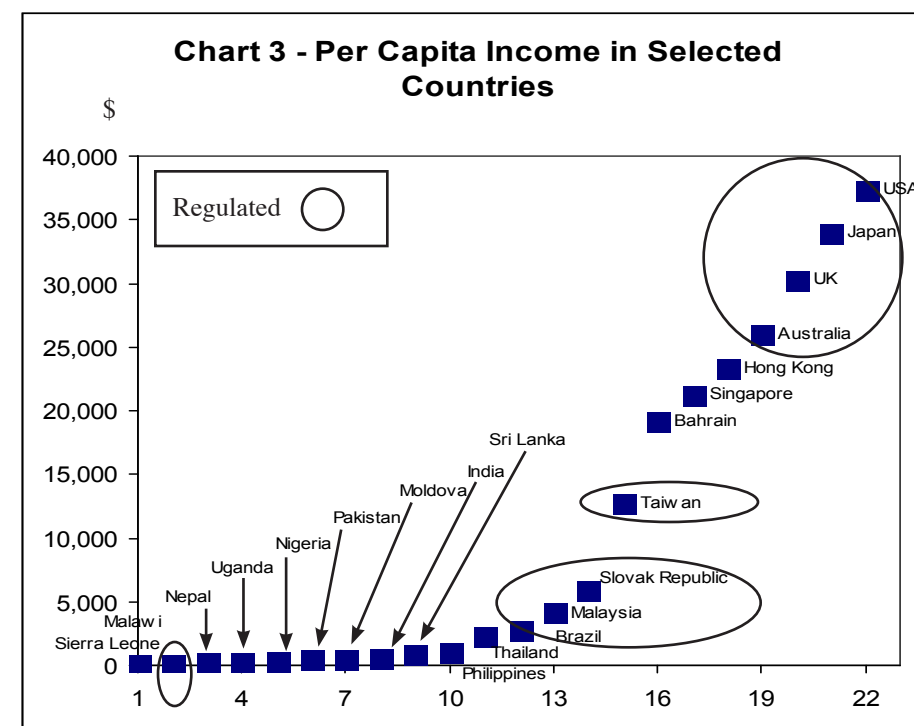
Table 6 - Summary of Licensing and Regulatory Practices of Money Brokers

Definition and Activities	Country	Licensing	Regulation and Supervision
As same as Sri Lanka[11]	India	Not required	Do not come under any regulatory authority as the MBs do not hold public funds.
	Pakistan	Not yet required, but in the process of introducing licensing requirement. To be registered with Securities and Exchange Commission of Pakistan (SECP)	Not yet available, but in the process of implementation. The Financial Market Association is about to obtain mandate from the Central Bank of Pakistan (CBP) and the SECP as self regulatory organization.
	Thailand	Not yet required.	Regulatory framework is not yet available but a study is being carried out about the scope of permissible activities, the regulations and supervision of MBs.
	Slovak Republic	Not required but money broking companies are required to register under the Company Law.	No regulatory authority to supervise MBs. They do have a self regulatory framework developed within the industry.
	Singapore	It is required to obtain approval from Monetary Authority of Singapore (MAS)	Apart from initial review at the point of licensing, the MAS or any other regulatory authority do not carry out supervision.
	Hong Kong	Licenses are issued by the Hong Kong Monetary Authority (HKMA).	No stringent regulatory framework to regulate and supervise MBs.
	The Philippines	Licenses are issued by the Securities and Exchange Commission.	The Securities and Exchange Commission. is empowered to supervise and regulate the MBs. If any doubt arises in relation to broker's activities, the SEC consults the Bangko Sentral ng Philippines (BSP). However, no tight regulations imposed on MBs
	Taiwan	It is required to obtain a license from Central Bank of China (CBC)	Both Ministry of Finance and the CBC are empowered to carry out supervision of MBs. However, regulatory framework is used to monitor the activities of the MBs and to maintain the Business standards. Both Ministry of Finance and CBC carry out regulatory and supervisory functions.

11/ Please refer foot note 4

Definition and Activities	Country	Licensing	Regulation and Supervision
As same as Sri Lanka. However, same legislation covers other financial businesses which may involve systemic risk	Malaysia	It is required to obtain a license from the Ministry of Finance (MOF). The MOF will grant the license only upon the recommendation of Bank Negara Malaysia (BNM).	The BNM is empowered to supervise and regulate licensed MBs.
	Malawi	The Reserve Bank of Malawi (RBM) grant approval to MBs with the approval of Ministry of Finance.	The RBM is empowered to supervise and regulate licensed MBs.
	Brazil	It is required to obtain a license from the Central Bank or Securities Exchange Commission.	All licensed brokers are subject to the regular supervision of the Central Bank or Securities Exchange Commission depending on the activities carried out by them.
	Bahrain	It is required to obtain a license from Bahrain Monitory Authority (BMA)	As the existing law does not define 'banking services' all the activities relating to financial services are regulated by the BMA. However, proposed law identifies money broking as 'non-regulated service'.
	USA	Common rules and regulations are applied to both dealers and brokers. Both general purpose dealers and brokers are required to register with ° the Security Exchange Commission (SEC) ° Self Regulatory Organization approved by the government ° Comply with the State legal requirements simultaneously. Dealer/broker who limits his activities to government securities market is required to follow the rules and regulations imposed by both US Treasury and SEC.	Self Regulatory Organisations (SROs) assist the SEC in regulating the activities of brokers. *i.e.*, National Association of Security Dealers and the National Securities Exchange. Requirements differ from State to State.
	North Dakota (A State of USA)	The Department of Financial Institutions regulates the money broker licensing in North Dakota. Even for operating as a Mortgage Broker in the state of North Dakota, an applicant is required to obtain the money broker license in the State.	The Consumer Division of the Department of Financial Institutions regulates MBs.
	Australia	All brokers need to obtain licenses from the Australian Securities and Investment Commission (ASIC). In addition, stock brokers are required to register with Australian Stock Exchange (ASX). Financial brokers hold a current business certificate and a license obtain from Finance Broker Supervisory Board established under the Section 26 of the Finance Brokers Control Act of 1975 (amended in 2003).	The ASIC supervise all brokers while overseeing activities of ASX. The Finance Broker Supervisory Board is responsible for supervision and regulation of finance brokers (Part IV of the Finance Broker Control Act).

Definition and Activities	Country	Licensing	Regulation and Supervision
	UK	The Financial Services authority (FSA) is responsible for the authorization and supervision of financial institutions, and for the supervision of financial markets and clearing and settlement systems. It is also responsible for regulatory policy in these areas.	The FSA plays a role of supervisor of all financial institutions in UK. Self regulating institutions such as British Insurance Brokers Association are committed to playing a central role in the industry.
Two types of MBs i.e. money market broker-cum-dealers and foreign exchange brokers	Japan	Broker cum dealers are required to register with the Bank of Japan (BOJ) and the Financial Services Agency (FSA). Brokers should register only with the FSA.	The BOJ carry out supervision of Broker/Dealer firms but it has no administrative powers. The FSA supervise and regulate both type of MBs. The FSA is given the mandate to conduct on-site inspections and to ask financial institutions to submit reports or material on their business of finance.
There are no institutions explicitly agreeing with definition as Money broking is not yet developed to a significant level.	Nigeria Uganda, Sierra Leone, Nepal and Moldova	Legal framework is not yet implemented	

V. Concerns for Sri Lanka's Money Broking Industry

This study clearly indicates following observations.

♦ **Money broking activities are not significant:** Countries where the money broking activities are not carried out explicitly or not significant in volume, legislative framework to regulate or supervise the MBs is not yet available. Under the current conditions it difficult to comment whether licensing or regulatory framework would be implemented eventually. Twenty four per cent of the countries in the sample (Nigeria Uganda, Sierra Leone, Nepal and Moldova) do not impose any regulations on MBs due to this reason.

♦ **Believe no systemic risk and no regulatory framework or promote self regulation:** Another 10 per cent of the countries in the sample (India and Slovak Republic) which have developed money broking industry have not used any licensing or regulatory framework to regulate MBs as this industry has no risk to the financial system or the savings of the public. Another 10 per cent of the countries in the sample (Pakistan and Thailand) with developing money broking industry who do not use any regulations on MBs so far, have taken steps to develop regulatory framework. These countries have felt that some form of licensing may be required with the expansion of the industry to avoid any malpractices and to monitor the development. However, they promote self regulation.

♦ **Believe no systemic risk, regulatory framework is in place but lenient approach in regulating:** Another 24 per cent of the countries in the sample (Singapore, the Philippines, Hong Kong, Taiwan and Bahrain) which have licensing procedures in place do not pay keen interest to regulate or supervise MBs. These countries, though the regulations are in place, do not impose them seriously as they feel it is not essential as the industry has not caused any systemic risk. Countries like Hong Kong and Taiwan use a very lenient approach in regulating but expect some form of coordination to monitor their activities. In the case of Bahrain, new legislation has clearly defined money broking activities as unregulated activity.

♦ **Tight regulation as MBs carry out additional businesses or the legislation cover additional businesses:** The balance 33 per cent of the countries (USA, UK, Australia, Japan, Malaysia, Malawi and Brazil) which have well established licensing and regulating framework, money broking activities cannot be identified separately as in these countries (*a*) brokers are defined together with dealers, (*b*) money brokers are defined together with mortgage brokers, insurance brokers, capital market brokers *etc*., (*c*) money brokers carry out a series of activities and some involve high risk factor *i.e.*, in Japan companies involving a in money broking and dealers activities have access to BOJ's funding facilities, in the US, some MBs do primary dealer businesses, in Australia, internet brokers are involved in all kinds of broking activities including stock broking/dealing activities (*d*) money broking activities are carried out as a secondary source of activity together with underwriting, deposit accepting, lending *etc*. (*i.e.*, Brazil).

This evidence clearly indicate that wherever, money broking activities can be clearly identified, the authorities do not pay much attention to regulate or supervise them but prefer to have some form of licensing or granting approval to commence businesses. Many countries (57 per cent) issue license or other form of approval to commence business as a money broker. The other two countries may introduce licensing procedures in the near future.

A. Reasons for having interest on licensing

(*a*) Financial sector stability is the common interest of many Central Banks/monetary authorities in the world and therefore, it is essential for them to monitor the activities of all important financial institutions as much as possible. Such monitoring enables the monetary authorities to measure the developments in the financial sector, identify risk elements involved and to impose any regulations whenever required. Issue of license or granting permission in other form provide an opportunity for monetary authorities to access money broking companies if required. Therefore, some countries include conditions when the license is granted and some keep provisions to impose any conditions whenever the authority feels, the necessity.

(*b*) To give credence to the operations of MBs and provide confidence for financial institutions to use their broking services.

(*c*) To prevent the entrance of non-qualified persons to the business and to maintain the common practice and fair playing field to all firms in the business. To maintain the high standards of the business. Many countries examine the quality of the money brokers employed by the company through evaluation of their professional qualifications, past experience, track records *i.e.*, whether they have been blacklisted *etc.*, to make sure whether the person is competent enough to accept as a specialist in the field of broking.

(*d*) To ensure the legality of the firm. Many countries require the firm to be registered as a limited liability company. Other countries too consider whether required legal conditions are fulfilled.

(*e*) To maintain the record of existing market players as money brokers have an important role to play in the money market.

(*f*) To monitor the development in the business in the context of national economy through the collection of information.

The survey results provide evidence that the countries where (*a*) money broking activities are not developed to a significant level or (*b*) MBs carry out the business within the definition of merely 'money broker' *i.e.*, only acting as an agent, using his expertise to bring two parties together, borrower and lender for a fee and do not hold any of those funds in their portfolios even for a very short period, the monetary authority or any other authority do not take any interest to supervise or regulate such business.

B. Reasons for not having interest on Regulating MBs

On the above grounds, as the MBs in Sri Lanka too fall into the same definition, necessity does not arise for the CBSL or any other authority to regulate or supervise the MBs in Sri

Lanka. However, it is appropriate for the CBSL to monitor the nature and volume of their activities as a measure of the development in the financial sector.

Major arguments in favour to this conclusion are

♦ According to the widely accepted definition, money brokers, are agents who bring two parties together enabling them to enter into contract to which they are not principals. They do not accept deposits or lend money but provide a service using their expertise in the business. They are paid for the service, a fee which is calculated based on the value of the transaction. Hence, MBs do not handle public funds.

♦ Monetary authorities are concerned about the soundness of a financial institution, based on its systemic importance and the exposure to the overall economy. Failure of such an institution may cause a risk to the stability of the overall financial system. In Sri Lanka, Financial Stability Review Report identifies licensed commercial banks, Employees Provident Fund, primary dealers, licensed specialized banks, and non-bank financial institutions as systemically important financial institutions (SIFI) that could pose a risk to the stability of the overall financial system. These institutions hold more than 75 per cent of the total financial sector assets and are supervised and regulated by the CBSL. There are a number of other institutions some of which are deposit taking institutions (co-operative rural banks, co-operative banks *etc.*), contractual savings institutions (Employees Trust Fund, insurance institutions *etc.*), and other specialized financial institutions (merchant banks, venture Capital, unit trust) which hold public funds but are not supervised or regulated by the CBSL. As such, there is no justification for the CBSL to regulate or supervise the MBs which do not even deal with public funds and also since the MBs have a negligible impact on the financial system.

♦ The financial institutions, experience various types of risks while carrying out their business. The monetary authorities or regulators determine the soundness of the firm through its efficiency and effectiveness of risk management.

● **Credit Risk** is the risk arising from borrowers failing to repay their dues on time. These type of risk is involved with lending institutions. MBs do not lend money or do not provide services on credit. They do not find debtors in the course of day to day activities. Therefore, MBs are not-vulnerable for credit risk.

● **Liquidity Risk:** The financial institutions face liquidity risk when they fail to meet its financial obligations. As MBs do not accept deposits and operate on their own funds liquidity risk does not arise.

● **Market Risk:** Generally, financial institutions face market risk due to adverse movements in interest rates and exchange rates, changing tax policies, changing prices of investments and trading activities in the securities market. However, activities of MBs do not link with any of those factors and their charges or fee

is based on the volume of successful transactions they negotiated on behalf of the customers. Generally, fee per unit is also pre-determined. In most countries, including Sri Lanka, all MBs charge standard fee for similar transactions.

- **Operational Risk:** There is a possibility for the MBs to face operational risk due to lack of experienced staff, system failures, wrong management techniques and procedures *etc*. This may cause losses to their customers (*i.e.*, If MBs fails to find the best possible offer to its customer due to lack of specialty). However, such losses may not cause any serious harm to the customer firms but such MBs will be out of business soon as fair amount of competition exists. The licensing authority always consider this factor when granting permission to start business as a money broker.

- **Systemic Risk**: As identified in the Financial Stability Review Report-2005, MBs do not belong to the systemically important financial institutions that could create a risk to overall financial system stability.

- The Majority of MBs, operate with a small capital. In Sri Lanka this range from Rs.450,000/- to Rs.14 million except for one company which has a capital of Rs.10,000/-. Taiwan, Singapore, Hong Kong, Brazil and Pakistan (proposed) have imposed relatively small capital requirement limits[12]. As most of these companies are limited liability companies their liability is limited to the capital.

- All these factors conclude that risk involved in MBs to the public or to the overall financial system is negligible.

VI. Recommendations

1. Currently all ten MBs operating in Sri Lanka are largely involved in the inter bank call money market, foreign exchange market and government securities market which have more market opportunities and scope for future expansion. However, a large share of these markets is yet to be harnessed by the money brokers. As the opportunities for MBs are increasing there is no constrain on profitability and therefore, a capable and professional money broker could be able to perform profitably under the current market conditions.

2. Even though, there is no legal framework to approve, regulate or supervise the money broking firms in Sri Lanka, the CBSL has a well established procedure to evaluate and grant permission to carry out money broking activities in Sri Lanka through the practice of issuing a 'no objection' letter. The CBSL has issued the 'no objection' letters after

the assurance of legality of the proposed company and reviewing market conditions, competence of the staff of the individual firms and the feasibility of the firms.

The procedure that Sri Lanka is adopting to grant permission to a money broker who carries out only money broking business as defined in this study[13] seems to be practiced by many other countries even with developed financial systems than in Sri Lanka. In some countries the procedure is well documented and enacted as legislation (Table 5). Therefore, the need does not arise for the CBSL to amend the existing procedure of granting permission for carrying out money broking business in Sri Lanka.

3. As long as MBs operate within the given definition, operations of the MBs will not cause any systemic risk to the financial stability of the country. If a money broker company is involved in acceptance of deposits of public funds, or is involved in stock broking as a part of their business, under the current law, it comes under the preview of the CBSL and SEC, respectively. Therefore, as far as MBs are within the current definition, it is not necessary for CBSL, Ministry of Finance or any other government body to be involved in supervision or regulating money broking business in Sri Lanka.

4. In none of the countries in the sample, licensing/regulating authorities consult nor obtain permission from respective professional organizations (*i.e.*, money broker associations) when licenses are issued to new comers. In Sri Lanka too, other professional bodies such as the Primary Dealers' Association, the Forex Association and the Bankers' Association are not consulted when the regulating authority grants license to new entrants to their professional fields. Therefore, need does not arise for the CBSL to consult the SLMBA when the CBSL grant permission to new entrants.

5. The study reveals that licensing power is always with the government authorities and in some cases supervisory role is carried out by the SRO. None of those countries recognizes SROs as a supervisory body unless they are governmental own or have developed their reputation over the years through the standards maintained in their practice. In the USA, all prospective applicants to become brokers should apply for a membership in a reputed SROs or a registered National Securities Exchange simultaneously while applying for the broking license. These SROs have developed their reputation and received government recognition through providing effective and quality services. For example, the National Association of Security Dealers (NASD), one of the world's leading SROs in the USA, achieved its reputation by helping to bring integrity to the markets and confidence to investors through more than 60 years in service. In addition to the role of primary private sector regulator of US broking industry, it provides a variety of services to the development of the industry such as outsourced regulatory products and services to a number of stock markets and exchanges, provide

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12/ Please refer Table 5.

13/ All MBs in Sri Lanka come under this definition.

education and conduct examinations to give professional qualifications to industry professionals and operate the largest securities Dispute Resolution Forum. Similarly, the Financial Market Association of Pakistan has been recognized by the CBP as a SRO, after seven years active service to promote the educational, professional, ethical and social interests of the financial markets and banking industry and developed International Standardized Best Practices and Code of Conduct to the industry. Even in Sri Lanka the Colombo Stock Exchange (CSE) is a self-regulatory organization licensed by the Securities and Exchange Commission of Sri Lanka (SEC) to operate the stock market in Sri Lanka. The CSE has a set of regulations which both provide trading and clearing infrastructure for securities trading in Sri Lanka and also enables the CSE to act as a Self Regulatory Organization (SRO). Hence, SLMBA too should endeavour to develop its reputation by introducing quality services and practice to its members and to the market rather than requesting official recognition from the Authorities.

6. It is appropriate for the CBSL to encourage the SLMBA to have close dialogue with the CBSL. However, the building up of its own reputation should come through the quality of its services rendered to own members, their customers and the development of the industry. Currently, all MBs operating in Sri Lanka are members of the SLMBA. The SLMBA should develop its image and the reputation to an acceptable level to be attractive to any new entrants to obtain the membership of the Association.

7. The CBSL should also build up a data base to monitor the trade performance of MBs on regular basis to evaluate their contribution to the overall financial sector and the their role in the economy. This will help the CBSL when it evaluate the feasibility of new entrants to the industry.

8. The SLMBA should develop its own Code of Ethics and Professional Conduct acceptable to all parties, involved in the business and follow that to build up its credibility in the market as the SRO. The Code of Conduct and Constitution proposed by the SLMBA is still at the draft stage. Therefore, the SLMBA should give priority to develop this draft to an acceptable level and use it to lay a solid foundation to boost up its reputation as the SRO for MBs.

Annex 1

Questionnaire on Money Brokers

1.	How many money broking companies (MB) are operating in your country ?		
2.	Please indicate the activities of Money Brokers in your country. (Please indicate 'Y' in front cage if MBs do following activities)		
		Foreign Exchange	
		Foreign Exchange Swaps	
		Foreign Exchange – Cross Currency	
		Foreign Exchange Deposits	
		Govt. Securities (T.bills, T.Bonds, Repos *etc.*)	
		Call Money	
		Any other services (please specify)	
3	Do you have any legal framework for establishing a money broking firm ?		
	If the answer is 'Yes' please describe the the legal framework [14]		
4	Please indicate the criteria used for granting approval for establishing money broking firm.		

14/ A copy of the relevant legislation with regulations and guidelines issued if any will be appreciated.

