

**Central Bank Independence, Budget Deficit and Inflation in SAARC
Regions: A Panel Data Analysis.**



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CERTIFICATE

This is to certify that Javed Iqbal has carried out the work in this dissertation. It has been completed and accepted in its present form under the supervision of Prof. Dr. Attiya Yasmin Javid, and recommended to the Department of Economics & Finance, Pakistan Institute of Development Economics (PIDE) Islamabad as satisfying for partial fulfillment of the Degree of Master of Philosophy in Economics and Finance.

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DEDICATION

To Ayyan Khan

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Abbreviation

| | |
|------|----------------------------------|
| CWN | Cukierman Webb and Neyapti Index |
| DFT | Budget Deficit to GDP ratio |
| GDP | Gross Domestic Product |
| GM2 | Rate of growth on Money |
| GMM | Generalized Method of Moment |
| GRTH | Real GDP growth rate |
| TOR | Turn Over Rate |

Abstract

This study is an endeavor to investigate whether central bank independence influences the budget deficit or not in the SAARC regions. Central bank independence is observed via undertaking two indices such as CWN (Proxy for *de jure* independence) and TOR (*de facto* independence).¹ For empirical analysis, GMM-IV estimation technique is employed by using data from 1981 to 2010. Findings show that policy formulation by central bank has negative and statistically significant impact on budget deficit. Keeping other things constant, result implies that policy formulation reduces budget deficit, whereas policy implementation is not found statistically significant in affecting budget deficit. Further, obtained results indicate that lag period inflation, money growth and GDP growth reduce budget deficit whilst current period variables play no role in doing so i.e. inflation, money growth and GDP growth affect budget deficit with one period lag. Unit-Root test confirms the stationarity of the data. J-stat is employed to observe the validity of the instruments, which confirms that lag instruments are valid.

Key word: central bank independence, budget deficit, SAARC regions, GMM

¹ CWN (Cukierman Webb and Neyapti Index), the detail is given in the Appendix A.

Chapter 1

Introduction

1.1 Background of the Study

Budget deficit and central bank independence is one of the highly debated issues in all the world economies. The target to achieve balanced budget, price stability and maintaining of macroeconomic stability is the dream of many developed, developing and underdeveloped economies. Therefore, countries in all over the world should focus on the fiscal policy with the help of the proper strategy.

Generally, fiscal policy is implemented by state and monetary policy is controlled by the central bank. Price stability and output growth is common goal of both authorities and they both use different instruments to achieve these goals. Monetary authority controls the growth of money and fiscal authority plans about its expenditure and revenue.

Budget deficit has an impact on inflation. As stated by the Fischer equation, real interest rate is the difference between nominal interest rate and expected inflation rate. If the expected inflation rate increases, it leads to increase the nominal interest rate. Resultantly, the public debt would also increase due to increased nominal interest rate. Consequently, a rise in nominal interest rate will increase the interest payments and budget deficit. Ultimately, debt to GDP ratio will increase.

The level of budget deficit presumed to be related with Central Bank Independence, which is defined as no intervention by the government in the issue of central bank [Wright and Quadrini (2009)]. Central bank must be independent in both the policy formulation and policy implementation. Persson and Tabellini (1993) and Walsh (1993) delineated that the central bank governor is responsible for the implementation of the monetary policy. So,

whenever the governor is not free from the intervention of state in decision-making process, central bank cannot be regarded as an autonomous body.

Hasse (1990) further pointed out that there are three kinds of the independence; i.e. 1) Personal independence, 2) Policy independence 3) Financial independence. Personal independence means that government does not influence the appointment procedure of the central bank governors. Policy independence refers to the formulation and implementation of the monetary policy. While financial independence means the government borrow directly or indirectly from the monetary authority. Independence is violated when fiscal authority influences the monetary. Hence, fiscal policy influences the design of the monetary policy.

In the literature, the attention was given to central bank independence after the Kydland and Prescott theory of time-inconsistency. Kydland and Prescott (1977)² established that a monetary authority's policy decisions are often time-inconsistent. This means that anticipated monetary policy changes is a remedy for an immediate problem such as unemployment but unobserved ramification are failed to redress the stated goal of reducing unemployment. However, the political authority influences the central bank to have flexibility to covenant with misperceived ramification. Rogoff (1985) demonstrated that credibility and flexibility would be achieved if the central bank were independent from the political authority.

When the government has fiscal deficit, it influences the central bank to monetized deficit. The government has four channels to monetize the fiscal deficit (i) political authority pressurized the central bank to stabilize the interest rate (ii) problem of time-inconsistency of monetary policy (iii) seigniorage (iv) fiscal authority influence (Sikken and Haan 1998).