5.	Do you have any regulatory framework for regulating / supervising a money broking firm ?		
	If the answer is 'Yes' please specify the regulatory authority.		
	And		
	Indicate the legal framework for regulating/supervising money broking firms ?		
6.	Reasons for regulation / supervision of money broking firms (prevent irregularities, minimize risk, safeguard depositors *etc.*)		

Thank You

15/ Copies of any guidelines issued and/or operational manual will be useful.

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Exchange Rate Pass-Through:
To What Extent do Prices Change in Sri Lanka?

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Abstract

This paper examines exchange rate pass-through into prices in Sri Lanka. The relevance of the study lies in the fact that domestic price changes due to changes in the exchange rate could be significant in monetary policy decision making. Pass-through is estimated taking two approaches. First, pass-through into import prices is estimated with the use of a log-linear regression model. The results obtained suggest that exchange rate pass-through into import prices is around fifty per cent, that is, import prices increase by about 0.5 per cent as a result of a 1 per cent depreciation of the nominal effective exchange rate. Second, taking a vector autoregressive approach, exchange rate pass-through into a set of prices in the "pricing chain" is estimated. Namely, exchange rate pass-through to factor input prices, trade prices, wholesale producer prices and retail consumer prices, is examined, with the presumption that changes in the exchange rate are due to shocks exogenous to the model. The results obtained for this model suggest that exchange rate pass-through into consumer prices is about thirty per cent, although pass-through into wholesale producer prices was found to be complete. The findings from the second model further suggest that changes in the exchange rate could have significant implications for the trade balance. (JEL E31 E52)

I. Overview

A. Introduction

Price stability being a core objective of the central bank, and given that monetary policy is the tool with which the central bank has to achieve price stability, it is important to understand those factors which govern or impact upon the effectiveness of monetary policy. It is in this context that a clear understanding of exchange rate pass-through, that is, how changes in the external value of the domestic currency affect domestic prices, is important, the exchange rate being a channel of monetary policy transmission.

The significance of exchange rate pass-through in understanding how prices behave in the domestic economy is further heightened by the fact that domestic markets are becoming increasingly integrated with global markets, with the liberalisation of the domestic economy

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beginning in the late 1970s. Accordingly, exchange rate-pass-through is likely to become increasingly more important in the external adjustment of the country, which in turn has significant implications for the monetary conditions within the country including the behaviour of prices. Hence, an analysis of domestic prices in relation to changes in the exchange rate is important, especially in the context of the floating exchange rate regime that has been in operation since 2001.

B. Significance of the Study

As stated above, exchange rate pass-through could be broadly defined as the relationship between the changes in the nominal exchange rate and the domestic price level. At a disaggregate level, exchange rate pass-through could be assessed in respect of different industries or with respect to various categories of goods such as consumer goods, intermediate goods and investment goods.

Particularly in the case of small, open, developing countries such as Sri Lanka, an external shock could exert pressure on the exchange rate, resulting in the depreciation of the domestic currency. While such a change in the external price of the currency affects domestic prices of consumer goods, intermediate goods as well as investment goods, some of these price changes could result in further increases in prices. For instance, prices of intermediate goods could indirectly impact on consumer goods as well as investment goods. One example would be oil prices, which tend to have a significant impact on consumer prices, when both direct and indirect effects of changes in oil prices are taken together. Meanwhile, wages, particularly if they are indexed to consumer price indices, tend to increase in turn, if consumer price increases persist. Hence, primary and secondary effects of an exchange rate depreciation following an external shock could have a spiralling effect on inflation, particularly if the central bank is slow in responding to such a price shock.

Comparison of exchange rate pass-through in Sri Lanka with that of countries of interest could also offer useful information. Across countries, exchange rate-pass through differs depending on a number of factors. At a micro level, these factors include firms' expectations about the persistence of the change and the prevailing market structure in different industries. The output gap and inflation expectations are two macroeconomic factors that impact on the exchange rate-pass through.

The degree of exchange rate pass-through affects the effectiveness of monetary policy mainly through expenditure switching effects, with low exchange rate pass-through generally being more supportive of monetary policy effectiveness. This is because if exchange rate pass through is high, then people are more likely to switch to imported products that are relatively cheaper compared to domestically produced goods in times of monetary tightening in the face of an external shock for instance, thus reducing the effect of the policy action. In any

case, given that the degree of exchange rate pass through, that is, both the extent and speed of change in domestic prices in response to a change in the external value of the domestic currency, has implications for the timing of monetary policy, a thorough understanding of the exchange rate pass-through in Sri Lanka is warranted.

C. Objectives of the Study

- To establish how much and how fast domestic prices change in response to a change in the exchange rate, in Sri Lanka.

- To examine the impact of a change in the exchange rate on factor input prices, trade prices, wholesale producer prices and consumer prices, *i.e.,* prices along the 'pricing chain'.

- To ascertain changes, if any, in exchange rate pass-through in Sri Lanka.

D. Scope and Method of Study

In this paper, pass-through would be studied in terms of two models. The first model is a log-linear regression model that has been tested in the exchange rate pass through literature, aimed at assessing the response of import prices to changes in the exchange rate, taking into consideration important control variables.

The second is a vector autoregression (VAR) model, aimed at estimating exchange rate pass-through into a set of prices along the pricing chain, *i.e.,* factors input prices, trade prices, wholesale producer prices and consumer prices. The impact of a structural shock such as an asset market disturbance giving rise to a change in the exchange rate, would be studied by way of this VAR model.

On the basis of data availability, the models would be estimated with data of a monthly frequency, for the period 2000 to 2005. Given that some of the variables used in the above models are not directly available, proxy variables would be used, which will be chosen on the basis of their economic and econometric properties.

E. Chapter Outline

This paper is organised as follows. In Chapter I, the background information pertaining to the issues being studied was presented. The specific objectives of the study, the significance of the study as well as how the researcher intends to go about studying the issues being raised were also presented in Chapter I. In Chapter II, the literature on exchange rate pass-through will be discussed in detail. Chapter III will deal with the analytical framework, namely, the econometric models used for assessing the degree of exchange rate pass-through in Sri

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Lanka. The data employed to estimate these models will also be discussed in this chapter. Chapter IV will present the findings as per the models estimated. These findings will be compared with the findings of other researchers, who have studied exchange rate pass-through in other parts of the world. The final chapter, Chapter V, will present the conclusions of the study as well as recommendations for further study.

II. Review of Literature

A. Introduction

The focus of literature on exchange rate pass-through has shifted over time. From the earlier focus on purchasing power parity, that is, the law of one price and convergence across countries, the focus of studies in the 1980s shifted to industrial organisation and the role of segmentation and price discrimination across geographically distinct product markets. More recently, studies on exchange rate pass-through have been in relation to monetary policy and exchange rate optimality. Meanwhile, some writers uncover evidence of structural changes in relation to trade as an important factor underlying the recent changes in exchange rate pass-through with respect to some countries.

Given that this paper analyses exchange rate pass-through in Sri Lanka in the context of its implications for monetary policy, the literature reviewed hereunder largely focus on exchange rate pass-through in relation to changes in domestic prices and monetary policy.

B. Degree of Exchange Rate Pass-Through: Reasons and Implications for Monetary Policy

Mishkin (1996) points out that with the growing internationalisation of economies throughout the world and the advent of flexible exchange rates, increasingly more attention is paid to monetary policy transmission operating through exchange rate effects on net exports.

As Fiore (1998) explains, the transmission of monetary policy through the exchange rate channel takes place as follows: when the monetary base is reduced by a rise in domestic real interest rates, the supply of the national currency falls and its price relative to the price of foreign currencies rises. This amounts to an appreciation of the exchange rate, which in turn would affect output in tradable sectors by increasing imports and decreasing exports. However, the net impact of a tightening (or a loosening) of monetary policy on tradable sectors would depend on the degree of exchange rate pass-through into these sectors.

Fiore, discussing the transmission of monetary policy in Israel, points out that in Israel, "At a sectoral level, industrial sectors open to trade appear to suffer from monetary policy shocks to a larger extent than sectors closed to trade, because of their exposure to the exchange rate channel." She goes on to point out that "Open sectors with a high value added and a low wage share, however, may be able to partially insulate themselves from the exchange rate channel."

Kiptui et al. (2005) highlight that the level of exchange rate pass-through has implications for the timing of monetary policy intervention. In particular, in forecasting inflation and formulating monetary policy in response to an external shock to inflation, knowledge of the speed and the extent of exchange rate pass-through is required, as they point out. This is particularly true if the share of imports is significant in aggregate consumption. Further, as the potential for second-round pass-through of price increases rises, implications of exchange rate pass-through for monetary policy become more significant in the event of an actual or potential significant change in the nominal exchange rate.

Discussing partial pass-through, the costs to firms in adjusting prices, *i.e.,* menu costs, uncertainty as to whether the import price movements are permanent or cyclical and the desire to maintain market share by "pricing-to-market", are cited by Kiptui et al. as some of the reasons for firms opting to vary their margins in response to changes in the exchange rate and the consequent changes in their costs. At a macroeconomic level, exchange rate volatility and volatility in aggregate demand (proxied by the output gap) are cited by them as factors leading to lower pass-through. While they also discuss some possible reasons for varying levels of pass-through in different countries, they draw attention to the finding by various economists, of partial pass-through of exchange rate changes into prices in most countries.

Devereux and Yetman (2003) also point to the substantial literature covering many countries, which document low exchange rate pass-through both at a disaggregated level and at the level of aggregate prices. They contrast these findings with the expectation of many economists in the early years of floating exchange rates to find a close association between movements in exchange rates and national price levels.

Referring to the debate on the causes of low exchange rate pass-through, Devereux and Yetman summarise the explanations put forth by various economists, both microeconomic and macroeconomic. Amongst the microeconomic explanations of low exchange rate pass-through cited by them are structural features of international trade such as pricing to market by imperfectly competitive firms, domestic content in the distribution of traded goods, the role of substitution between goods in response to changes in exchange rates, and the changing composition of imported goods. On a macroeconomic level, the slow adjustment of goods prices at the consumer level, *i.e.,* sticky prices, is according to them a key reason cited by economists for the low exchange rate pass-through. Devereux and Yetman conclude that their findings also confirm that sticky prices play an important role in cross-country variations in exchange rate pass-through. Accordingly, they argue that exchange rate pass-through is endogenous to the monetary policy regime. Specifically, they conclude that

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when firms can adjust their frequency of price changes, "looser" monetary policy leads to more frequent price changes and therefore higher depreciation and higher pass-through. Hence, they agree with Taylor (2000), who posits that pass-through is systematically related to monetary policy.

Accroding to Devereux and Yetman, in general, the optimal frequency of price changes would vary with the monetary policy regime. They point out that, firms will choose a higher frequency of price adjustment, the higher the average rate of inflation, which tends to result in higher variability in the exchange rate. The higher frequency of price changes, they point out, would result in greater exchange rate pass-through. They also cite the findings in a paper by Choudri and Hakura (2001), namely, that exchange rate pass-through tends to vary systematically with the mean inflation rate, as being similar to their own findings about the relationship between exchange rate pass-through and inflation, and therefore monetary policy. While they conclude that pass-through increases (in a non-linear fashion) with increases in both mean inflation and mean exchange rate depreciation, they suggest that this endogenous nature of exchange rate pass-through be taken into account in designing monetary policy for a small open economy.

Gagnon and Ihrig (2004) who study the decline in pass-through of exchange rate changes into domestic inflation in twenty industrial countries since the 1980s, conclude that it can be attributed to the increased emphasis on inflation stabilisation by many central banks. They show that, countries with low and stable inflation, which they attribute to central bank policies, have low estimated pass-through. While their empirical results indicate a statistically significant link between the decline in the level and the variability of inflation, and the decline in exchange rate pass-through, they explain that, when a central bank's commitment to keeping inflation low is credible, firms are less inclined to quickly pass higher costs on to consumers in the form of higher prices.

While there is now a large body of literature, which support the view that there is a significant link between inflation and therefore monetary policy and the degree of exchange rate pass-through, the change in the focus of discussions on exchange rate pass-through, from the pricing power of firms to inflation and monetary policy, is largely attributed to John B. Taylor. In the paper titled "Low Inflation, Pass-Through, and the Pricing Power of Firms", 2000, he put forth the view that the reduction in the degree to which firms pass-through cost increases due to exchange rate movements or other factors is due to lower and more stable inflation, that is, the low inflation environment that has been achieved by many countries by the early 1990s. Although economists had at that time attributed this lower inflation to such factors as the absence of "shocks", favourable structural changes, a decline in pricing power of firms, a decrease in the natural rate of unemployment due to demographic factors and/or an increase in potential GDP due to higher productivity growth, Taylor was of the opinion that the primary cause was a change in monetary policy. In his paper, while he concludes that lower pass-through is caused by lower inflation, he is of the view that a change of

monetary policy and a return to higher inflation expectations would result in a higher level of pass-through. The main point of his paper, as he stresses, is that, lower pass-through should not be taken as exogenous to the inflationary environment. This is because, as he explains, the general inflationary environment affects the pricing behaviour of firms. In this context, he highlights the importance of assessing the degree of pass-through for forecasting inflation and for deciding how much to tighten monetary policy in response to an increase in inflation that can be identified with a change in the exchange rate.

Adolfson (2001) highlights the significance of the exchange rate for small open economies, given that it impacts inflation directly through import prices as well as indirectly, through aggregate demand. However, he stresses that empirical evidence for both large and small open economies seem to suggest that there are systematic deviations from the law of one price, and that exchange rate pass-through is incomplete both for export and import prices. He goes on to suggest that these nominal rigidities imply that it is expectations about future exchange rate movements and future inflation that play an important role in the inflation-output relation.

Adolfson obtains three main results in his paper. First, he concludes that the monetary policy response to both foreign and domestic shocks depends on the degree of exchange rate pass-through. In this regard, he notes that as the exchange rate channel has less impact when pass-through is low, this in turn implies that foreign shocks require smaller interest rate adjustments. Second, he notes that incomplete pass-through implies less conflict between inflation and output variability because of the lower exposure to exogenous as well as policy induced exchange rate fluctuations. Third, he notes that volatility of the nominal exchange rate increases as pass-through decreases. With respect to this last observation, he explains that, given import price stickiness (due to 'menu' costs, producers' concern for reputation due to imperfectly informed consumers and brand-switching costs in the domestic market), the required relative price adjustment is generated through larger movements in the exchange rate.

Empirical results obtained by Campa and Goldberg (2002) point to partial pass-through across the OECD[2] countries in the short-run[3]. Hence they reject the prevalence of both producer-currency-pricing and local currency pricing of imports in OECD countries, in the short-run. However, they find evidence of producer-currency-pricing for many types of imported goods in the long-run.

As they point out, low exchange rate pass-through into import prices means that nominal exchange rate fluctuations may lead to lower expenditure switching effects of domestic

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2/ Organisation for Economic Cooperation and Development
3/ They find that the unweighted average of pass-through elasticities for OECD countries is about 60 per cent over one quarter (*i.e.,* in the short-run), and nearly 80 per cent over the longer term (*i.e.,* one year). They also find that the USA has the lowest exchange rate pass-through, at around 25 per cent in the short-run and around 40 per cent over the longer term.

monetary policy, thereby leaving monetary policy more effective for dealing with real shocks. In this regard, they note that if pass-through rates are endogenous to a country's relative monetary stability, as was hypothesised by Taylor (2000), the extent of this monetary policy effectiveness would be fragile and regime specific. But, on the basis of the empirical results obtained by them, Campa and Goldberg claim that 'the Taylor argument' is not of first order importance for the low and medium inflation OECD countries. They emphasise that, despite lower inflation in many OECD countries in recent years, declining exchange rate pass-through into import prices is not a general feature of OECD countries, with levels of pass-through being significantly higher in countries with higher nominal exchange rate variability and higher average inflation. According to Campa and Goldberg, with respect to pass-through rates in the OECD countries, most important are the changes in the composition of industries in a country's import basket. In particular, they cite the move away from energy and raw materials as a high proportion of the import bundles, to a much higher share of manufactured products (from around 50 per cent in 1980 to around 70 per cent by 1992), as the primary driver behind the recent pass-through declines into import prices in many OECD countries. They further explain that given that this change in the industry composition of trade is more structural than inflation performance, it is more robust and durable. Their findings imply that monetary policy transmission could be expected to be more robust in these countries, to the extent that industry pass-through rates remain stable.

Faruqee (2004), who examines exchange rate pass-through in a set of euro area prices along the pricing chain, concludes that exchange rate pass-through is incomplete in the euro area, which he attributes to euro-currency pricing and pricing-to-market behaviour. Accordingly, he suggests that, as in the United States of America, expenditure switching effects of the exchange rate on the current account are generally small in the euro area. This is due to the fact that incomplete pass-through could delay or diminish the response in external variables and produce a certain degree of "exchange rate disconnect", as he explains.

C. Conclusions from the Review of Literature

The inflation environment in the country, the composition of the import basket, and at a microeconomic level, competitiveness of domestic firms or the market structure at the industry level, have been highlighted as being important determinants of the degree of exchange rate pass-through into import prices in a country, in the literature on exchange rate pass-through. Exchange rate pass-through has been found to be incomplete in many countries. However, depending on the relative importance of the specific factors that determine the degree of exchange rate pass-through in a country, these factors must be given due consideration in forecasting inflation and formulating monetary policy, especially as there could be second-round pass-through of price changes.

III. The Analytical Framework

In this paper, exchange rate pass-through in Sri Lanka is examined taking two approaches. First, on the basis of a log-linear regression model, exchange rate pass-through into prices of imported goods is examined. Second, exchange rate pass-through along the pricing chain, that is, from the exchange rate to factor input prices to trade prices, *i.e.,* import prices and export prices; to wholesale producer prices and retail consumer prices.

The Models

(i) Model 1: Log-Linear Regression Model.

$$P_t = \alpha + \delta x_t + \gamma e_t + \varphi Z_t + \varepsilon_t$$

where P_t are local currency import prices, et is the exchange rate, x_t is a primary 'control' variable representing foreign prices, and Z_t, which is another control variable, is the real gross domestic product (GDP) of the destination market. It is a log-linear regression specification.

As a proxy for local currency import prices, an index computed for the monthly expenditure (amounts) on imported items included in the CCPI was used (where the base year is 1999). The exchange rate series used is the nominal effective exchange rate (NEER) with 1999 as the base year, for the 5-currency basket (which reflects the movements of the Sri Lanka rupee *vis-à-vis* its most important trading partners). A proxy variable was used for the data series on foreign prices (x), which was constructed using the real effective exchange rate (REER) based on the Sri Lanka Consumers' Price Index (SLCPI), with 1999 as the base year, and the NEER, both for the 5-currency basket[4]. As data on the GDP are not available on a monthly basis, the industrial production index, which was found to be cointegrated with the GDP series (see Appendix I), was used as the proxy variable. All data series are expressed in logarithms. In estimating the model, first differences of the series were used given the presence of a unit root in all the variables included (see Appendix II). An error correction term was not included as none of the variables are cointegrated.

'The textbook definition of exchange rate pass-through is the per cent change in local currency import prices resulting from a one per cent change in the exchange rate between the exporting and importing country' (Campa and Goldberg, 2002).

However, as Campa and Goldberg point out, the microeconomic foundations of pricing behaviour are a better starting point for generating the more economically meaningful specifications for hypotheses testing. They examine exchange rate pass-through in 25 OECD countries, using the log-linear regression model given above (model 1).

4/ $x = NEER \cdot P^d / REER$, where P^d is the domestic price index, which is the SLCPI.

(ii) Model 2: Structural VAR Model.

$$Y_t = c + A(L)Y_{t-1} + \mu;$$

$$E[\mu_t \mu_t^1] = \Omega$$

where $Y = [\Delta e\ \Delta w\ \Delta m\ \Delta x\ \Delta p\ \Delta c]^1$, c is a vector of deterministic terms (*i.e.,* monthly dummies), A is a matrix polynomial of degree p in the lag operator L, and μ is the (6x1) vector of reduced form residuals with variance-covariance matrix Ω.

The exchange rate (e) is placed first, reflecting the presumption that exchange rate innovations at monthly frequency are primarily driven by factors exogenous to the model. The ordering after the exchange rate follows the pricing chain, from factor input prices (w) to trade prices, *i.e.,* import prices (m) and export prices (x); to wholesale producer prices (p) and retail consumer prices (c). All series are expressed in logarithms. In estimating the model, first differences were used, considering the presence of a unit root in most variables (see Appendix III), and with the aim of estimating the accumulated response to an exchange rate shock, on the basis of impulse response functions, over a period of one and a half to two years.

The exchange rate series used is the nominal effective exchange rate with 1999 as the base year, for the 5-currency basket, as it reflects the movements of the Sri Lanka rupee *vis-à-vis* its most important trading partners, as mentioned before. As a proxy for factor input prices, the real wage rate index for workers in the Wages Boards Trades, that is, the Combined Index for workers in Agriculture, Industry and Commerce, and Services, with 1978 as the base year, was used. Import and export price indices, which are unit value indices with 1997 as the base year, are the indices computed for trade prices in US dollar terms. As a proxy for the series on wholesale producer prices, the wholesale price index for intermediate goods, with the base year of 1974, was used. (Amongst the items covered by the wholesale price index for intermediate goods are fertiliser including urea, phosphate, sulphate ammonia and rock phosphate; wheat grain; citronella oil; cocoa; tobacco; cardamom; rubber (RSS2); fuel including kerosene, petrol and diesel; electricity; cotton yarn; bulbs; switches; fans; insulated wires; dry battery cells; chrome leather; zinc oxide; zinc chloride; wood pulp; mammoties; and tyres for bicycles, tractors, lorries and cars). The series on consumer prices is the Colombo Consumers' Price Index, with the base year of 1952, which is the official price index. An error correction term was not included in the model as there was no cointegration among these variables.

The empirical approach associated with model 2 closely follows Faruquee (2004). While he estimates exchange rate pass-through into domestic prices in the Euro area using a vector autoregression (VAR) model, he cites several advantages of the use of a VAR approach to examine exchange rate pass-through. First, the types of underlying exchange rate shocks

(for example, whether permanent or transitory), may be distinguished. Second, the relative degree of pass-through into different prices along the pricing chain may be determined.

Sims' (1980) vector autoregressive (VAR) approach has the property of treating all variables included in the model symmetrically. A structural VAR differs from a VAR in this aspect, because it involves imposing restrictions on selected variables, given that the aim of using a structural VAR is to use economic theory.

The researcher intends to examine the impact of a unit change in the (nominal, trade weighted effective) exchange rate on the set of prices along the 'pricing chain', that is, factors input prices, trade prices, wholesale producer prices and consumer prices, in Sri Lanka. Accordingly, following the methodology used by Faruqee (2004), a structural VAR was estimated, from which the relevant impulse response functions were obtained, which trace out the time path of the shock, *i.e.,* the effect of a change in the nominal effective exchange rate, on the other prices in the structural VAR system; namely, factors input prices, trade prices, wholesale producer prices and consumer prices.

The structural VAR model was estimated imposing restrictions so that only those variables placed upstream in the pricing chain affect the changes in any given variable in response to an exchange rate shock. In other words, the contemporaneous values of downstream prices do not have a contemporaneous effect on any of the prices in the system. The imposition of this identification restriction by using Choleski decomposition implies an ordering of the prices within the system. Impulse responses to an exchange rate shock were thereafter obtained.

IV. Analysis and Findings

A. Model I - Findings

The exchange rate was found to have a significant impact on import prices, with a lag. The Durbin-Watson Statistic was found to be very close to 2, suggesting that the model specification was appropriate, that is, all relevant variables have been included. However, the R-squared value was found to be only 0.38.

The response of import prices to a change in the exchange rate was found to be prolonged, with the most significant adjustment in import prices taking place after eight months. The empirical estimates from the model suggest that import prices increase by a total of about 0.5 per cent during a period of around eight months, following a depreciation of the exchange rate by 1 per cent, or *vice versa* (see Table 1).

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Table 1 – Exchange Rate Pass-Through into Import Prices in Sri Lanka

(Results for the Log-Linear Regression)
Dependent Variable: Import Prices
Method: Least Squares
Date: 07/22/06   Time: 10:53
Sample(adjusted): 2000:10 2005:12
Included observations: 63 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004167	0.007406	0.562624	0.5769
Foreign Prices	-0.127875	1.131654	-0.112998	0.9106
Foreign Prices (-1)	-2.313532	1.105623	-2.092515	0.0429
Foreign Prices (-2)	-0.432264	1.006209	-0.429596	0.6699
Foreign Prices (-3)	0.981248	1.027704	0.954796	0.3456
Foreign Prices (-4)	-0.931754	1.073981	-0.867570	0.3909
Foreign Prices (-5)	0.958187	1.052721	0.910200	0.3683
Foreign Prices (-6)	1.922476	1.111375	1.729818	0.0916
Foreign Prices (-7)	0.833222	0.966999	0.861657	0.3941
NEER	-0.192017	0.170694	-1.124921	0.2675
NEER (-1)	-0.238960	0.169285	-1.411583	0.1660
NEER (-2)	0.280861	0.171746	1.635331	0.1100
NEER (-3)	0.029933	0.175369	0.170686	0.8654
NEER (-4)	0.194425	0.170740	1.138722	0.2618
NEER (-5)	-0.118934	0.164839	-0.721516	0.4749
NEER (-6)	-0.103671	0.171705	-0.603773	0.5495
NEER (-7)	0.134120	0.170299	0.787557	0.4357
NEER (-8)	-0.483661	0.172211	-2.808530	0.0077
GDP	0.048127	0.033090	1.454435	0.1538
GDP (-1)	0.042788	0.039663	1.078801	0.2873
GDP (-2)	-0.022202	0.039296	-0.564977	0.5753
GDP (-3)	0.045952	0.047862	0.960101	0.3429
GDP (-4)	0.096801	0.056177	1.723119	0.0928
GDP (-5)	0.080870	0.046112	1.753758	0.0873
R-squared	0.383985	Mean dependent var		0.008756
Adjusted R-squared	0.020694	S.D. dependent var		0.015307
S.E. of regression	0.015148	Akaike info criterion		-5.259628
Sum squared resid	0.008948	Schwarz criterion		-4.443195
Log likelihood	189.6783	F-statistic		1.056962
Durbin-Watson stat	1.983086	Prob(F-statistic)		0.428480

The control variables, that is, both foreign prices and GDP, were also found to have a significant impact on import prices, with a lag. It was found that import prices increase by a total of around 0.05 per cent during a period of six months, in response to an increase in foreign prices by 1 per cent. With respect to the impact of economic activity on import prices, it was found that import prices increase by about 0.3 per cent within a period of around 5 months, in response to an increase in the GDP by 1 per cent.

While these findings suggest that exchange rate pass-through is incomplete in Sri Lanka, at about 50 per cent, this phenomenon has been found to be common to many countries, with some of the effect of a change in the exchange rate being absorbed in the mark-ups of the exporters or the profit margins of importers. Amongst the OECD countries, the USA has been found to be a country with very low exchange rate pass-through into import prices, at about 25 per cent. In contrast, exchange rate pass-through has been found to be complete within a year or so in several OECD countries including Portugal, the Netherlands, Ireland, Italy and Japan. However, in many countries, it has been found that exchange rate pass-through is incomplete, as stated before. For example, after one year, total pass-through into import prices is estimated at around 27 per cent for Greece, around 34 per cent for Norway, around 56 per cent for the UK, around 73 per cent for Germany and around 80 per for the Czech Republic. (The import pass-through elasticities for other countries are estimates by Campa and Goldberg, 2002).
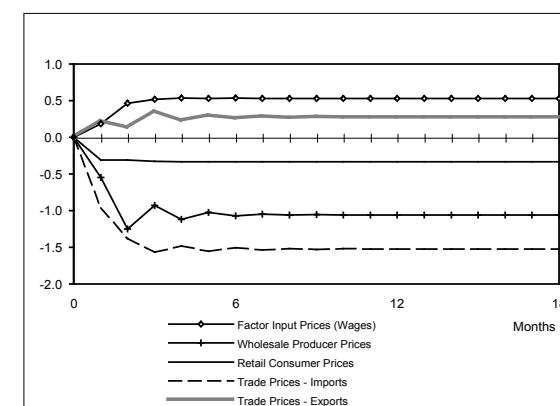
Graph 1 – Effect of an Exchange Rate Shock on Prices
(Effect of a unit structural shock)

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Exchange Rate Pass-Through: To What Extent do Prices Change in Sri Lanka?

Table 2 – Pass-Through Elasticities*

(Per cent change in prices divided by per cent change in exchange rate)

	T=1	T=3	T=6	T=12	T=18
Factor Input Prices (Wages)	0.19	0.52	0.53	0.53	0.53
Trade Prices – Imports	-0.96	-1.57	-1.50	-1.52	-1.52
Trade Prices – Exports	0.22	0.34	0.25	0.27	0.27
Wholesale Producer Prices	-0.55	-0.93	-1.07	-1.06	-1.06
Retail Consumer Prices	-0.31	-0.33	-0.33	-0.33	-0.33

* Pass-through elasticities are accumulated elasticities, up to the selected time period, where *T* refers to the number of months. Based on impulse response functions from the structural VAR model.

B. Model II - Findings

The VAR approach to the analysis of the impact of a change in the exchange rate reveals that retail consumer prices in Sri Lanka increase by about 0.3 per cent in the long run in response to a depreciation of the nominal effective exchange rate by 1 per cent[5]. The pass-through to wholesale producer prices, in contrast, becomes complete within about 6 months. The pass-through to worker compensation (factor input prices), which is positively related to the nominal effective exchange rate, is about 50 per cent in the long run, suggesting that the purchasing power of workers increases by about 0.5 per cent with an appreciation of the nominal effective exchange rate by 1 per cent. With respect to trade prices, given the relatively much larger response of import prices to a change in the exchange rate, compared to the response of export prices, movements in the exchange rate appear to have significant implications for the trade balance.

V. Summary and Conclusions

The exchange rate is one of the factors, which determine the behaviour of domestic prices. With the liberalisation of the domestic economy, domestic markets are becoming increasingly integrated with global markets, which is likely to further heighten the importance of the exchange rate for the movements of domestic prices. Another important factor in this regard is the fact that there would be some degree of second-round pass through of price increases, if domestic prices increase as a result of a depreciation of the rupee. Hence, exchange rate pass-through should necessarily be given due consideration in the formulation of monetary policy for Sri Lanka.

In this paper, exchange rate pass-through in Sri Lanka was examined taking two approaches. First, a log-linear regression model was estimated to determine the degree of exchange rate pass-through into import prices. The results obtained suggest that exchange rate pass-through into import prices is about 50 per cent, that is, a 1 per cent depreciation of the rupee vis-a-vis its trading partners' currencies, results in import prices increasing by around 0.5 per cent, within a period of about 8 months. Second, prices along the pricing chain, namely, factor input prices (wages), trade (import and export) prices, wholesale producer prices and retail consumer prices, were examined to determine their response to a depreciation/appreciation of the rupee vis-a-vis its trading partners' currencies, taking a VAR approach. The results obtained for the structural VAR model suggest that consumer prices increase by around 0.3 per cent in response to a 1 per cent depreciation of the nominal effective exchange rate. The pass-through into wholesale producer prices was found to be much larger, with complete pass-through within a period of about 6 months. Factor input prices (worker compensation) were found to increase by around 0.5 per cent in response to an appreciation of the nominal effective exchange rate by 1 per cent. Import prices were found to respond by a relatively much larger magnitude than export prices, to a change in the exchange rate (import and export prices included in the model were the trade weighted indices), which implies that movements in the exchange rate has significant implications for the trade balance.

It was the intention of the researcher to ascertain by way of a Chow test, whether a change has occurred in the degree of exchange rate pass-through into import prices following the floating of the rupee in January 2001. However, given that the exchange rate impacts on import prices with a lag, the number of observations before January 2001 are not sufficient to do so. The main restriction was that the relevant data are not available. In particular, data on the nominal effective exchange rate, which has 1999 as its base year, are available only from 2000. One could perhaps extend backwards the relevant data series by using the appropriate statistical methods, in order to ascertain whether any significant changes have occurred in exchange rate pass-through in Sri Lanka.

5/ Wijesinghe (1990) found that, during the period 1982-1987, a 1 per cent depreciation of the exchange rate induced a 0.59 per cent increase in consumer prices, of which 80 per cent takes place within a year.

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Exchange Rate Pass-Through: To What Extent do Prices Change in Sri Lanka?

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Cointegration: Quarterly Data on the GDP and the Industrial Production Index

Date: 05/07/06   Time: 14:22

Sample(adjusted): 2000:3 2005:4

Included observations: 22 after adjusting endpoints

Trend assumption: Linear deterministic trend

Series: Industrial_Production_Index GDP

Exogenous series: @TREND

Warning: Critical values assume no exogenous series

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test

Hypothesized		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.929047	59.71007	15.41	20.04
At most 1	0.066067	1.503704	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5% (1%) level

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

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Exchange Rate Pass-Through: To What Extent do Prices Change in Sri Lanka?

**Results of the Tests for the Presence of a Unit Root –
Variables included in Model I**

Results of Unit Root Tests:

Variables (in logs) -	Included		ADF Test*
in Levels	Constant	Trend	Statistic
CCPI-Expenditure on Imports(Proxy for Import Prices)	Yes	Yes	-2.5055 [1,2,3]
Foreign Prices (cost proxy)	Yes	Yes	-2.3471 [1,2,3]
NEER (5-Currency Basket)	Yes	Yes	-1.0755 [1,2,3]
Industrial Production Index(Proxy for GDP)	Yes	Yes	1.5571 [1,2,3]

1/ I(1): Significant at 10% level
2/ I(1): Significant at 5% level
3/ I(1): Significant at 1% level
* Augmented Dickey-Fuller test

Results of Unit Root Tests:

First Difference of	Included		ADF Test	KPSS Test**
Variables (in logs)	Constant	Trend	Statistic*	
CCPI-Expenditure on Imports(Proxy for Import Prices)	Yes	Yes	-8.2401 1,2, 3	
Exporter Costs (cost proxy)	Yes	Yes	-7.2113 1, 2, 3	
NEER (5-Currency Basket)	Yes	Yes	-8.0129 1, 2, 3	
Industrial Production Index(Proxy for GDP)	Yes	Yes	-2.9193 4	0.0278 1,2,3

1/ I(0): Significant at 10% level
2/ I(0): Significant at 5% level.
3/ I(0): Significant at 1% level.
4/ I(1)

* Augmented Dickey-Fuller (ADF) test was carried out for all the variables.
** Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test was carried out, when the differenced series was found to have a unit root, given the possibility of it being a near unit-root series.

**Results of the Tests for the Presence of a Unit Root –
Variables included in Model II**

Results of Unit Root Tests:

Variables (in logs) -	Included		ADF Test*
in Levels	Constant	Trend	Statistic
NEER (5-Currency Basket)	Yes	Yes	-1.0755 [1,2,3]
Real Wage Rate Indexa	Yes	Yes	-3.9714 [3]
Import Prices (Trade weighted unit value index for prices in USD terms)	Yes	Yes	-2.1453 [1,2,3]
Export Prices (Trade weighted unit value index for prices in USD terms)	Yes	Yes	-4.1007 [4]
Intermediate Prices – WPI (proxy for whole-sale producer prices)	Yes	Yes	-5.4763 [4]
CCPI	Yes	Yes	-2.9954 [1,2,3]

a   Real Wage Rate Index for Workers in the Wages Board Trades is the combined index for workers in Agriculture, Industry and Commerce, and Services.
1/ I(1): Significant at 10% level
2/ I(1): Significant at 5% level
3/ I(1): Significant at 1% level
4/ I(0)
* Augmented Dickey-Fuller test

Results of Unit Root Tests:

First Difference of	Included		ADF Test*
Variables (in logs)	Constant	Trend	Statistic
NEER (5-Currency Basket)	Yes	Yes	-8.0129 [1,2,3]
Real Wage Rate Indexa (proxy for factor input prices)	Yes	Yes	-6.9653 [1,2,3]
Import Prices (Trade weighted unit value index for prices in USD terms)	Yes	Yes	-9.0589 [1,2,3]
Export Prices (Trade weighted unit value index for prices in USD terms)	Yes	Yes	-9.4971 [1,2,3]
Intermediate Prices – WPI (proxy for whole-sale producer prices)	Yes	Yes	-13.2803 [1,2,3]
CCPI	Yes	Yes	-7.782 [1,2,3]

1/ I(0): Significant at 10% level
2/ I(0): Significant at 5% level
3/ I(0): Significant at 1% level
* Augmented Dickey-Fuller test

Monetary Policy and Inflation Performance: Evidence from Exchange Rate Regimes in Sri Lanka

P.K.G. Harischandra*

Abstract

This paper examines empirical evidence on monetary policy and inflation performance across exchange rate regimes in Sri Lanka. The criterion used to examine inflation performance is the degree of inflation persistence. Three alternative definitions of inflation persistence are used to model inflation dynamics. First, autocorrelation properties of inflation process are examined. Estimates of traditional Phillips curve and the hybrid-new Keynesian Phillips curve (H-NKPC) suggest a significant upward shift in inflation persistence following the change in exchange rate system in late 1977. Recursive estimates of coefficient on lagged inflation and Chow parameter stability tests confirm these results. Second, inflation response to systematic monetary policy actions is examined. Results suggest that inflation is more persistent and monetary policy is more accommodative in the flexible exchange rate regime. However, the correlation between money growth and inflation is found to be modest. Finally, inflation response to non-systemic policy actions (i.e., policy shocks) is examined through impulse response functions of an unrestricted VAR system. Results suggest that policy shocks are more persistent in the flexible exchange rate regime, than in the fixed exchange rate regime. However, maximum lag length of inflation response to a policy shock is not significantly different across regimes, suggesting that results from the impulse response analysis are inconclusive. Overall, there is substantial evidence to suggest that the shift in inflation persistence coincides with the change in exchange rate regimes. Moreover, during the flexible regime, higher monetary accommodation has resulted in higher inflation persistence. Because of sluggish response of inflation to changes in monetary policy measures, more stringent monetary policy measures may be needed to curb inflationary pressures.

(JEL E 31, E 52)

Key Words: Inflation Persistence, Monetary Policy, Exchange Rate Regimes

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I. Introduction

Does the nominal exchange rate regime matter for macroeconomic performance? is widely a discussed topic in the open economy literature. One of the key aspects of this strand of research deals with the relation between exchange rate regimes and inflation performance. Thus, many studies attempt to examine the effects of exchange rate regime on the conduct of monetary policy. The underlying theme of those studies is to analyse the degree of inflation persistence across different exchange rate regimes. While some authors report a direct relation between shifts in exchange rate regimes and the degree of inflation persistence [see for example, Alogoskoufis and Smith (1991), Alogoskoufis (1992), Obstfeld, (1995)], others argue, instead, that shifts in inflation persistence may coincide with factors like oil price shocks, outbreak of wars, and economic reforms and central bank reforms *etc*. [Burdekin and Siklos (1999), Bleaney (2001)]. The explanation for the former argument suggests that lower degree of monetary accommodation in the fixed exchange rate regime results in lower inflation persistence, while the contrary occurs in the flexible exchange rate regime. However, in Sri Lanka, only limited attempts have, so far, been made, to examine the implications of exchange rate regimes on inflation performance.[1]

The key policy implication of a regime change derives from the fact that the central bank's monetary autonomy in making policy decisions may vary between regimes. Under flexible exchange rate regime central bank can adopt discretionary monetary policy, to soften the effects of price increases, which may result in more persistence. By contrast, under fixed exchange rate regimes central bank is committed to defend the exchange rate parity, which results in lower degree of monetary policy autonomy, subsequently, lower inflation persistence through contained discretionary accommodation. However, the views among researchers on this explanation are, often, divisive. Agenor (2004) reports that "simply pegging the exchange rate did not prove to be a substitute for maintaining monetary stability and credibility. […] Recent experiences suggest that exchange rate pegs can be sustainable only when they are credible, and credibility is to a large extent determined by domestic macroeconomic policies" (p.150). Thus, the effectiveness of a policy change may be dependent upon several factors. As Agenor and Taylor (1992) report, lack of confidence of public in the newly implemented policy may be caused by (*a*) perceived *inconsistency* between other policies that are pursued by the government simultaneously, (*b*) *time-inconsistency* problem faced by the government between the *ex-ante* and *ex-post* strategies, (*c*) *incomplete* or *asymmetric* information that may hinder private agents' ability to asses the effects of policy change, and finally, (*d*) uncertainty about the *predictability* of policy reforms due to exogenous shocks that are caused by external factors. In general, private agents' expectations with regard to a policy change will greatly influence the sustainability

of the new policy.

A. Classification of Exchange Rate Regimes[2]

Sri Lanka has experienced several exchange rate regime changes during the past five decades. Table 1.1 summarises the evolution of exchange rate regimes in Sri Lanka since 1949. However, all the regimes can broadly be categorised into three groups, namely, fixed exchange rate regime, managed float with a crawling band and an independent floating system. The fixed exchange rate regime which lasted for nearly thirty years came to a halt with the introduction of major economic liberalization policies by end of 1977. Since then, the exchange rate system has been subject to several changes within a flexible exchange rate regime framework, including a major shift towards an independent floating system, introduced in early 2001.