² "rules rather than discretion"

Government policies are carried out by two different distinct agencies i.e. the fiscal authority and the monetary authority. The fiscal authority manages the revenue and expenses of the government and the monetary authority arrange the stock of money. In this scenario, the debt is obtained residually. (Martin 2013).

Cukierman *et al.* (1992) proposed, “*The legal status of a central bank is only one of several elements that determine its actual independence. Many central banks laws are highly incomplete and leave a lot of room of interpretation. As a result, factors such as tradition or the personalities of the governor and other high officials of the bank at least partially shape the actual level of central bank independence. Even when the law is quite explicit, reality may be very different.*”

In developing countries, *de jure* independence that shows the policy formulation of the monetary authority is strong. While, *de facto* independence that shows the implementation of the monetary policy is influenced by the indirect intervention of the government. Therefore, Cukierman, A. *et al.* (1992) identified the CWN Index proxy for *de jure* independence (concerning law), and TOR proxy for *de facto* independence (concerning practice).

1.2 Motivation of the study

In the literature, central bank independence influences the government budget deficit. The focus was given to developed, developing and Asian countries. While SAARC regions constitute about 23 per cent of the world’s population and has 15 per cent of the arable land of the world, but only 6.0 per cent of Purchasing Power Parity (PPP) based global gross domestic product (GDP). To the best of my knowledge, there is no study is conducted in SAARC regions. SAARC regions are selected, based on few other similarities among them not only geographical, political system, language and culture but also qualitative i.e. developing nations.

1.3 Significance of the study

Number of researchers has analyzed the relationship among these three variables budget deficit, growth of money, inflation and central bank independence, by employing different econometric technique, different time periods for different countries (Sargent and Wallace 1981, Carlstrom and Fuerst 1999, Neyapti 2003 Dreher *et al.* 2007). Most of the studies demonstrated that there is a negative correlation between inflation and budget deficit when the central bank is independent in the developed as well as developing countries. This study analyze that in the SAARC regions whether central bank policy formulation and implementation is appropriate or not and reduces the government budget deficit.

1.4 Objectives of the Study

Specifically, the main objective of underlying study is to investigate the effects of central bank independence on budget deficit in SAARC region. Central bank independence is incorporated by following two approaches i.e. *de facto* independence and *de jure* independence. So, the objectives are outlined as follow:

1. To investigate the effects of *de jure* central bank independence (Policy Formulation) on the budget deficit.
2. To analyze the effects of *de facto* central bank independence (Policy Implementation) on the budget deficit.
3. To analyze the effects lag of the macroeconomic variables (inflation, money growth and economic growth) on budget deficit.

1.5 Hypotheses of the Study

Hypotheses of this study are formulated as:

1. H_0 : *De jure* central bank independence does not have significant effects on the budget deficit.
2. H_a : *De jure* central bank does have significant effects on budget deficit.
3. H_0 : *De facto* central bank independence does not have significant effects on the budget deficit.
4. H_a : *De facto* central bank independence does have significant effects on the budget deficit.
5. H_0 : Macroeconomic variables have not significant effects on the budget deficit.
6. H_a : Macroeconomic variables have significant effects on the budget deficit.

1.6 Organization of the study

The rest of the study organized is as follow; in chapter 2 we will give extensive literature review on budget deficit and role of central bank independence (CBI). In chapter 3 we will give the theoretical framework of the study. Chapter 4 will give detail about the source of data, variable construction and an overview of the central bank independence. Chapter 5 will discuss econometric model and econometric methodology used in the study. In Chapter 6, we will discussed the result obtained from the different estimation technique and interpret them. In the last chapter, we give conclusion and give policy recommendation based on empirical result obtained from the study.

Chapter 2

Literature Review

There are several single and multi country studies on central bank independence. The most comprehensive study on the relationship between central bank independence is the cross-country analysis of Cukierman, Webb, and Neyapti, (1992), which includes 72 countries in their study. Through the construction of formal and informal indicators of CBI, Cukierman (1992) analyze the legal aspects of independence of central bank. Furthermore, their empirical result suggested that usually the policy implemented in practice is the result of a negotiation between the monetary and the fiscal authorities.

Levy D. Mickey (1981) identified that the central bank expand the monetary base due to fiscal deficit rather than that of unemployment and inflation expectation. Estimating the Federal Reserve reaction function of the monetary base in the context of IS-LM framework, used the variables (interest rate, unemployment, gross national product and lagged monetary base), he concluded that political pressure to stabilize the interest rate should stimulated monetization of the public debt.