However, classifying exchange rate regimes has become a debatable issue, in the

Table 1.1 – Evolution of Exchange Rate Regimes in Sri Lanka

Date	Major Changes	Exchange Rate Regime
1949	Rupee was linked to sterling pound	Fixed
22 Nov 1967	Rupee was depreciated by 20%	Fixed
06 May 1968	Introduced Foreign Exchange Entitlement Certificate Scheme	Dual exchange rate system
01 Aug 1971	Rupee was linked to US dollar	– do –
10 July 1972	Rupee was linked to sterling pound	– do –
24 May 1976	Rupee was pegged to a weighed average basket of currencies	– do –
12 March 1977	Rupee was depreciated by 20%	– do –
16 Nov 1977	Dual exchange rate system was abolished and managed floating exchange rate system was introduced	Managed floating with crawling band
20 June 2000	Band was widened	Managed floating with horizontal band
03 Nov 2000	Band was widened	Managed floating with crawling band
23 Jan 2001	Central Bank stopped announcing its buying and selling rates in advance	Independent floating

Source: Central Bank of Sri Lanka - Annual Report 2001

1/ Of course, to our knowledge, this is the first study, which examines the relation between inflation persistence and exchange rate regimes in Sri Lanka.

2/ The terms 'fixed exchange rate regime' and 'flexible exchange rate regime' would, respectively, be referred to as 'fixed regime' and 'flexible regime', for brevity.

recent literature. The official source of information on exchange rate policy is the *de jure* classification presented by the International Monetary Fund (IMF) for its member countries (the *Annual Report on Exchange Arrangements and Exchange Restrictions*). The information contained in this report has been challenged by various authors claiming that countries may not always follow the exchange rate policy as they announce [see for example, Shambaugh (2004), Reinhart and Rogoff (2004), and Levy-Yeyati and Sturzenegger (2005)]. In line with this argument, Agenor (2004) reports that "many of the countries that now claim to have independent floating rates use official intervention to alter the exchange rate path and should be classified as managed floaters or *de facto* peggers". (p.173). Thus, several studies attempt to provide alternative *de facto* classifications, based on observed behaviour of exchange rate performance. Consequently, IMF itself started publishing a *de facto* classification based on actual arrangements of member countries, which may differ from the *de jure* classification, and its publication for 2006 classifies Sri Lanka under *Managed floating with no pre-determined path for the exchange rate and monetary aggregate target* framework.

However, recent studies suggest that, in order to avoid misclassification problems, exchange rate regimes should be examined under broader categorisation. Therefore, this study classifies exchange rate regimes in Sri Lanka into two categories, namely, fixed regime (from 1960Q1 to 1977Q3) and flexible regime (from 1977Q4 to 2005Q4).

A brief review of inflation rates across different exchange rate regimes provides a significant piece of evidence on inflation dynamics across regimes. As Table 1.2 shows, there is a dramatic shift in mean inflation during the flexible regime, which is nearly three times higher than in the fixed regime. The volatility of inflation has also been much higher during the flexible regime, as measured by the standard deviation of 5.80. Figure 1.1 also depicts the volatility of inflation rates between regimes.

Table 1.2 – Descriptive Statistics of Consumer Price Inflation over Exchange Rate Regimes

	Full Sample Period (1960Q1-2005Q4)	Fixed Exchange Rate Regime (1960Q1-1977Q3)	Flexible Exchange Rate Regime (1977Q4-2005Q4)
Mean	8.44	3.83	11.34
Standard Deviation	6.31	3.89	5.80
Maximum	29.93	14.18	29.93
Minimum	-3.6	-3.6	-0.88

Figure 1.1 – Consumer Price Inflation across Exchange Rate Regimes

(a) Fixed Exchange Rate Regime   *(b) Flexible Exchange Rate Regime*
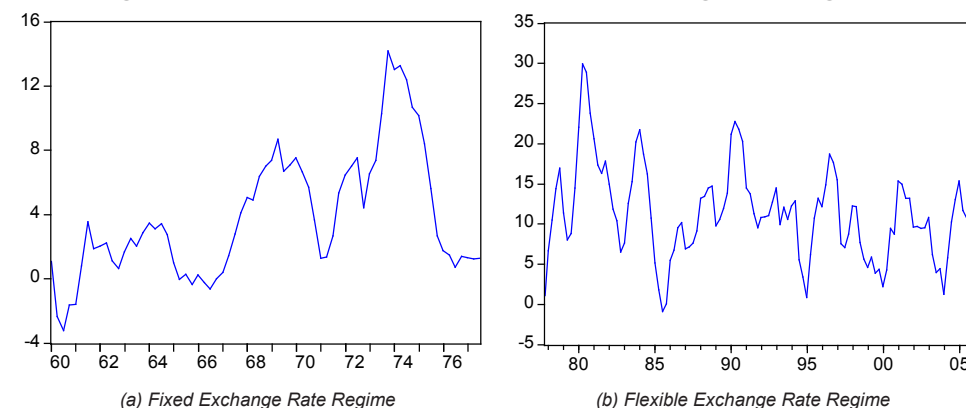
As claimed by various authors, modelling inflation persistence appears to have been a critical issue. One of the major concerns is attributed to the issue of how to define inflation persistence. Batini and Nelson (2001, p.383) describe three types of inflation persistence:

(I) Positive serial correlation in inflation

(II) Lags between *systematic* monetary policy actions and their (peak) effect on inflation

(III) Lagged response of inflation to *non-systematic* policy actions (*i.e.*, policy shocks).

The type I inflation persistence relates to autocorrelation properties of inflation as discussed in various studies [see for example Fuhrer and Moore (1995), Cogley and Sargent (2001), Sbordone (2002)]. The type II relates to the number of lags between the change in monetary policy measure and maximum effect on inflation, as described by Freidman (1972). The type III inflation persistence refers to the effects of policy shocks on inflation, which is often measured by means of impulse response functions. Policy shocks can be either monetary policy shocks [as discussed by Christiano *et al.*, (1999); (2001), McCallum (1999)] or non-policy shocks such as technology, preferences, government spending *etc*. (see for example Christiano *et al*. 2001). However, Batini (2002) reports that "[t]he economic literature is not unanimous about the definition of inflation persistence" (p.10). Sheedy (2005) also shares the same view that "[t]he debate on inflation persistence has been hindered by the lack of a clear definition". He brings about the idea of *structural* inflation persistence which is the "inflation inherited from the past which cannot be avoided without suffering a reduction in economic activity". However, he asserts that most of studies tend to use either autocorrelation function of inflation or impulse response functions.

Similarly, there is no consensus on the issue of theoretical modelling of inflation persistence. Recently, the use of new Keynesian Phillips curve (NKPC) to model inflation dynamics has been highlighted by many researchers. Specially, the open economy new Keynesian models highlight the relation between nominal exchange rate regime and the response of economy to monetary or real disturbances. These models predict that under fixed exchange rates, due to price stickiness, real exchange rate shows a lower degree of persistence in the short run, while the central bank defends the nominal exchange rate parity. By contrast, under flexible exchange rates, nominal exchange rate is greatly influenced by expectations of future behaviour of money supply and interest rates. However, there are some disagreements among researchers on the issue of using NKPC to model inflation. Some argue that the NKPC is incapable of accounting for inflation persistence due to its purely forward looking nature. As a result, the hybrid version of the NKPC is widely used in recent literature, which includes both forward looking as well as backward looking components.

B. Objectives of the Study

As described, the purpose of this paper is to examine monetary policy and inflation performance under different exchange rate regimes in Sri Lanka. The criterion used to examine inflation performance is 'inflation persistence' across regimes. The sample period spans from 1960Q1 to 2005Q4 and, the exchange rate regimes are broadly categorized into fixed and flexible regimes. Fixed exchange rate regime comprises of pegged exchange rate arrangements and dual exchange rate regimes, while flexible exchange rate regime comprises of managed floating with crawling band, managed floating with horizontal bands and independent floating.

Accordingly, the paper is intended to,

(i) examine inflation persistence across fixed and flexible regimes in order to identify whether shifts in inflation persistence coincide with changes in exchange rate regimes,

(ii) examine inflation response to changes in (*systematic*) monetary policy measures and the degree of monetary accommodation under fixed and flexible regimes and;

(iii) identify inflation response to monetary policy shocks (*i.e.*, *non-systematic* policy actions) under fixed and flexible regimes.

The structure of the paper is as follows. Section 2 reviews existing literature on both empirical and theoretical grounds on the issue. Section 3 describes the theoretical model and the methodology adopted in this paper. Section 4 presents the findings and analysis. Section 5 concludes.

II. Literature Review

Recently, a large volume of research is devoted to study inflation dynamics. Various theoretical and empirical models explain behaviour of macroeconomic variables under different monetary and exchange rate regimes. However, it is noted that most of early work examining inflation persistence is based on traditional Phillips curve literature, while the models developed more recently are based on the new Keynesian framework. This section briefly describes empirical and theoretical underpinnings on the issue.

The empirical evidence on inflation persistence over exchange rate regimes draw mixed conclusions. Some argue that shifts in inflation persistence are associated with changes in monetary and exchange rate regimes, while some find no direct relation between the two, and suggest that shits in inflation persistence could occur due to various other factors like wars, oil price shocks and institutional reforms etc. Early contributions on the empirical analysis of inflation persistence and exchange rate regimes are due to Alogoskoufis and Smith, (1991, henceforth, AS), Alogoskoufis, (1992), and Obstfeld (1995). Subsequently, several studies attempt to test empirical validity of AS's findings with wider country coverage and extended data sample. However, contrasting views emerge among researchers with regard to AS's initial findings [Burdekin and Siklos (1999), Bleaney (2001).

A. Inflation Persistence and Traditional Phillips Curve

Alogoskoufis and Smith, (1991) provide a good starting point for the discussion of the behaviour of monetary variables under different exchange rate regimes. They examine shifts in inflation persistence using the price inflation process and expectation-augmented Phillips curve for U.K. and U.S. data, under broader regime categorization *i.e.*, fixed and managed floating exchange rate regimes. They conclude that the fixed exchange rate regime is associated with lower monetary accommodation while the managed float shows a higher monetary accommodation. Similarly, estimates of inflation persistence coefficients suggest that during the fixed regime, inflation persistence has been low due to less monetary accommodation, where as in the managed float, inflation is highly persistent due to higher accommodation. Further, Alogoskoufis (1992) extends the same analysis for OECD countries using annual data from 1952 to 1987 and re-confirm the findings.

Subsequently, Obstfeld (1995) examines inflation persistence in twelve industrialised countries based on annual data during the post-war period. Results are in consistent with AS's findings. He shows that under floating regime, monetary authorities accommodate inflation more than under fixed regime, which results in greater inflation persistence. However, recently, Burdekin and Siklos (1999) and Bleaney (2001) provide contrasting evidence to theses findings. Burdekin and Siklos (1999) show that inflation persistence has changed over time for reasons which are not solely attributed to shifts in exchange rate regimes. They extend AS's Phillips curve analysis by including data for Canada and Sweden with the

updated data for U.K. and U.S. Their findings are partly contradictory to the conclusions of AS, in that, they do not support for the argument that shifts in inflation persistence coincide with changes in exchange rate regimes. Instead, they show that there are several other factors which are closely related to shifts in inflation persistence such as wars, oil price hikes and central bank reforms. Among these factors, the effects of oil price hikes in 1970's seem to have greater impact on shifts in inflation persistence.

Bleaney (2001) examines the same issue by using annual data for OECD countries for the period 1954 - 1999. He explains that degree of inflation persistence is highly sensitive to shifts in mean inflation, and therefore estimates of persistence can be biased upward or downward depending on the number of mean shifts allowed in the sample. His findings are contradictory to the findings of AS and Obstfeld, (1995).

B. Inflation Persistence and the New Keynesian Phillips Curve (NKPC)

The use of NKPC to describe inflation dynamics is quite common in recent literature. However, the standard purely forward looking NKPC is subject to severe criticism due to its inability to account for persistence in the inflation process. One of the early criticisms to the standard NKPC is put forth by Fuhrer and Moore (1995). More recently, Mankiw (2001) and, Rude and Whelan (2005) show that purely forward looking models cannot generate plausible results as it cannot relate to inertial nature of inflation. Due to these limitations of the standard NKPC, the use of the hybrid NKPC which incorporates both forward and backward looking elements has gained momentum.

In addition to the structural problem in the NKPC, there is another issue which relates to the driving variable of inflation process; whether it is the real marginal cost or a measure of output gap. Literature provides supportive evidence for both. The idea of using real marginal cost is pioneered by Gali and Gertler (1999), (2001- henceforth GG). Subsequently, this argument has been strengthened by Gali *et al.*, (2001), (2005), Sbordone (2001), (2002), (2005), and several others. On the contrary, many authors report empirical evidence on the use of output gap measure, for example Roberts, (1995), (1997), (1998), Fuhrer and Moore (1995), Fuhrer (1997), Rudebusch (2002). Moreover, Linde (2005) estimates a hybrid NKPC by using standard measures of output gap and suggests that "backward-looking behaviour is about equally or more important than forward-looking behaviour in order to fit the data well" (p.1148).

Overall, despite the disagreements on the issues pertaining to the NKPC, it is widely used by researchers to describe the effects of past inflation and expected inflation on the current inflation. Several researchers attempt to extend the basic new Keynesian closed economy model to describe open economy dynamics. However, the existing literature on new Keynesian models provides little evidence on explaining small open economy behaviour.

The present study, thus, evaluates the inflation persistence across exchange rate regimes in the context of a small open economy.

III. The Model and Methodology

A. The Model

The Phillips curve specification has been the focal point of many researches on modelling inflation dynamics. The present study also uses alternative specifications of the traditional Phillips curve and the new Keynesian Phillips curve (NKPC) in order to examine which specification may better explain the inflation process. Recently, the standard model for describing inflation dynamics has been the new Keynesian Phillips curve of the following form;

$$\pi_t = \beta E_t \pi_{t+1} + \alpha x_t + v_t \tag{3.1}$$

where π_t is inflation rate, x_t is output gap, β measures the degree to which current inflation is determined by the expectations of future inflation, E_t is expectations operator, and v_t is exogenous shock to inflation process. However, as the standard NKPC does not have structural dependence of lagged inflation terms, many researchers now claim that it cannot account for inflation persistence. Therefore, due to empirical limitations of standard NKPC, the present study adopts the hybrid Phillips curve specification which can be written as follows,

$$\pi_t = \beta E_t \pi_{t+1} + (1 - \beta)\pi_{t-1} + \alpha_x x_t + v_t \tag{3.2}$$

However, the hybrid specification of NKPC is also not free from criticism, as there is no consensus among researchers on determining the value of β. Ball (1999) sets $\beta = 0$, so that current inflation is solely determined by past inflation, while McCallum (1997) uses $\beta = 1$ so that current inflation depends on the expectations of future inflation. However, most of the researchers tend to assume β to be less than one leaving some persistence in the inflation process. As the present study uses quarterly data, the basic form can be extended to:

$$\pi_t = \beta E_t \pi_{t+4} + (1 - \beta)(\alpha_{\pi 1}\pi_{t-1} + \alpha_{\pi 2}\pi_{t-2} + \alpha_{\pi 3}\pi_{t-3} + \alpha_{\pi 4}\pi_{t-4}) + \alpha_x x_{t-1} + u_t \tag{3.3}$$

where $\beta E_t \pi_{t+4}$ relates to expectation of average inflation over the next year. Further, one-quarter lag is used in output gap and the one year-ahead inflation is based on information set at time t. In this specification, inflation persistence is measured by the sum of coefficients on lagged inflation terms.

B. Methodology

Following Batini and Nelson (2001) this study adopts three definitions to examine inflation persistence, namely, (a) positive serial correlation in inflation (Type I inflation persistence), (b) lags between *systematic* monetary policy actions and their (peak) effects on inflation (Type II inflation persistence), and (c) lagged response to *non-systematic* policy actions - policy shocks (Type III inflation persistence). Batini (2002) and Kara and Nelson (2002) also use similar definitions.

Accordingly, type I inflation persistence is estimated using autocorrelation coefficient of price inflation process and different specifications of Phillips curve. Type II inflation persistence is examined using estimates of correlations between monetary policy measures and consumer price inflation. Type III inflation persistence is examined by using impulse response analysis.

(i) Measuring Type I Inflation Persistence

Type I inflation persistence relates to "a reduced form property of inflation" which can be represented by three factors, namely, "underlying pricing process, conduct of monetary policy, and expectation formation process of price setting agents," Batini and Nelson (2001). Various researchers adopt this definition in measuring inflation persistence including Fuhrer and Moore (1995), Taylor (2000), Cogley and Sargent (2001) and Sbordone (2002).

The price inflation process is specified as follows,

$$\Delta cpi_t = \alpha_0 + \sum_{i=1}^{4}\alpha_1 \Delta cpi_{t-i} + \sum_{i=1}^{4}\alpha_2 \Delta oil_{t-i} + \sum_{i=1}^{4}\alpha_3 \Delta imp_{t-i}$$
$$+ \sum_{i=1}^{4}\alpha_4 \Delta reer_{t-i} + \varepsilon_t \tag{3.4}$$

where Δcpi_t is change in the domestic price level (measured by the change of consumer price index: CPI)[3]. To capture the effects of oil price shocks on domestic inflation, an 'oil inflation index' is included, and to take account of the impact of import price inflation on domestic consumer prices, an 'import price index' is used. Further, to capture the effects of exchange rate movements on domestic inflation, a term relating to change in the real (effective) exchange rate ($reer_t$) is included, which implies a depreciation of the real exchange rate improves competitiveness, thereby creating inflationary pressures on the domestic consumer prices.[4] Accordingly, the expected sign of all the independent variables and the lagged inflation term is positive. ε_t is the stochastic white noise error term. The term Δcpi_{t-i} is of prime interest which explains the inertial nature of price inflation.

In order to examine possible shifts in price inflation process and how they may be reflected in corresponding shifts in the Phillips curve [as documented by AS (1991)], three

alternative Phillips curve specifications are used. The reason to test different versions of the Phillips curve is motivated by the literature on both theory and empirics. The standard Phillips curve specification which is built upon closed economy assumptions is slightly modified to represent open economy characteristics by including terms relating to oil price inflation and import price inflation. Further, real exchange rate term is also included in consistent with various studies which examine open economy inflation dynamics [Ball (1999), Kara and Nelson (2002)].

(a) Price-Based Phillips Curve:

$$\Delta cpi_t = \sum_{i=1}^{4}\gamma_1 \Delta cpi_{t-i} + \sum_{i=1}^{8}\gamma_2 \Delta gap_{t-i} + \sum_{i=1}^{4}\gamma_3 \Delta oil_{t-i}$$
$$+ \sum_{i=1}^{4}\gamma_4 \Delta imp_{t-i} + \sum_{i=1}^{4}\gamma_5 \Delta reer_{t-i} + v_t \tag{3.5}$$

Interpretation of the variables is same as in the price inflation process. The output gap measure refers to the difference between actual output and the natural level of output. All variables enter with four lags, except for the output gap measure, as it is assumed to have effects on inflation well over a year. v_t refers to stochastic disturbance term.

(b) Standard New Keynesian Phillips Curve (NKPC):

$$\Delta cpi_t = \sum_{i=1}^{4}\eta_1 E_t \Delta cpi_{t-i} + \sum_{i=1}^{8}\eta_2 \Delta gap_{t-i} + \sum_{i=1}^{4}\eta_3 \Delta oil_{t-i}$$
$$+ \sum_{i=1}^{4}\eta_4 \Delta imp_{t-i} + \sum_{i=1}^{4}\eta_5 (\Delta reer_t - E_t \Delta reer_{t+i}) + v_t \tag{3.6}$$

The standard NKPC defers from the price based Phillips curve on two counts. First, the term $E_t \Delta cpi_{t-i}$, which accounts for the impact of inflation expectations on current inflation. Because data series on inflation expectations is not available in Sri Lanka, an inflation forecast series is obtained by using the estimates of the price inflation process (equation 3.4). Of the options available to generate an inflation forecast, *one-step ahead static* forecasting is preferred to *dynamic* forecasting, because, the former uses actual values for lagged inflation rather than forecast values. Accordingly, equation 3.4 can be rearranged to represent the *one-step ahead static* forecasting process.

3/ See Appendix A for a detailed description of date series and sources.

4/ The procedure adopted in computing the real (effective) exchange series is shown in the data appendix.

$$\Delta \hat{c} pi_{t+i} = \hat{c}(1) + \hat{c}(2)\Delta oil_{t+i} + \hat{c}(3)\Delta imp_{t+i} + \hat{c}(4)\Delta reer_{t+i} + \hat{c}(5)\Delta c\hat{p}i_{t+i-1} \quad (3.7)$$

Equation 3.7 assumes that cpi_t, is a function of past innovations (ε_t, $i \geq 0$), due to stationarity and, therefore, ε_{t+i} does not appear in equation 3.7, as it is uncorrelated with all observations.

Second, an openness condition ($\Delta reer_t - E_t \Delta reer_{t+i}$), is added to the standard closed economy NKPC specification followed by Kara and Nelson (2002). This relates to the difference between current real exchange rate depreciation relative to next period's expected real depreciation which accounts for the effects of changes in exchange rate depreciation on domestic consumer price inflation. Allsopp *et al.*, (2006) use the standard NKPC model with a similar *openness* condition and highlight three features of this specification, (*a*) movements in real exchange rate and inflation relative to their expected values are tightly related, (*b*) incomplete exchange rate pass-through implies only a lower value of the coefficient η_5 in equation 3.6, but not the prediction of tight conditional relationship between the exchange rate and inflation, finally, (*c*) implication of a tight relationship between nominal exchange rate and consumer price inflation, monetary policy rules. All other variables in equation 3.6 posit similar interpretation as above and v_t refers to stochastic white noise disturbances.

(c) Hybrid NKPC:

$$\Delta cpi_t = \sum_{i=1}^{4}\varphi_1 E_t\Delta cpi_{t+i} + \sum_{i=1}^{4}\varphi_2\Delta cpi_{t-i} + \sum_{i=1}^{4}\varphi_3\Delta gap_{t-i} + \sum_{i=1}^{4}\varphi_4\Delta oil_{t-i}$$

$$+ \sum_{i=1}^{4}\varphi_5\Delta imp_{t-i} + \sum_{i=1}^{4}\varphi_6(\Delta reer_t - E_t\Delta reer_{t+i}) + u_t \quad (3.8)$$

All variables are defined as above, while u_t refers to exogenous shocks which are assumed to be white noise. Thus, the hybrid version of NKPC combines the rational forward looking element with lagged inflation term which takes account of inertia in inflation. Lagged inflation term is the parameter of interest in each of the Phillips curve specification, as it explains the degree of inflation persistence. Accordingly, estimates are obtained for all these specifications and they are used to test for shifts in inflation persistence between regimes.

(ii) Testing for Shifts in Inflation Persistence and Structural Breaks

(a) Recursive Estimates

In order to identify shifts in inflation persistence, recursive estimates of the lagged inflation coefficient are obtained. Recursive estimates enable to trace evolution of coefficient on lagged price inflation as more data are used in the sample. A plot of recursive estimates on the lagged price inflation coefficient shows any structural breaks in the inflation generating process. Recursive estimates do not require a predetermined observation to be imposed in examining for structural breaks.

(b) Chow Breakpoint Tests (Parameter Stability Tests)

To examine the exact time of which the shift in inflation persistence takes place, *Chow* breakpoint tests are carried out. Breakpoint test uses the estimates of the price inflation process and Phillips curve specifications over the two regimes and examines whether there is significant parameter instability between them. Two test statistics are used in breakpoint tests namely, *F*-statistic and log likelihood ratio statistic. The *F*-statistic is obtained from the equation;

$$\Delta m_t = \frac{(RSS_R - RSS_{UR})/k}{(RSS_{UR})/(T-2k)} \quad (3.9)$$

where RSS_R is the residual sum of squares of the pooled regressions and RSS_{UR} refers to the total of the residual sum of squares of the two regressions based on sub-samples. T refers to the number of observations and k refers to the number of parameters to be estimated. Alternatively, the log likelihood ratio statistic is based on the comparison between restricted and unrestricted maximum of the log likelihood function.

(iii) Measuring Type II Inflation Persistence

Type II inflation persistence relates to the time it takes for inflation to have peak response to change in monetary policy measures. Monetary policy measures considered in this study are growth in monetary aggregates, namely, M_1, M_2 and Reserve Money and the real interest rate.

(a) Correlation Coefficient

Type II inflation is estimated through the correlation coefficients between monetary policy measures and CPI inflation. The number of leads in money and inflation are correlated in order to identify the lag between change in money and peak response of inflation. The corresponding lag relates to the maximum coefficient in the correlation matrix is taken as a measure of type II inflation persistence.

(b) Monetary Accommodation

The degree of monetary accommodation is characterised by the following equation,

$$\Delta m_t = \gamma_0 + \sum_{i=1}^{8} \gamma_1 \Delta cpi_{t-i} + \sum_{i=1}^{8} \gamma_2 \Delta ir_{t-i} + \sum_{i=1}^{8} \gamma_3 \Delta gap_{t-i}$$

$$+ \sum_{i=1}^{8} \gamma_4 \Delta m_{t-i} + \mu_t \qquad (3.10)$$

where, measures the rate of money growth as proxied by alternative monetary aggregates *i.e.*, log of narrow money supply (M_1), log of money plus quasi-money series (M_2) and Reserve Money. The explanatory variables used are lagged terms of consumer price inflation (cpi_{t-i}), interest rate (ir_{t-i}), growth of GDP (gdp_{t-i}) and lagged dependent variable. The term μ_t refers to stochastic white noise disturbance term. Accordingly, equation 3.10 examines slope difference in the monetary reaction function between exchange rate regimes. The coefficient (γ) measures the degree of monetary accommodation and is estimated by an autoregressive process with sufficient lags, as instruments.

(iv) Measuring Type III Inflation Persistence

Type III inflation persistence relates to lagged response of inflation to policy shocks (non-systematic policy actions). In order to identify inflation response to policy shocks under different exchange rate regimes, a system of equations is estimated using vector autoregressive-unrestricted (VAR) method. The VAR specification stated below embraces the characteristics of an open economy model. The theoretical underpinning of the model draws to a greater extent to the model suggested by Ball (1999). Ball's model consists of an open economy IS curve, an open economy Phillips curve and an equation linking interest rate and exchange rate. The IS curve is formed by real output variable which depends lags of interest rate, exchange rate, and lagged output and demand shocks. The open economy Phillips curve which explains inflation process, depends on lagged output, change in exchange rate and random shocks. Further, interest rate and the exchange rate are used as policy rules as chosen by the central bank.

Accordingly, the variables used in VAR include log of real output, log of consumer price inflation, interest rate, and log of real exchange rate. In order to identify inflation response to policy shocks, monetary aggregates and short term interest rates are used. Further, to account for price shocks, log of oil price inflation is included as an exogenous variable. The VAR system is specified as follows;

$$\Delta gdp_t = \alpha_1 \Delta gdp_{t-i} + \alpha_2 \Delta cpi_{t-i} + \alpha_3 \Delta ir_{t-i} + \alpha_4 \Delta reer_{t-i} + \varepsilon_{1t}$$

$$\Delta cpi_t = \beta_1 \Delta gdp_{t-i} + \beta_2 \Delta cpi_{t-i} + \beta_3 \Delta ir_{t-i} + \beta_4 \Delta reer_{t-i} + \varepsilon_{2t}$$

$$\Delta ir_t = \chi_1 \Delta gdp_{t-i} + \chi_2 \Delta cpi_{t-i} + \chi_3 \Delta ir_{t-i} + \chi_4 \Delta reer_{t-i} + \varepsilon_{3t}$$

$$\Delta reer_t = \delta_1 \Delta gdp_{t-i} + \delta_2 \Delta cpi_{t-i} + \delta_3 \Delta ir_{t-i} + \delta_4 \Delta reer_{t-i} + \varepsilon_{4t} \qquad (3.11)$$

This system of equations relates to the operating characteristics of a stationary autoregression with white noise shocks. The order of the VAR system is determined by the lag selection criteria. In this study, no attempt is made to interpret the individual VAR coefficients as they provide only little information on the overall effect of changes in policy measures on inflation. The *Impulse Response Functions* are generated through innovations to short term interest rate, change in monetary aggregates M_1, M_2 and Reserve Money. The main interest is on the responses of consumer price inflation to shocks in monetary policy measures.

IV. Findings and Analysis

The empirical findings with regard to inflation persistence across fixed and flexible exchange rate regimes are discussed here. First, the estimates of type I inflation persistence are presented as modelled by price inflation process and various Phillips curve specifications. Results of *recursive estimates and parameter stability tests* are also discussed. Second, estimates of type II inflation persistence are discussed as measured by correlation between money and inflation, as well as by monetary accommodation coefficients. Finally, results of type III inflation persistence are discussed by means of impulse response functions of an unrestricted VAR system.

A. Summary of Descriptive Statistics

In order to examine basic features of data series used in the study, descriptive statistics are computed. Table 4.1 presents a summary of descriptive statistics of all the data series. The mean and the standard deviation of each variable are shown for the entire sample period as well as for each regime, separately. Consumer price inflation shows a dramatic shift in mean inflation (about 7.50 percentage point) between the regimes, while the shift in the standard deviation is about a 1.91. Import price inflation and oil price inflation also show an increase in both measures, but the magnitude is small. Particularly, oil price inflation shows a larger shift in standard deviation in the flexible regime. Similarly, all other series show an increase in both mean and standard deviation across regimes.

Table 4.1 – Descriptive Statistics of Data Series

Series	Mean			Standard Deviation		
	Full Sample Period (1960Q1 to 2005Q4)	Fixed Regime (1960Q1 to 1977Q3)	Flexible Regime (1977Q4 to 2005Q4)	Full Sample Period (1960Q1 to 2005Q4)	Fixed Regime (1960Q1 to 1977Q3)	Flexible Regime (1977Q4 to 2005Q4)
Δcpil	8.4412	3.8322	11.3371	6.3076	3.8917	5.7978
Δoil	3.6174	2.4175	5.5544	27.4243	15.6512	39.7493
Δimp	2.9694	2.8229	3.0601	5.0381	5.6779	4.6221
ir*	10.1380	5.4718	13.0961	4.6505	1.3625	3.3963
reir*	8.1330	4.5658	10.3625	4.1342	1.5166	3.6607
exrate*	32.4104	5.8026	49.1286	30.3852	1.1395	27.8735
Δexrate	1.8651	0.9643	2.4231	6.8720	4.8309	7.8448
reer*	71.2536	31.4262	96.2779	32.2431	5.3107	6.6087
Δreer	1.0224	1.2566	0.8774	9.1535	7.5469	10.0504
Δrmoney	3.1137	2.5884	3.7345	5.9170	7.1386	4.9903
Δm1	2.9990	2.1434	3.5337	4.5565	3.8164	4.9042
Δm2	3.6875	2.4794	4.4426	3.7167	3.2000	3.8293
Δgdp	1.1918	0.9425	1.3462	3.7847	0.5907	4.7957
No. of Observations	184	71	113	184	71	113

Notes: * refers to series which are in levels, while others are in log differences.

All series are in logs except for ir* and reir*. Data definitions and sources are in the Appendix A.

B. Unit Root Tests

Time series data often tend to be trended. In order to avoid spurious regressions resulted from time trended data, it is common to test for stationarity of data series. Therefore, as the first step, Unit Root Tests are carried out for all the data series using Augmented Dickey Fuller (ADF) method. Results are reported in Table 4.2. First, all the series (seasonally adjusted) are tested for unit roots at levels, before and after taking logs (the interest rate series are not logged). Results show that all the data series except the real interest rate (*reir*) and output gap (*gap*) are non-stationary at levels, before and after logged. Therefore, log difference is obtained for these series. The log differenced series are stationary, I(0), at conventional significance levels. The results are also confirmed by the Phillips-Perron test.

Table 4.2 – Results of the Augmented Dickey-Fuller (ADF) Test for Unit Roots

Series	Levels I		Log Levels II		Log Difference III	
	T-statistic	No. of Lags	T-statistic	No. of Lags	T-statistic	No. of Lags
Δcpi	5.1201 (1.0000)	11	3.3221 (1.0000)	4	-3.8945* (0.0026)	4
Δimp	-1.9432 (0.6267)	1	-0.9974 (0.9408)	2	-4.4804* (0.0003)	1
Δoil	-1.7552 (0.7259)	1	-1.707 (0.748)	4	-6.2632* (0.0000)	4
ir	-2.6541 (0.2574)	4	--		-6.6921* (0.0000)	4
reir	-3.1865** (0.0432)	2	--		--	
gdp	1.2032 (1.0000)	5	1.2178 (1.0000)	5	-7.1302* (0.0000)	2
exrate	2.3328 (1.0000)	4	-0.9271 (0.9496)	4	-7.1909* (0.0000)	4
reer	-1.3645 (0.5998)	4	-1.5912 (0.793)	4	-6.1270* (0.0000)	4
gap	--		-5.50* (0.0000)	4	--	
Δrmoney	5.4408 (1.0000)	1	-1.956 (0.6497)	1	-16.4412* (0.0000)	4
Δm1	3.3802 (1.0000)	10	-2.4385 (0.3646)	12	-5.0412* (0.0000)	3
Δm2	2.2378 (1.0000)	13	-2.4321 (0.3650)	4	-3.7901* (0.0035)	3

Notes: MacKinnon critical values for rejection of hypothesis of a unit root are used. *, **, and *** indicate significance levels at 1%, 5% and 10% respectively. P-values are presented in parentheses. The optimal lag length based on SIC criterion is presented. For variables *ir, reir, exrate, reer,* and *oil* 'user specified' lag lengths are used. Further, *ir, reir, exrate,* and *reer* are tested only with a *constant (without a trend)* and other series are tested constant with a trend. The series *ir* and *reir* are not in logs.

C. Estimates of Type I Inflation Persistence

This section describes the estimates of price inflation process and Phillips curve specifications, with more emphasis on lagged inflation coefficient which relates to degree of inflation persistence. First, results of price inflation process are described, followed by a discussion on recursive estimates of lagged price inflation coefficient. Results of Chow parameter stability tests are described next. Second, estimates of Phillips curve specifications are presented with a discussion on recursive estimates and breakpoint tests in the context of shifts in inflation persistent across exchange rate regimes.

(i) Price Inflation Process

Price inflation process includes lags of consumer price inflation, oil price inflation, real import price inflation and real effective exchange rate. The ordinary least squares (OLS) estimates of the price inflation process (equation 3.4) are presented in Table 4.3, for the whole sample period as well as for each regime, separately. Inflation persistence is measured by lagged price inflation coefficient which is about 46.95 per cent for the full sample period with only the first quarter lag being statistically significant. Results show an increase in inflation persistence between the regimes but the change is small (about 4.01 percentage points).

The impact of oil price inflation on domestic consumer price inflation is significant after 2 lags but its magnitude is small. This may be due to the deficiencies in the CPI index (1952=100) used, which bears only smaller weight on fuel (4.30 per cent) and, moreover,

the prices are administered by the government. (An alternative consumer price index does not exit for the entire sample period in quarterly frequency).

The real import price inflation which can partly account for oil price changes, is significant after three lags, and the magnitude is larger, compared to oil price inflation. The effect of import price inflation on consumer prices has been about 14.62 per cent in the flexible regime, while in the fixed regime none of the lags appears to be significant at conventional significance levels. The inclusion of real exchange rate in the price inflation process improves overall significance of the regression even though its impact seems to be minimal, also the coefficients are only weakly significant.

Further, in order to test for evidence of a shift in inflation persistence, recursive estimates of lagged inflation coefficient are obtained without imposing a predetermined date (observation) for a possible structural break. Figure 4.1 shows a plot of the recursive estimates, which, in general, ignores some observations in the first few years. As shown in the figure, there is some evidence of a structural break in late 1970s and it is more apparent during the year 1979/80. As described earlier, the period starting from late 1970s up until late 1980s has been very significant for Sri Lanka, in many ways. During that period major economic and institutional changes occurred, specially, the year 1977 is considered as a breakpoint for many reasons. Introduction of open economic policies which includes current account liberalization, switching from fixed exchange rate to managed exchange rate, and establishment of new constitution for the country which lead to redefining the role of economic policy for price controls, wage bargaining and fiscal policy stance etc. Therefore, it is far from clear, at this stage, that the evidence of structural break can solely be attributed to the regime change, because of several changes introduced in macroeconomic policy stance in Sri Lanka during that period.
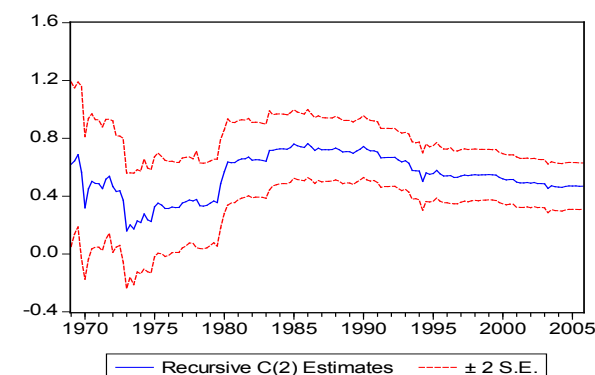
Table 4.3 – Estimates of Consumer Price Inflation Process

Dependant Variable: Consumer Price Inflation

$$\Delta cpi_t = \alpha_0 + \sum_{i=1}^{4} \alpha_1 \Delta cpi_{t-i} + \sum_{i=1}^{4} \alpha_2 \Delta oil_{t-i} + \sum_{i=1}^{4} \alpha_3 \Delta imp_{t-i} + \sum_{i=1}^{4} \alpha_4 \Delta reer_{t-i} + \varepsilon_t$$

Independent Variable	Full Sample Period (I)	Fixed Exchange Rate Regime (II)	Flexible Exchange Rate Regime (III)
Constant	0.0063 (0.0022)	0.0029 (0.0020)	0.0135 (0.0044)
Δcpi	0.4695(1) (0.0801)	0.3734(1) (0.1489)	0.4135(1) (0.1063)
Δoil	0.0201(2) (0.0083)	0.0176(2) (0.0092)	0.0225(2) (0.0129)
Δimp	0.0814(3) (0.0405)	–	0.1462(3) (0.0178)
$\Delta reer$	0.0353(3) (0.0179)	–	0.0500(1) (0.0274)
No. of Observations (after adjusting end points)	117	64	113
Durbin-Watson Statistic	1.98	1.91	1.99
Serial Correlation (LM Test)	0.62	0.67	0.52
R-Squared	0.36	0.53	0.32

Notes:

1. Asymptotic standard errors are in parentheses below the estimated coefficients. Four lags of each variable are used as instruments Only the statistically significant lags are reported with the lag number in parentheses besides the coefficient.
2. The Breusch-Godfrey Lagrange multiplier test is the most appropriate for testing serial correlation when the lagged dependent variables exist in the right hand side of the regression. The probability value for rejecting the null hypothesis of *no serial correlation* is reported.

Figure 4.1 – Recursive Estimates of Lagged Price Inflation Coefficient of Price Inflation Process

Table 4.4 – Chow Breakpoint Tests of Price Inflation Process

	Breakpoints			
	1977Q4	1978Q1	1979Q1	1980Q1
F-statistic	1.5695	1.6917	1.9001	1.7092
	(0.0798)	(0.0505)	(0.0223)	(0.0473)
Log likelihood ratio	30.2815	32.4342	36.0477	32.7419
	(0.0243)	(0.0133)	(0.0045)	(0.0121)

Note: The probability values are presented in parenthesis below the computed test statistics.

In order to examine whether the shift in inflation exactly coincides with the period of regime change, Chow breakpoints tests are carried out. Chow test assumes that there is parameter stability during the full sample period and therefore, the null hypothesis is set out as the estimates reported in columns II and III in Table 4.3 are statistically the same. Results are presented in Table 4.4. For this test, four observation points are used during the period of economic liberalization. The first point (1977Q4) relates to the period of regime change and, others are subsequent periods which may capture any lag effect in the adjustment process followed by the policy change.

As Table 4.4 shows, there is evidence of structural break during the period of regime change. The null hypothesis of *no structural break* is rejected at 5 percent significance level by the Log Likelihood ratio, while at 10 per cent level by the F-statistic. However, the observation point which relates to the quarter immediately after the regime change becomes significant at 5 percent level as indicated by both test statistics. Further, evidence on structural breaks is more apparent in the year 1979/80, which may, perhaps, be due to the accumulated effects of various policy changes introduced during that period. On the other hand, this suggests a gradual adjustment process of inflation expectations of public, as they perceive inflation to be high followed by the regime change.

Overall, there is substantial evidence of parameter instability in the estimates of consumer price inflation process before and after the regime change. In the remainder of this section, this evidence is re-examined with estimated parameters of different Phillips curve specifications.