Roubini N. (1991) tested two hypotheses that fiscal deficit is determined by economic factor (tax rate, seigniorage and inflation) and political factor (political instability and military coup). In his study, author employs the data of 71 developing countries. Obtained results indicate that only fiscal deficit has been found statistically significant for 48 countries, while political factor found to be significant. It implies that higher political instability leads to higher fiscal deficit.

Alesina and Lawrence (1993) have found that the monetary authority which was linked with central bank independence only trim down the variability of inflation by employing the data

from 1955 to 1988. Moreover, findings of this study reveal insignificant impact of Central Bank Independence (CBI) on the real performance of the economy whilst it leaves on just monetary variables owing to neutrality of money. Many institutional factors and exogenous shocks manipulate the macroeconomic performance of the different economies.

Eijffinger *et al.* (1994) undertook effects of the Central Bank Independence (CBI) on price level in major industrial countries by using the data from 1977-1990. Their regression results showed that the more independent central bank, the lower average inflation rate. Moreover, CBI escalates with lower money market rate and current account surpluses. Further findings showed that these variables did not affect the economic growth. They divided the whole sample into two different sub-samples to identify the effect of CBI but it gave the same result as the whole sample. These findings are commensurate with GMT (1991).

Chaudhary and Ahmad (1995) have analyzed that the domestic financing of the government budget deficit predominantly from the banking sector create inflation in the long run. Their result signifies that there is a direct relationship between government deficit and inflation. The main conclusion of their study is that central bank policy is influenced by the government decision. To achieve the objective of price stability, the government should reduce the fiscal deficit.

Sikken and Haan (1998) identified that central bank independence negatively affect on the budget deficit by using the data of 30 developing countries from 1954 to 1994. They further investigated that when lagged of budget deficit and turnover rate of central bank governor (proxy for central bank independence), then there is negative relationship exists. While the legal indicator of central bank independence for less developed countries showed insignificant result.

Blinder (1998) stressed the distinction between *de jure* independence and *de facto* independence. He stress that reliability is the most important situation for achievement of the monetary policy formulation and implementation. He surveyed the central bank around the world and reached on the conclusion that monetary history was the most important element of a reliable monetary policy. He points out that the countries that have a very long history of liberal and slack monetary policy would not be able to persuade the public or markets of a change in its monetary policy by just shifting the authoritative condition of the central bank.

Carlstrom and Fuerst (1999) suggested that inflation is due to the fiscal policies adopted by the government. Fiscal authority influences the monetary authority to increase money supply. In this way increases the inflation. There is strong correlation between government deficit and inflation in this regard. Same result were identified by (Haan and Zelhorst 1990) that budget deficit influence monetary expansion, the government increase the growth of money and therefore, create inflation.

Neyapti (2003 a) identified the relationship between government fiscal deficit and inflation with the view that this relationship depends on the characteristics of monetary and financial institutions. The main objective of this study is that government fiscal deficit is inflationary when central bank dependent and financial institutions were not developed. He used 54 developed and developing countries in his study. In his study, he investigate that the lagged of the variable influence the relationship. The panel data is unbalanced and dynamic in nature. So used the first difference and two-stage least square method and valid instrument were formed by GMM-estimation.

Pollin and Zhu (2005) concluded that higher inflation is associated with temperate gain in GDP growth. In this study, 80 countries were used. They divide these countries into three different categories: OECD countries, middle-income countries and low-income countries.

Their obtained result showed that in case of OECD countries, there is no strong positive relationship between inflation and economic growth. While in case of middle-income and low-income countries, it has strong positive relationship exit.

Christopher and David (2005) stated that the government budget is not always impartial. The government expenditures are higher than the revenue. The government has five way of financing the deficit. 1) taxes (direct and indirect) 2) grants 3) printing of money 4) domestic debt 5) external debt. Their results recommend that the influence of taxes and grants are plausibly high. Furthermore, they identified that the impact of the deficit is reasonably complicated due to the financing of the government expenditure and the outstanding debt stock. If the financing through the printing of money it is growth enhancing, but internal or external borrowing restrain the growth of the economy.

Dreher *et al.* (2007) has found that when the inflation increased there would be the possibility of the replacement of governors of central bank. They collected data of 137 developing countries. This study further revealed the negative synergy between central bank independence and inflation. Martin (2013) has found similar results in short run.

Lucotte (2009) provides a detailed scrutiny of the relationship between central bank independence and budget deficit by using the panel data of developing countries. His sample data is made up of 56 developing countries and sample period ranges from 1995 to 2004. His findings indicate that the legal index used as proxy for CBI is not statistically significant and thus is an irrelevant indicator of CBI for developing countries. But the turnover rate (TOR) of central bank governor proves to be a very good measure of CBI with strong empirical evidence at 1 or 5 percent level of significance. This strongly supports the hypothesis that there exists a negative relationship between government primary

budget surpluses and central bank independence (CBI). Moreover, developing countries should reform their budgetary institution and fiscal administration.