(ii) Price Based Open Economy Phillips Curve

In order to identify whether shifts in consumer price inflation process seem to generate corresponding shifts in parameters of the Phillips curve, three open economy Phillips curve specifications are used, namely, the traditional price-based Phillips curve (purely backward looking), the standard new Keynesian Phillips curve (NKPC - purely forward looking), and the hybrid NKPC (incorporating both forward and backward looking elements). The OLS

Table 4.5 – Estimates of Open Economy Price-Based Phillips Curve

Dependant Variable: Consumer Price Inflation

$$\Delta cpi_t = \sum_{i=1}^{4}\gamma_1 \Delta cpi_{t-i} + \sum_{i=1}^{8}\gamma_2 \Delta gap_{t-i} + \sum_{i=1}^{4}\gamma_3 \Delta oil_{t-i}$$

$$+ \sum_{i=1}^{4}\gamma_4 \Delta imp_{t-i} + \sum_{i=1}^{4}\gamma_5 \Delta reer_{t-i} + v_t$$

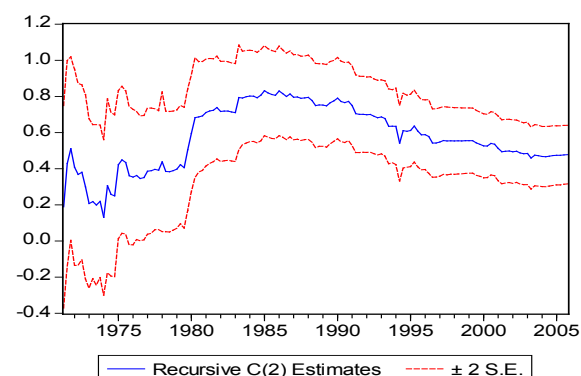| Independent Variable	Full Sample Period (I)	Fixed Exchange Rate Regime (II)	Flexible Exchange Rate Regime (III)
Δcpi	0.4782(1)	0.3966(1)	0.4041(1)
	(0.0809)	(0.1672)	(0.1099)
gap	0.6481(7)	--	0.5823(7)
	(0.2748)		(0.3551)
Δoil	0.0196(2)	0.0226(2)	--
	(0.0211)	(0.0107)	
Δimp	0.0824(3)	--	0.1446(3)
	(0.0417)		(0.0625)
Δreer	0.0351(3)	--	0.0551(3)
	(0.0180)		(0.0283)
No. of Observations (after adjusting end points)	176	63	113
Durbin-Watson Statistic	1.99	1.92	1.99
Serial Correlation (LM Test)	0.46	0.61	0.52
R-Squared	0.40	0.60	0.36

Notes:
1. Asymptotic standard errors are in parentheses below the estimated coefficients. Four lags of each variable are used as instruments Only the statistically significant lags are reported.
2. The Breusch-Godfrey Lagrange multiplier test and the Durbin-Watson statistic are used to test serial correlation. The probability value for rejecting the null hypothesis of *no serial correlation* is reported.

estimates of the price based Phillips curve (equation 3.5) are presented in Table 4.5, for the full sample period and each regime as well.

Results are almost identical to the estimates obtained for the consumer price inflation process. Overall, inflation persistence during the full sample period is marked at 47.82 per cent, while fixed and flexible regimes report 39.66 and 40.41 per cent, respectively. The shift in inflation persistence across regimes is 0.75 per cent which is borderline. Estimates of output gap measure[5] is in expected sign and becomes significant after seven lags. However, none of the lags of output gap measure becomes statistically significant in the fixed regime. Output

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5/ Output gap measure is computed as the difference between log of real GDP (seasonally Adjusted) and the long-term trend output as obtained from the Hodrick-Prescott (HP) filter, using the smoothing parameter 1600 to represent quarterly frequency of data.

Figure 4.2 – Recursive Estimates of Lagged Price Inflation Coefficient in Open Economy Price-Base Phillips Curve

hypothesis of no structural break at any conventional significance levels for any observation point, the Log Likelihood ratio provides evidence of a structural break during the period of regime shift (1977Q4) at 10 per cent significance level. Further, there is strong evidence of a structural break during the period after about a one year of the regime change, implying gradual adjustment process of inflation expectations, followed by the policy change.

(iii) Open Economy New Keynesian Phillips Curve (NKPC)

As described above, NKPC is defined; current inflation as a function of next period's expected inflation and deviation of lagged output from its potential level. Inflation expectations are proxied by an inflation forecast generated using the *one-step ahead static* forecasting method. As described, the estimates of price inflation process (equation 3.4) are used to generate inflation forecast series. A plot of the inflation forecast series is shown in Figure 4.3. Of the options available to generate inflation forecast, the *static* forecasting is more accurate than dynamic forecasting, because it uses actual lagged inflation values rather than forecasted values. A plot of the actual and fitted values are shown in Figure 4.4, while Figure 4.5 shows the deviation of inflation forecast from the actual inflation, which indicates larger variations during the flexible regime.

In order to verify robustness of the forecast series, a forecast evaluation is conducted. Results are shown in Table 4.7. The smaller values of the *Root Mean Squared Error (RMSE)* and *Mean Absolute Error (MAE)* statistics provide evidence of better fit of the forecast series. Further, the smaller values of the *Theil Inequality Coefficient* which lies between zero and one and, the *Bias Proportion* which indicates how far the mean of the forecast deviates from that of actual series, reassure the accuracy of the forecast. Moreover, smaller *variance proportion* indicates that the actual series is well represented by the forecast series.

gap measure seems to yield better results in the flexible regime despite contrasting views among researchers. Effects of oil price inflation seem to be marginal, which may, perhaps, be due to data limitations as described in the previous section. Impact of real import price inflation is significant only in the flexible regime (14.46 per cent) and it enters as significant after three lags. Further, real effective exchange rate becomes significant only in the flexible regime but its impact on inflation is low.

Because the main focus of the paper is on shifts of inflation persistence parameter, recursive estimates of lagged inflation coefficient are obtained and results are plotted in Figure 4.2. Similar results are observed as in the price inflation process which provide evidence of a shift in inflation persistence in late 1970s and it is more apparent during the year 1979/80.

In order to identify exact point of time the shift occurs, *Chow* breakpoint tests are carried out in the similar fashion, as described above. *Chow* test examines whether there is a significant difference between estimates reported in columns II and III in Table 4.5. Results are shown to be mixed as reported in Table 4.6. While the *F*-statistic cannot reject the null

Table 4.6 – Chow Breakpoint Tests of Open Economy Price-Base Phillips Curve

	Breakpoints			
	1977Q4	**1978Q1**	**1979Q1**	**1980Q1**
F-statistic	1.1021	1.1450	1.2462	1.1902
	(0.3501)	(0.3046)	(0.2135)	(0.2611)
Log likelihood ratio	34.8055	36.0306	38.8862	37.3117
	(0.0918)	(0.0711)	(0.0378)	(0.0539)

Note: The probability values are presented in parenthesis below the computed test statistics.

Figure 4.3 – Inflation Forecast Series (One-Step Ahead *Static* Forecasting)
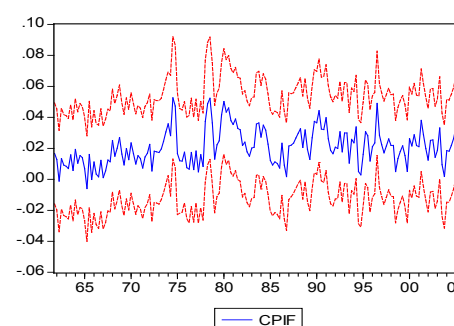

Figure 4.4 – Actual and Forecasted Inflation Series
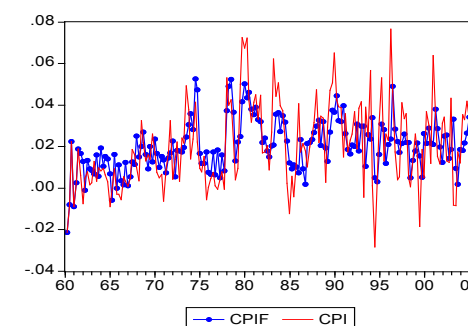
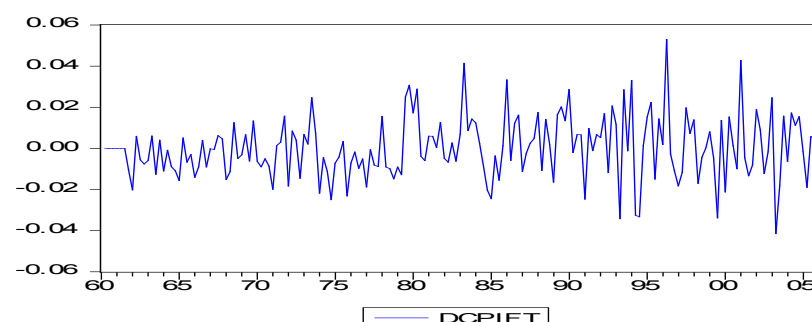### Figure 4.5 – Deviation of Inflation Forecast from Actual Inflation

Table 4.7 – Results of Inflation Forecast Evaluation

Forecast Series: CPIF
Actual Series: CPI

Root Mean Squared Error	0.015200
Mean Absolute Error	0.011918
Mean Absolute Percentage Error	164.2696
Theil Inequality Coefficient	0.292403
Bias Proportion	0.000000
Variance Proportion	0.247066
Covariance Proportion	0.752934
Sample Period : 1961Q4 to 2005Q4	
No. of Observation:	177

Estimates of the open economy standard NKPC specification are shown in Table 4.8. Results need to be interpreted cautiously. Coefficient on the expected inflation term is near unity for the full sample period suggesting the importance of accounting for inflation expectations in modelling inflation dynamics. However, the standard purely forward looking NKPC provides no evidence of inflation inertia due to non-existence of structural dependence of inflation. Output gap coefficient becomes significant after seven lags in both full sample period and the flexible regime period indicating that it takes nearly two years to have impact on price inflation. However, none of the output gap coefficients turns out to be statistically significant in the fixed regime.

None of the terms in oil price inflation is statistically significant at the conventional significance levels. However, dropping oil price inflation from the regression does not seem to improve explanatory power of the regression. Real import price inflation yields a positive but smaller impact while expected depreciation in real exchange rate shows a significant impact in the flexible regime period which is about 39.71 per cent. This implies

Table 4.8 – Estimates of Open Economy New Keynesian Phillips Curve (NKPC)

Dependant Variable: Consumer Price Inflation

$$\Delta cpi_t = \sum_{i=1}^{4}\eta_1 E_t\Delta cpi_{t-i} + \sum_{i=1}^{8}\eta_2\Delta gap_{t-i} + \sum_{i=1}^{4}\eta_3\Delta oil_{t-i}$$

$$+ \sum_{i=1}^{4}\eta_4\Delta imp_{t-i} + \sum_{i=1}^{4}\eta_5(\Delta reer_t - E_t\Delta reer_{t+i}) + v_t$$

Independent Variable	Full Sample Period (I)		Fixed Exchange Rate Regime (II)	Flexible Exchange Rate Regime (III)		
Δcpif	1.0927(3) (0.2630)	0.4630(4) (0.0586)	1.1184(1) (0.0504)	1.3229(3) (0.0017)	-0.8789(4) (0.027)	
gap	0.5445(7) (0.2183)			0.5462(7) (0.2802)		
Δimp	0.0774(1) (0.0462)	0.0753(3) (0.0382)	–	–	–	–
(Δreer – EΔreer)	0.0606(1) (0.0149)	0.0577(3) (0.0193)	–	0.1298(1) (0.0240)	0.1318(2) (0.0424)	0.1292(3) (0.0455)
No. of Observations (after adjusting end points)	171		62	109		
Durbin-Watson Statistic	1.94		2.02	1.82		
Serial Correlation (LM Test)	0.74		0.84	0.84		
R-Squared	0.42		0.58	0.48		

Notes:
1. Asymptotic standard errors are in parentheses below the estimated coefficients. Four leads of expected inflation and four lags of every other variables are used as instruments. Only the statistically significant lags are reported. The lag/lead number is indicated besides the coefficient estimate.
2. The model includes an autoregressive error term to account for serial correlation. The Durbin-Watson statistic and Breusch-Godfrey Lagrange multiplier test results are shown after inclusion of the error term. The probability value for rejecting the null hypothesis of *no serial correlation* is reported.

a fairly quicker pass-through effect in the flexible regime which results in tight relationship between real exchange rate movements and inflation. A possible channel through which this effect takes place is that an increase in activity followed by a depreciation of real exchange rate *via* increased competitiveness. On the other hand, with increased cost of production of domestic goods, potential output declines resulting a positive output gap, which eventually causes increased inflation. [See for example McCallum and Nelson (1999), and Allsopp *et al.*, (2006)].

The use of General Methods of Moments (GMM) to estimate NKPC is quite common in the literature. However, in this study, GMM estimates of standard NKPC do not yield robust results and therefore not reported. Overall, the purely forward looking standard

NKPC specification provides little evidence in explaining inflation persistence as claimed by various researchers. Rudd and Whelan (2005, p.9) reports that "[p]robably the most important implication of the NKPC model is that there is no 'intrinsic' inertia in inflation, in the sense that there is no structural dependence of inflation on its own lagged values". Therefore, in order to account for both backward and forward looking effects in inflation, hybrid NKPC is used as described in Table 4.8.

(iv) Open Economy Hybrid New Keynesian Phillips Curve (NKPC)

As discussed, price inflation process and the traditional Phillips curve (purely backward looking) show evidence of a marginal shift in inflation persistence between exchange rate regimes. However, the purely forward looking standard NKPC seems to be incapable of accounting for persistence in inflation process. In what follows, a discussion on the estimates of hybrid Phillips curve specification (equation 3.8). A summary of estimation results is shown in Table 4.9.

Overall, the impact of expected inflation on current inflation varies significantly over exchange rate regimes. The parameter of interest is the coefficient on lagged inflation which accounts for inertial behaviour of inflation. As estimates in Table 4.9 suggest, inflation persistence has been around 57.03 per cent during the full sample period which is well above the estimates of purely traditional Phillips curve specification. Moreover, persistence between regimes shows a dramatic shift of about 37.67 percentage points (*i.e.*, in the fixed regime, persistence coefficient is 26.68 per cent, while in the flexible regime it is more than double *i.e.*, 64.35 per cent). However, it is observed that the output gap measure in the hybrid specification does not yield better results as the coefficients are in wrong signs even though they become statistically significant. Further, oil price inflation does not report significant results and the coefficient on import price inflation also shows only marginal impact. However, the expected change of real exchange rate becomes highly significant in the flexible regime with an overall impact of 37.55 per cent. This can be interpreted in the same way as it is the case in estimates of standard NKPC specification. On one hand, a depreciation of real exchange rate results in an increase of output, and on the other hand, due to rise in import prices potential output declines, which eventually may give rise to a positive output gap, creating inflationary pressures on domestic consumer prices. However, in the fixed regime, none of the coefficients becomes statistically significant, which may suggest lack of expectations in real exchange rate depreciation.

In order to examine whether a shift in inflation persistence is suggestive of a structural break due to regime change, recursive estimates are carried out with respect to lagged inflation coefficient. A plot of recursive estimates is shown in Figure 4.6, which is almost identical to what is obtained in the case of price inflation process and price-based Phillips curve. There is clear evidence of a structural break in late 1970s, during the period of which

Table 4.9 – Estimates of Open Economy Hybrid New Keynesian Phillips Curve

Dependant Variable: Consumer Price Inflation

$$\Delta cpi_t = \sum_{i=1}^{4}\eta_1 E_t \Delta cpi_{t-i} + \sum_{i=1}^{8}\eta_2 \Delta gap_{t-i} + \sum_{i=1}^{4}\eta_3 \Delta oil_{t-i}$$

$$+ \sum_{i=1}^{4}\eta_4 \Delta imp_{t-i} + \sum_{i=1}^{4}\eta_5(\Delta reer_t - E_t \Delta reer_{t+i}) + v_t$$

Independent Variable	Full Sample Period (I)		Fixed Exchange Rate Regime (II)		Flexible Exchange Rate Regime (III)	
Δcpif	1.2401(3)	-0.8001(4)	1.2939(1)	1.2192(1)	2.5250(3)	-1.83576(4)
	(0.3647)	(0.2764)	(0.2478)	(0.5536)	(0.6274)	(0.4573)
Δcpi	0.5703(1)		0.2668(1)		0.6435(1)	
	(0.0858)		(0.1329)		(0.1209)	
gap	0.5884(7)	-0.5072(8)	-1.2066(7)		-0.46624(8)	
	(0.2894)	(0.2069)	(0.6061)		(0.2545)	
Δimp	0.0957(3)		0.0939(3)	--	--	--
	(0.0421)		(0.0424)			
Δ(Δreer – EΔreer)	0.0534(1)	0.0483(3)	--	0.1233(1)	0.1041(2)	0.1481(3)
	(0.0172)	(0.0193)		(0.0264)	(0.0395)	(0.0429)

No. of Observations (after adjusting end points)	172	63	109
Durbin-Watson Statistic	1.92	1.88	1.90
Serial Correlation (LM Test)	0.60	0.63	0.88
R-Squared	0.43	0.77	0.51

Notes:

1. Asymptotic standard errors are in parentheses below the estimated coefficients. Four leads of expected inflation and four lags of every other variables(except for output gap with eight lags) are used as instruments. Only the statistically significant lags are reported. The lag / lead number is indicated besides the coefficient estimate.

2. LM test reports the probability value for rejecting the null hypothesis of no serial correlation.

economic liberalization policies were introduced, and also the exchange rate regime change occurred.

However, in order to identify shift in inflation persistence coincides with the regime change, *Chow* breakpoint tests are carried out as before. *Chow* test assumes parameter stability between two regimes, *i.e.*, the estimates in columns II and III in Table 4.9 are statistically the same. Results are summarised in Table 4.10. Both the *F*-statistic and the log Likelihood ratio provide strong evidence of parameter instability between regimes, rejecting the null hypothesis of *no structural break* at 1 per cent level for all the breakpoints considered. Further, evidence of a structural break becomes more apparent even after two years of the

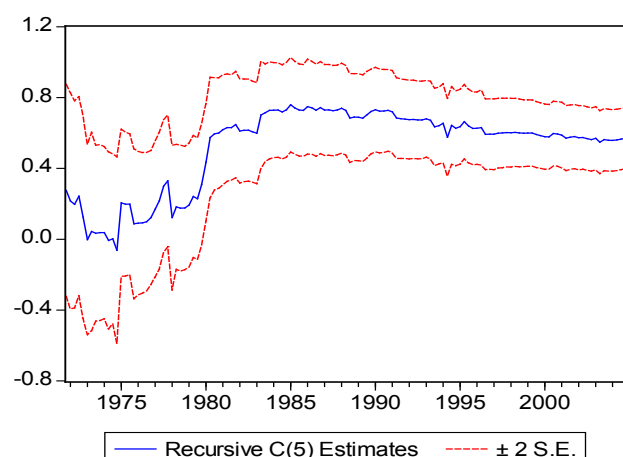**Figure 4.6 – Recursive Estimates of Lagged PriceInflaction Coefficient of Open Economy Hybrid NKPC**

Recursive C(5) Estimates   ----- ± 2 S.E.

Table 4.10 – Estimates of Chow Breakpoint Tests of Hybrid NKPC

	Breakpoints			
	1977Q4	**1978Q1**	**1979Q1**	**1980Q1**
F-statistic	1.8845	2.0889	2.0907	1.9211
	(0.0104)	(0.0034)	(0.0034)	(0.0086)
Log likelihood ratio	64.4876	70.2215	70.2729	65.5299
	(0.0001)	(0.0000)	(0.0000)	(0.0000)

Note: The probability values are presented in parenthesis below the computed test statistics.

regime change, suggesting gradual adjustment process of expectations subsequent to the policy changes.

Overall, inflation persistence as measured by type I definition, seems to have been highly persistent in the flexible regime than in the fixed regime, as evidenced by estimates of price inflation process, price based Phillips curve and the hybrid Phillips curve. Further, as shown in recursive estimates and Chow tests for the hybrid NKPC specification, there is strong evidence of parameter instability before and after the exchange rate regime change.

D. Estimation of Type II Inflation Persistence

Type II inflation persistence refers to *systematic* component of monetary policy actions and is measured by lags between the change in monetary policy measures and the peak effects of inflation. As described in the previous section, price inflation process indicates a slight shift in persistence parameters with the regime change, and the hybrid NKPC estimates provide strong evidence in support of a dramatic upward shift of inflation persistence between regimes. One of the major conclusions of AS (1991) is that "the persistence of inflation is a positive function of the degree of monetary and exchange rate accommodation" (p.1272). Accordingly, they show that the higher monetary accommodation of inflation, in the flexible regime, leads to increased inflation persistence. However, this proposition is challenged by recent studies. For example, Bleaney (2001) argues that "[t]here is no presumption, that monetary policy will *necessarily* be more accommodating under floating rate" (p.396). Therefore, the aim of this section is to empirically test these contrasting views. First, the correlation tests are carried out in order to gauge any relations between change in monetary policy measures and inflation. Second, the degree of monetary accommodation is examined during the fixed and flexible regimes, separately.

(i) Correlations between Monetary Policy Measures and CPI Inflation

In Sri Lanka, monetary policy operates through a monetary targeting framework. Major monetary policy tools used are (active) Open Market Operations (OMO), Statutory Reserve Requirement (SRR) and the Bank Rate (the lending rate to commercial banks by CBSL). The annual report for published by the Central Bank for 2005 states that "[t]he Central Bank conducted monetary policy operations within the monetary targeting framework, under an independent floating exchange rate system" (CBSL Annual Report, 2005, p.114). Accordingly, CBSL currently adopts the Reserve Money (high powered money) as the operating target while a broad money measure $(M_{2b})^6$ as the intermediate target. However, the use of M_{2b} as a policy measure is a recent development aimed at taking account of the impact of Foreign Currency Banking Units (FCBUs), on the domestic economy. Historically, CBSL has used narrow money (M_1) as the policy measure followed by broad money (M_2) in the 1980s, with the rapid expansion of economic activities. Therefore, this study will use all three measures of money supply and short term real interest rate in order to examine type II inflation persistence. A review of previous work on measuring type II inflation persistence provides no evidence of a commonly agreed measure to estimate inflation persistence and also there is no appropriate statistic (Batini, 2002). Therefore, examining with several policy measures would provide fuller description of data and strengthen the analysis. Results, thus obtained, are summarised in Table 4.11.

6/ The consolidated broad money (M_{2b}) includes broad money plus the operations of foreign currency banking units (FCBUs).

Table 4.11 – Correlations between CPI Inflation and Monetary Policy Measures

Period	Monetary Policy Measure			
	Money Growth			Change in Short term Real Interest Rate
	M_1	M_2	Reserve Money	
Full Sample (1960Q1– 2005Q4)	0.1551(7)	0.2248(14)	0.1943(10)	-0.1613(4)
Fixed Exchange Rate Regime (1960Q1 – 1977Q3)	0.1285(7)	0.2046(4)	0.2210(9)	-0.2048(1)
Flexible Exchange Rate Regime (1977Q4 – 2005Q4)	0.3612(11)	0.2946(14)	0.2661(10)	-0.1936(4)

Notes: Maximum values of the correlation estimates are reported with number of leads (in quarters) in parentheses.

As Table 4.11 shows, correlation estimates of all monetary policy measures over CPI inflation are significantly smaller through out the sample period. This suggests a modest relation between money and inflation during the period under study. However, when considered the estimates separately across regimes, coefficients are slightly higher in the flexible regime. Overall, the number of lags between the change in monetary aggregates and the peak effects of inflation is found to be larger in the flexible exchange rate regime than in the fixed regime, which in turn implies higher persistence.

During the fixed regime, inflation responds fairly quickly to M_2 and it reaches maximum after four quarters of change in M_2, suggesting lower persistence. However, response of inflation to M_1 and Reserve Money takes comparatively longer lags. On the other hand, response of inflation to real interest rate seems fairly quicker during the fixed regime. A possible reasoning for this response is, perhaps, the use of more direct controls by the Central Bank to curtail inflation during that period. However, estimates of interest rate as a monetary policy tool does not seem to yield significant results during the fixed regime period. However, during that period Bank Rate has been more prominent as a policy rule.

By contrast, during flexible regime, peak response of inflation to M_2 records after fourteen quarters which indicates higher inflation persistence. The maximum response of inflation to changes in M_1 and Reserve Money takes eleven and ten quarters, respectively. Further, response of inflation to real interest rate shows four quarter lag in the flexible regime, however the correlation is comparatively low. The weak correlation between interest rate and consumer price inflation in Sri Lanka may, perhaps, be due to under-developed financial sector and inefficiency in banking sector, the points highlighted in previous country studies, Thenuwara (1998).

Overall, results suggest that the lag between monetary policy actions and inflation has widened dramatically before and after the regime change. Several researchers attempt to

measure the relationship between money growth and inflation using data for developed countries. Batini and Nelson (2001) use monthly data for U.S. and U.K. for the period February 1953 to August 2001. They show that the lead of money over inflation ranging from 12 to 49 months (*i.e.*, nearly 4 to 16 quarters) for U.S. and that of U.K. is 6 to 24 months (*i.e.*, nearly 2 to 8 quarters). But they do not relate these difference estimates with the changes of policy regimes. Similarly, Batini (2002) uses quarterly data to model inflation persistence in the Euro area and estimates a lead of money growth over inflation ranging from 2 to 16 quarters for the period 1970Q1 to 2000Q4. Both studies find significant correlations between monetary policy measures and consumer inflation.[7] However, their results are not directly comparable with the findings of the present study, due to differences in country sample.

(ii) Estimates of Degree of Monetary Accommodation

In order to examine type II inflation persistence further, the monetary accommodation parameters are examined, as suggested by AS (1991). AS show that changes in international monetary and exchange rate regimes were associated with corresponding changes in monetary accommodation. Accordingly, they examine the degree of monetary accommodation assuming exogenous component of money supply rule is a random walk with a drift (p.1269).

The process of monetary accommodation is a simple monetary policy reaction function which describes the central bank behaviour in response to changes in price level as a feedback rule. The coefficient on lagged inflation term measures the degree of monetary accommodation, where setting it equal to zero means no monetary intervention by the central bank (*i.e.*, the case of independent float), while it is being equal to unity means perfect monetary accommodation, where price shocks are completely offset by changes in money supply (Akiba, 2002). Further, more than unity coefficient value implies that rise in price level leads to under proportionate adjustment in nominal money supply while less than unity coefficient relates to over proportionate adjustment. The former case leads to decrease in real money balances while latter leads to an increase of real balances. If the monetary accommodation coefficient takes a negative value, central bank reacts to an increase in price level by reducing the nominal money supply. Accordingly, tests of monetary accommodation coefficients across the regimes are conducted using equation 3.10. However, more lags need to be allowed in instrumental variables than in the original specification, as shown in Table 4.12 and Table 4.13 for the fixed and flexible regimes, respectively.

Initially, the regression was specified with four dependent variables, namely, lagged terms of consumer inflation, short term interest rate, real GDP growth and lagged terms of the dependent variable. However, last two variables do not yield significant results at conventional significance levels, therefore the coefficients are not reported.

7/ Batini and Nelson (2001) adopt adjusted money base, M_2 and change in short real rate as monetary policy measures while Batinil(2002) uses M_3 and short real rate.

Table 4.12 – Estimates of Monetary Accommodation Coefficients in Fixed Exchange Rate Regime

Dependent Variable : Growth in Money Supply

$$\Delta m_t = \gamma_0 + \sum_{i=1}^{12} \gamma_1 \Delta cpi_{t-i} + \sum_{i=1}^{8} \gamma_2 \Delta ir_{t-i} + \sum_{i=1}^{8} \gamma_3 \Delta gap_{t-i} + \sum_{i=1}^{12} \gamma_4 \Delta m_{t-i} + \mu_t$$

Independent Variable	M_1		M_2		rMoney	
Constant	0.0322		0.0311		0.0277	
	(0.0104)		(0.0086)		(0.0153)	
Δcpi	-1.9499(5)	1.2235(6)	-1.816(5)	1.0304(6)	-1.3156(9)	1.0228(10)
	(0.5580)	(0.5456)	(0.4637)	(0.4535)	(0.7826)	(0.7221)
ir	-0.0964(3)		-0.0439(3)		-0.0626(7)	
	(0.0262)		(0.0218)		(0.0361)	
No. of Observations (after adjusting end points)	62		62		58	
Durbin-Watson Statistic	2.07		1.88		2.29	
Serial Correlation (LM Test)	0.69		0.92		0.31	
R-Squared	0.47		0.42		0.50	

Notes:

1. Asymptotic standard errors are in parentheses below the estimated coefficients. Only the statistically significant lags are reported. The lag number is indicated in parentheses besides the coefficient estimate. The lagged values of dependent variable and the GDP are found to be insignificant in standard significance levels.
2. LM test reports the probability value for rejecting the null hypothesis of *no serial correlation.*

Table 4.13 – Estimates of Monetary Accommodation Coefficients in Flexible Exchange Rate Regime

Dependent Variable : Growth in Money Supply

$$\Delta m_t = \gamma_0 + \sum_{i=1}^{12} \gamma_1 \Delta cpi_{t-i} + \sum_{i=1}^{8} \gamma_2 \Delta ir_{t-i} + \sum_{i=1}^{8} \gamma_3 \Delta gap_{t-i} + \sum_{i=1}^{12} \gamma_4 \Delta m_{t-i} + \mu_t$$

Independent Variable	M_1	M_2	rMoney
Constant	0.0242	0.0127	0.0006
	(0.0152)	(0.0120)	(0.0147)
Δcpi	–	0.3294(4)	0.4476(12)
		(0.1774)	(0.2419)
ir	-0.0047(4)	-0.0044(4)	-0.0047(8)
	(0.0019)	(0.0015)	(0.0020)
ΔLagged Dependant Variable	0.3206(4)	0.3411(4)	0.2472(3)
	(0.1074)	(0.1058)	(0.0991)
No. of Observations (after adjusting end points)	112	112	112
Durbin-Watson Statistic	1.98	1.97	1.98
Serial Correlation (LM Test)	0.32	0.54	0.71
R-Squared	0.40	0.42	0.39

Notes:

1. Asymptotic standard errors are in parentheses below the estimated coefficients. Only the statistically significant lags are reported. The lag number is indicated in parentheses besides the coefficient estimate. The coefficients of lagged GDP terms as an explanatory variable are found to be insignificant at conventional significance levels.
2. LM test reports the probability value for rejecting the null hypothesis of *no serial correlation.*

As shown, coefficients on M_1 and M_2 are significant in fifth and sixth lags at 5 per cent significance level. Overall, the impact of monetary growth in response to changes in inflation has been negative, where, the sum of coefficients is about -0.75 per cent in both M_1 and M_2 estimates. This indicates that during the fixed regime, monetary policy is shaped by stringent policy stance, where no monetary accommodation of inflation differentials. Moreover, the coefficient on response of Reserve Money is also negative. It is important to note that most of the previous studies focus on the experience in developed countries and therefore their conclusions may not be directly comparable with the findings of the present study.

In addition to the degree of monetary accommodation, coefficients on lagged interest rate terms provide evidence on the slower adjustment of nominal money supply to changes in the interest rates. As shown in Table 4.12, the changes in interest rates affect nominal money supply growth with a three quarter lag in case of both M_1 and M_2, and with seven quarters in Reserve Money. However, the coefficient estimates are smaller in magnitude.

As shown in Table 4.13, results in the flexible regime are mixed. Coefficients on lagged inflation terms in the regression for M_1 are found to be insignificant. However, significant coefficients are obtained when more lags are added (*e.g.:* lag 15), however, with wrong sign. In contrast, estimates of lagged M_2 and Reserve Money terms become significant in fourth lag for M_2 and twelfth lag for Reserve Money. Both coefficients suggest only lower degree of accommodation in the flexible regime which indicates an over proportionate adjustment of nominal money supply in response to inflation. Among the monetary policy measures considered, M_2 shows comparatively quicker adjustment in response to inflation which is approximately within an year, while Reserve Money, in contrast, takes almost three years.

As shown in Table 4.13, effects of interest rate changes on money growth have been marginal during the flexible regime. Coefficients on lagged interest rate terms are in the expected sign, but very smaller in magnitude. This suggests that during the flexible regime, adjustment of nominal money for changes in interest rates shows only moderate relationship. Overall, results suggest that during the flexible regime, there is some evidence on more monetary accommodation compared to fixed exchange rate regime which results in higher inflation persistence. There is no evidence on monetary accommodation during the fixed
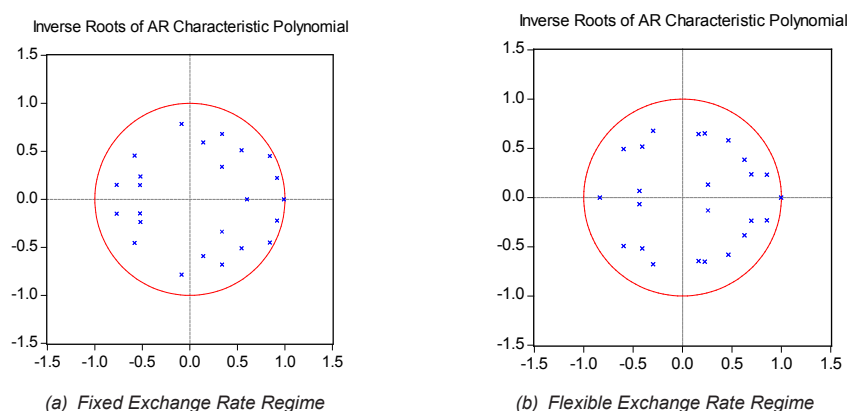
regime, while the monetary policy has been most relying on direct controls. Among the alternative policy measures, M_2 seems to generate better results, however, the effectiveness of M_2 as a monetary policy measure has not been significant during the flexible regime.

E. Estimates of Type III Inflation Persistence

As described, type III inflation persistence relates to lagged response of inflation to policy shocks (*non-systematic* policy actions). In order to identify the behaviour of lagged inflation on policy shocks, the VAR system is estimated over two regimes. Then, the impulse response functions are obtained on innovations to different monetary policy measures namely, short term interest rate and growth in monetary aggregates *i.e.,* M_1, M_2 and Reserve Money. The impulse response functions are used to examine the number of lags of peak inflation response to policy shocks.

In specifying VAR, ordering of variables is important. The ordering used in this study is: output, inflation, real exchange rate and interest rate, which is in line with previous research [see for example Bernanke and Blinder (1992), Bernanke and Mihov (1998)]. This implies that policy shocks have no contemporaneous impact on output. However, this assumption heavily relies on frequency of data, *i.e.,* the more frequency of data, the better would be the plausibility of the assumption. Apparently, quarterly data seem to be more plausible when compared to annual data, given monthly data would be more appropriate, but not available for all series for the entire sample period). Further, in order to avoid a potential problem of VAR estimates *i.e.,* the price puzzle (a positive shock to interest rate tends to be followed by a rise in the price level), oil price index is included as an exogenous variable in the VAR system. Inclusion of inflation-sensitive prices such as oil and commodity prices in the VAR system is regarded as the most apparent remedy for the price puzzle.
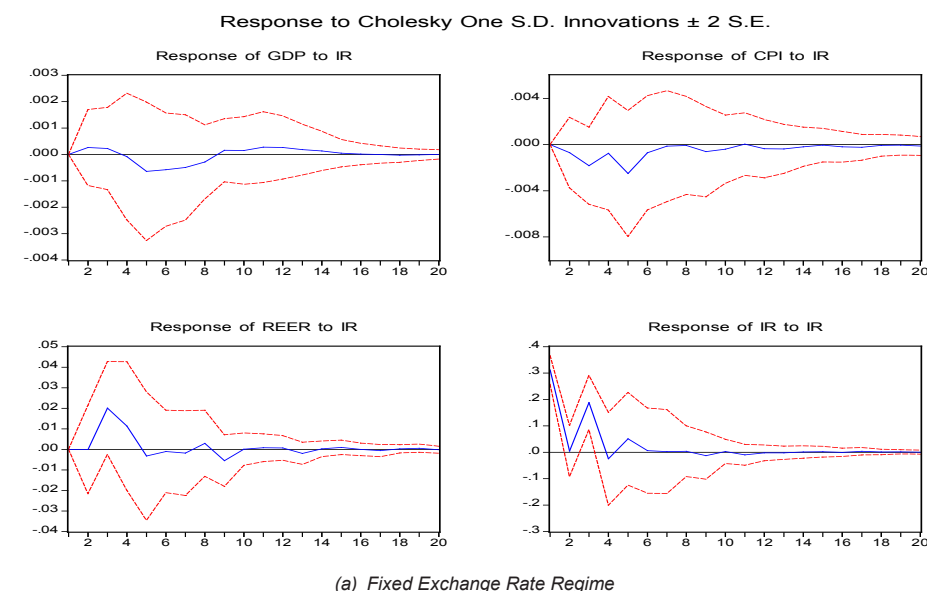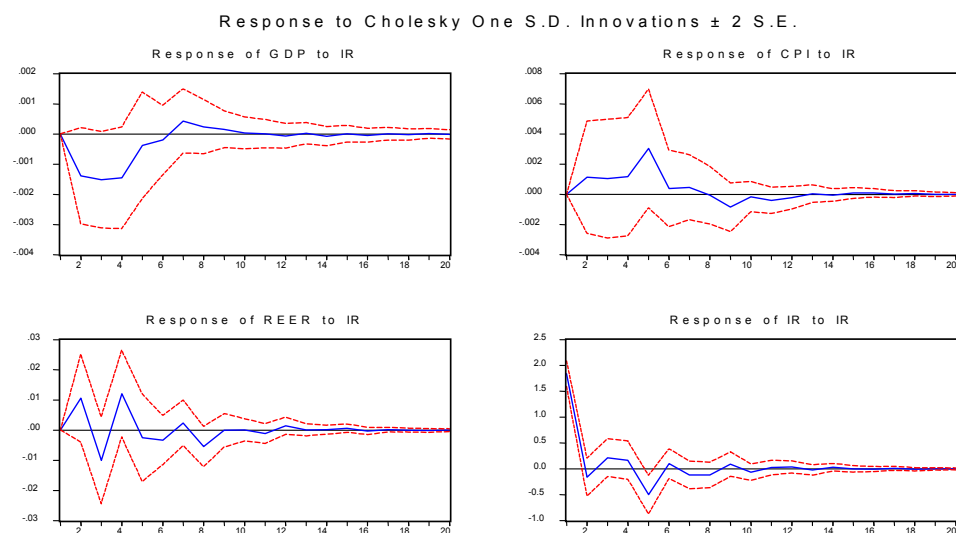
Before estimating the VAR system as specified in equation 3.11, its stability is verified using inverse roots of the characteristic polynomial. As shown in Figure 4.7, all roots lie inside the unit circle for both cases of fixed and flexible exchange rate regimes.

Further, the VAR system is estimated using four lags as suggested by VAR lag order selection criteria. Both Akaike Information Criterion (AIC) and 'sequential modified LR test statistic' (each test at 5 per cent level) suggest four lag structure as the optimal for the system. Estimates are obtained for the two regimes separately. Based on VAR estimates, impulse response functions are obtained for shocks on monetary policy measures with 'analytic (asymptotic)' standard errors. The responses include two standard error bands with *Choleski* one standard deviation (SD) innovations. All impulse responses are obtained for a period of 20 quarters. The main interest lies on the impulse response functions of CPI inflation caused by innovations to monetary policy measures. Results are presented in Figures from 4.8 to 4.11 for each monetary policy measure, separately. Each figure includes analysis for both fixed and flexible regime.

Figure 4.8 shows response of inflation to shocks on interest rates, for the two regimes, separately. In the fixed regime [Panel (*a*)], the peak effect of inflation marks at lag five and the total effect of the shock dies out after about ten lags. However, it is noted that during the fixed regime the Central Bank extensively used the Bank Rate and some direct measures like credit controls. The Bank Rate which proxies for the policy interest rate during the fixed

Figure 4.7 – Stability of the VAR System

(a) Fixed Exchange Rate Regime

(b) Flexible Exchange Rate Regime

Figure 4.8 – Impulse Response Functions caused by Innovations to Interest Rate

Response to Cholesky One S.D. Innovations ± 2 S.E.

(a) Fixed Exchange Rate Regime

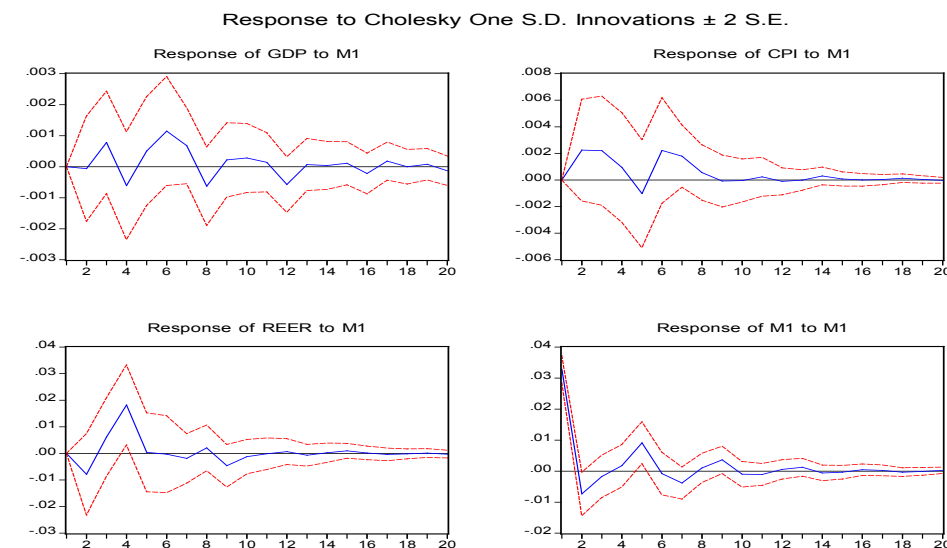Response to Cholesky One S.D. Innovations ± 2 S.E.
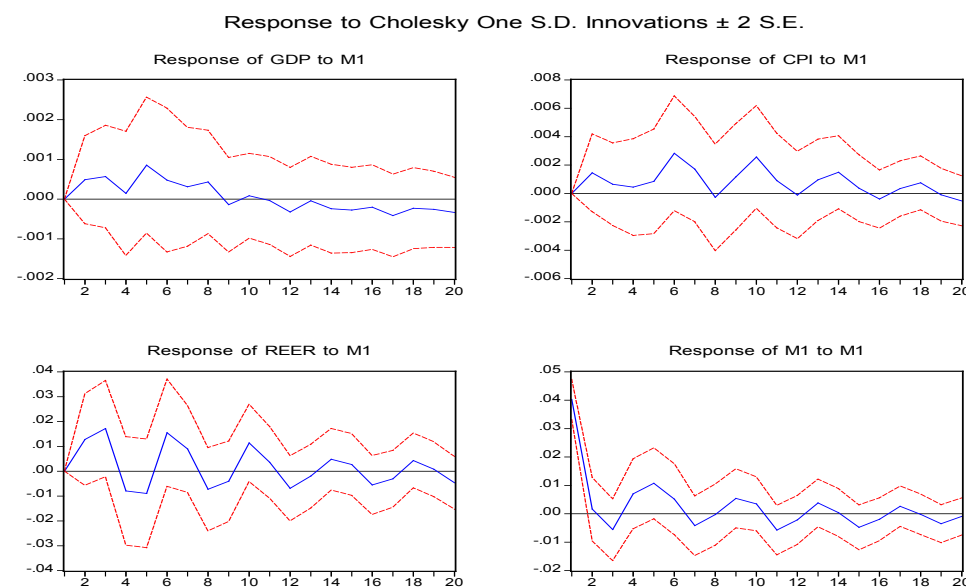

(b) Flexible Exchange Rate Regime

regime has been fixed for several years *i.e.*, it has been changed only four times during that period which spans from 1960Q1 to 1977Q3. Therefore, during the fixed regime, the impulse responses of inflation to interest rate shocks do not yield robust results (this problem can be overcome with use of other monetary policy measures as described below).

However, the policy interest rate during the flexible regime is proxied by short term Treasury Bill rate. Results are presented in Panel (*b*) of Figure 4.8. As shown in the upper-right corner, results do not suggest evidence on inflation persistence due to emerge of the price puzzle. This suggests that the inclusion oil price inflation is not fully capable of eliminating the price puzzle. Various interpretations have been put forwarded by researchers in explaining the price puzzle. Walsh (2003) describes that "[t]he most commonly accepted explanation for the price puzzle is that it reflects the fact that the variables included in the VAR do not span the full information set available to the [monetary authority]." However, some researchers argue that the price puzzle is not an outcome of misspecification of the VAR system, but due to some other aspects like *cost channel* of monetary policy [Barth and Ramey, 2001 (quoted Walsh, 2003, p.29)].

Due to these drawbacks in using the interest rate to account for policy shocks, the use of monetary aggregates may seem to be more plausible. As described before, correlation estimates between inflation and money growth show significant differences before and after the regime change. In the flexible regime, peak response of inflation to monetary policy changes takes longer lags than in the fixed regime. This initial finding is further strengthened by inflation response to impulses on monetary measures.

Figure 4.9 – Impulse Response Functions caused by Innovations to M$_1$

Response to Cholesky One S.D. Innovations ± 2 S.E.

(a) Fixed Exchange Rate Regime

Response to Cholesky One S.D. Innovations ± 2 S.E.

(b) Flexible Exchange Rate Regime

Figure 4.10 – Impulse Response Functions caused by Innovations to M$_2$
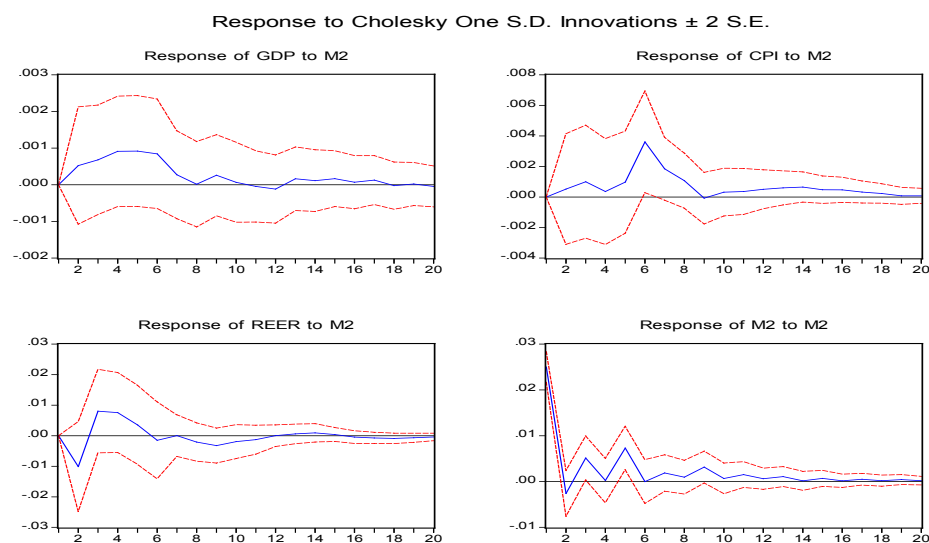
(a) Fixed Exchange Rate Regime
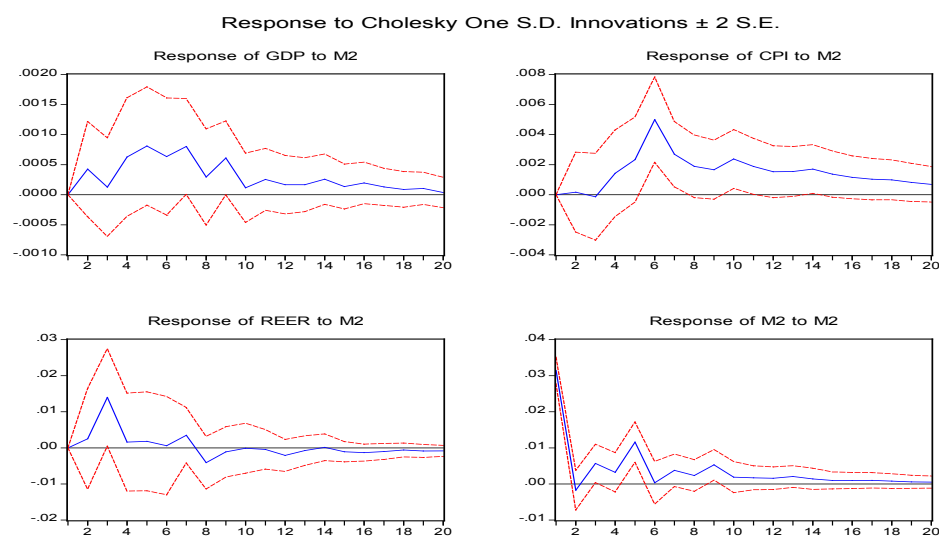
(b) Flexible Exchange Rate Regime

Figure 4.11 – Impulse Response Functions caused by Innovations to Reserve Money
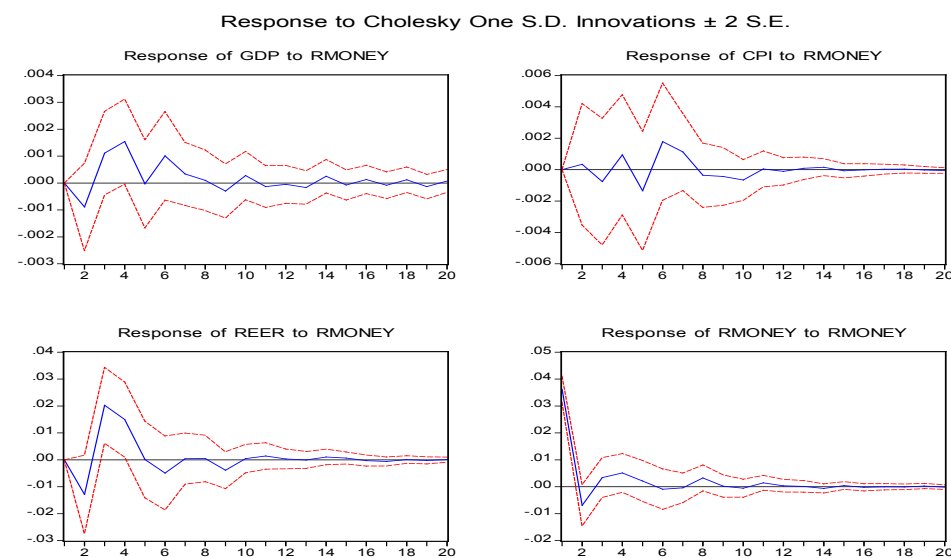
(a) Fixed Exchange Rate Regime
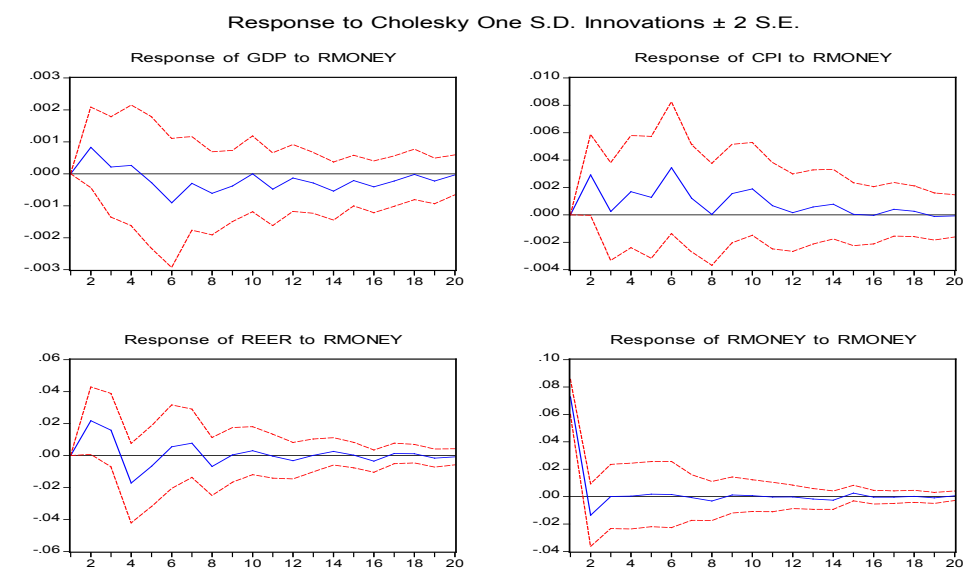
(b) Flexible Exchange Rate Regime

The response of inflation to shocks on M_1, M_2, and Reserve Money are shown in Figures 4.9, 4.10 and 4.11, respectively. Results show that the effects of a policy shock are more persistent during the flexible regime, than in the fixed regime. However, time taken for peak inflation response followed by policy shock is not significantly different between regimes. Therefore, results of the impulse response analysis are mixed. Figure 4.9 shows that in the fixed regime, total effect of a shock to M_1 disappears after about eight lags with the peak effect reporting after six lags. In contrast, during the flexible regime the shock persists for longer, reporting the peak effect after ten quarters.

Similarly, Figure 4.10 shows the lagged inflation response to shocks on M_2. In the fixed regime [Panel (a)], effects of the shocks are transitory and mark the peak after six quarters. In contrast, during the flexible regime, shocks to M_2 seems long lived though the peak effect points at lag six as same as in the fixed regime.

Identical results are observed when Reserve Money is used as the monetary policy measure, as depicted in Figure 4.11. Inflation records the peak effect followed by a shock to Reserve Money after about six lags in both regimes. However, the persistence of the shock is long lasting in the flexible regime. Overall, results suggest that the effects of a shock to monetary policy measures during the flexible regime take a longer time to completely die out, than in the fixed regime. This implies that during the flexible exchange rate regime inflation appears to be more persistent than in the fixed regime.

IV. Conclusion

This paper examines inflation performance in Sri Lanka across different exchange rate regimes. The degree of inflation persistence is used as a proxy for examining inflation performance. Sample period spans from 1960Q1 to 2005Q4, and exchange rate regimes are categorised under broader classification, namely, fixed exchange rate regime (pre 1977Q4 period) and flexible exchange rate regime (post 1977Q4 period).

The study is carried out with respect to three objectives. First, evidence on the degree of inflation persistence is examined through price inflation process and three Phillips curve specifications, namely, price-based traditional Phillips curve (purely backward-looking), standard NKPC (purely forward-looking) and hybrid-NKPC (incorporating both forward and backward-looking elements). Second, inflation response to *systematic* monetary policy actions is examined through correlation between money growth and inflation. Finally, an unrestricted VAR system identifies the inflation response to *non-systematic* policy shocks, through impulse response functions.

The study examines three definitions (types) of inflation persistence followed by Batini and Nelson (2001). Type I inflation persistence relates to positive serial correlation in inflation, while type II relates to the number of lags between (*systematic*) monetary policy

actions and the peak effect of inflation. Type III inflation persistence relates to the lagged response of inflation to policy shocks *i.e.*, *non-systematic* policy actions. Major findings and conclusions of the study are described below.

First, Type I inflation persistence is examined through consumer price inflation process and Phillips curve specifications. The coefficient on lagged inflation in price inflation process provides some evidence on an upward shift in inflation persistence between regimes, which is consistent with AS's (1991) findings. Recursive estimates also suggest a shift in inflation persistence during the period of regime change. These results are further confirmed by *Chow* parameter stability tests. Among the open economy Phillips curve specifications examined, price-based Phillips curve suggests a modest shift in inflation persistence providing evidence on parameter instability between regimes. However, estimates of the purely forward-looking NKPC seem to be incapable of accounting for inflation persistence, as claimed by many researchers [see for example Rudd and Whelan (2005)]. According to the estimates of the hybrid NKPC, inflation persistence records a dramatic upward shift between regimes. Recursive estimates and parameter stability tests re-confirm these results. Further, parameter stability tests provide significant evidence even after one year of the regime change, which may, perhaps, be due to accumulated effects of various policy measures being implemented during that period. It also implies that the slower adjustment process of inflation expectations, followed by the policy change.

Second, estimates of Type II inflation persistence suggest that there is a significant lag between the peak effect of inflation followed by a change in the monetary policy measures. Results show that during the flexible regime, inflation has been more persistent than in the fixed regime. However, correlation between money and inflation seems to be modest through out the sample period. Further, the estimates of degree of monetary accommodation yield negative coefficients during the fixed regime providing no evidence of accommodation, while in the flexible regime there is significant evidence of monetary accommodation, which results in higher inflation persistence.

Type III inflation persistence is examined through impulse response functions caused by innovations to monetary aggregates and short term interest rate. In the fixed regime, effects of a policy shock seem to be less persistent compared to flexible regime. However, inflation response to changes in interest rate provides only weak evidence due to emerge of price puzzle. Overall, impulse response analysis provides mixed evidence on inflation persistence across regimes.

The findings of this study may have important implications on the assessment and design of monetary policy framework in Sri Lanka. Since the abandonment of fixed exchange rate regime, coupled with open economic policies, inflation persistence reaches a higher level, perhaps, with increased monetary accommodation. In contrast, before the regime change, inflation shows lower persistence and lower monetary accommodation. Nonetheless, these

findings may not suggest that the pegged exchange rate system to be restored. Instead, it may highlight the importance of precommitment to policy measures that is necessary to curtail inflationary pressure. Further, in order to maintain inflation persistence at a lower level, several other factors need to be considered, such as maintaining consistency between policy objectives and policy instruments, time consistency of policy announcements etc.

However, this study has several limitations, some of which are related to data availability. Mainly, a proper 'policy' interest rate series does not exist for the entire sample period. Further, data on consolidated broad money (M_{2b}), which is the intermediate target of the present monetary targeting framework, is available only for the recent ten years. The effects of oil price inflation on domestic consumer prices seem to have not captured well due to apparent deficiencies in the consumer price index, because of administered prices. Further, there are some limitations due to policy implications. It is a fact that in developing countries like Sri Lanka, fiscal concerns may influence on monetary policy effectiveness. Therefore, taking account of the effects of macroeconomic policies may improve the results. Expanding the analysis by including more variables such as external debt, official foreign reserves, domestic credit expansion, government spending etc. may lead to more robust results. Further, one may consider the independently floating exchange rate system as a separate regime, as when the present study is carried out, the period of independent floating is too short to be considered as a credible regime.

Moreover, in this paper more emphasis is placed on persistence in inflation under different exchange rate regimes. However, it can be extended to account for the effects of exchange rate shocks and costs of exchange rate fluctuations within and between exchange rate regimes. Also the exchange rate pass-though effects in different exchange rate regimes is yet to be considered. Overall, more research may be needed on the effects of exchange rate variability and monetary policy models that fully endogenise exchange rate effects.

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Appendix A

Data Description

The main data source is the IMF's International Financial Statistics (IFS) database for the period 1960Q1 to 2005Q4. The incomplete IFS data series are updated using data from the Annual Reports of the Central Bank of Sri Lanka (CBSL) and internal sources. All data series are seasonally adjusted, before logged, using Census X-12, in order to normalise seasonal fluctuations.

(a) **cpi** – The log of Consumer Price Index for Sri Lanka (1952=100). The percentage weights are based on the average expenditure of a sample of working class households as per the Colombo Family Budget Survey in 1949/50 revalued at prices in 1952.

(b) **oil** – The log of oil price based on the Dubai Spot Price Index obtained from IFS. To account for the effects of nominal exchange rate fluctuations the following adjustment is made: $\Delta oil_t = (f_t - f_{t-1}) + (s_t - s_{t-1})$, where f_t and s_t refer to log of oil price index values and the nominal exchange rate, respectively.

(c) **imp** – The log of (Real) import price based on the Import Price Annual Index (1990=100) taken from the Annual Report 2003 (Table 17) of the Central Bank of Sri Lanka. The quarterly series is obtained by quadratic interpolation using Goldstein and Khan method (1976). The real import price inflation is obtained by adjusting for domestic consumer price inflation: $\Delta imp_t = (m_t - m_{t-1}) - (p_t - p_{t-1})$, where m_t and p_t refer to log of import price index values and consumer price index, respectively.

(d) **gdp** – The log of gross domestic price series at constant prices: A quarterly GDP data series is not available for the entire sample period. The existing data series in the CBSL starts from 1996Q1. Therefore, a quarterly real GDP data series is generated through quadratic interpolation using Goldstein and Khan method. The interpolated series is replaced by the existing series (seasonally adjusted) since 1996Q1.

(e) **gap** – The quarterly output gap measure is computed as the difference between log of real GDP (seasonally adjusted) series and the long-term trend output series obtained from the Hodrick-Prescott (HP) filter. The smoothing parameter 1600 is used as data series is in quarterly basis.

(f) **exrate** – The log of quarterly nominal exchange rate series, based on the market rate as per the amount of domestic currency units per US dollar.

(g) **reer** – The log of real (effective) exchange rate series, calculated using consumer price indices and relative trade shares for four major trading partners with Sri Lanka, namely India, Japan, the United Kingdom and the United States. These countries represent a major share of the volume of international trade in Sri Lanka during the sample period. For each country the bilateral real exchange rate is computed according to the formula,

$$ RER = E_{ij} \frac{P_j^*}{P_i} $$

where, E_{ij} is the nominal exchange rate between Sri Lanka and j^{th} country, expressed as domestic currency units per foreign currency and taken as quarterly averages (spot rates) in order to be compatible with the quarterly-average price levels. P_j^* and P_i refer to consumer price indices of foreign country and the domestic price level, respectively. All bilateral real exchange rates are transformed in to an index based on 2000, as the price indices are also in the same base year. The trade weights are computed based on the average of total exports and imports with each trading partner. Finally, the real effective exchange rate is obtained by assigning the trade weights to the real exchange rate on quarterly basis. Accordingly, a rise in real effective exchange rate indicates a depreciation of domestic currency and vice versa.

(h) **ir** – The nominal interest rate series which represents the Treasury Bill rate is obtained from IFS for the period starting from 1981Q1. The Advance Rate (Bank Rate) is used for the earlier period.

(i) **reir** – The real interest rate is obtained by taking the difference between the nominal interest rate series and consumer price inflation series.

(j) **M$_1$** – The log of narrow money supply

(k) **M$_2$** – The log of money plus quasi money

(l) **rmoney** – The log of reserve money (the monetary base)