Mukhtar and Zakaria (2010) suggested that in Pakistan, it is largely asserted that budget deficits have played an imperative role in illumination price fluctuation, and it is more attributed to the growth of money. There is no long run association between money supply and inflation. Agha and Khan (2006) concluded that there is long-run relationship among inflation, fiscal deficit and the government borrowing from the central bank. In case of Pakistan, inflation is mainly attributable to untenable fiscal deficit.

Harshana *et al.* (2011) found that the central bank independence contributes to plummeting inflation rate. Using the 20 African countries and period 1988-2007, they found that higher turnover rate of governors then higher will be the inflation rate. Similarly higher budget deficit implies higher inflation in the African countries. More independent central bank delivers lowest inflation rate in the short-run. However, it may be unfavorable for future growth potential Ismihan and Ozkan (2004).³

Saedi and Valizadeh (2012) identified that the budget deficit increased the inflation and lagged inflation increases the current period inflation. They also identified that budget deficit decreased the unemployment in Iran. While (Javid, Arif and Arif, 2011) reached on the conclusion that the countries with high income, high inflation and large budget deficit to GDP ratio have more budget instability. Lag of deficit volatility is significant which showed that it have persistent effect. Corruption, institutional quality, internal and external ethnic have more variation in budget deficit.

³ In contrast to Ismihan and Ozkan (2004), Brumm (2006) believes that their econometric method is problematic and finds that even if the sample is limited to developing countries, there is always a strong negative relation between central bank independence and inflation.

Neyapti (2013 b) has sought out the synergy between Fiscal Decentralization (FD) and Fiscal Rules (FR) for developing and developed countries. In this regard, she aimed to see through the influence of FR on effectiveness of FD. This study applies the GMM to find out pragmatic evidences by undertaking Panel Regression (PR). Findings of the study exert that FR enhances the efficiency in FD via institutional mechanisms and structural arrangements adopted by subjective countries. Further obtained evidences exhibit if fiscal expenditures and revenues are effectively used, it will reduces the budget deficit on the wake of existence of the FR.

The major conclusion from these studies is that central bank independence influence the government budget deficit in both developed and developing countries. The political authority influence monetary authority to monetize the deficit and central bank increase the growth of money. Money supply increases the inflation. Therefore, there is distinction between fiscal authority and monetary authority.

Chapter 3

Theoretical Framework

The importance given to central bank independence relies upon the assumption that policy makers are subject to an inflationary bias. This bias refers to the dynamic inconsistency of monetary policy. The government has an incentive to explore the tradeoff between inflation and unemployment in an expectational Phillips Curve model of output determination. The government also collects inflation-induced revenue (inflation tax). In the first case, the government is able to induce a higher employment level because an unexpected higher inflation rate reduces the real wage of workers. Lower real wages represent lower labor costs to employers and result in higher employment levels. In the second case, the government is able to increase its revenue collection by taxing the public's holding of real cash balances. By increasing the inflation rate unexpectedly, the public cannot reduce its holdings of real cash balances and prevent the reduction of their real value.

In both cases, the government has an incentive to use discretion on the monetary policy implementation to achieve short run objectives, such as higher revenue and/or employment, in detriment of price stability, once the monetary policy has already been announced and incorporated by economic agents in their decision process.

The time inconsistency problem that allows for the inflationary bias of 'discretionary' monetary policy is first acknowledged by Kydland and Prescott, (1977) and Barro and Gordon, (1983). In the Barro and Gordon, (1983) model, the central bank objective's is to maximize to expected value of

$$U = \lambda(y - y_n) - \frac{1}{2}\pi^2 \dots\dots\dots (1)$$

In the given equation y is output and y_n is economy's natural rate of output and π is inflation rate. One potential solution to the time discrepancy problem of monetary policy is to create some form of fixed rule to be followed by the government when setting its monetary policy, such as a constant growth rate for the money supply. Fixed rules have, however, the disadvantage of not allowing the monetary authorities to react to unexpected disturbances, such as supply shocks or shift in the demand for money. Although there is a focus ground between a fixed-rule and a 'discretionary' policy with arrangements that can recover the credibility of monetary policy, separating the Treasury (which benefits from unexpected changes in the monetary policy) from the central bank, allows for some degree of discretion while significantly reduces the incentive to change policy unexpectedly.

The theoretical problem of central bank independence entails finding ways of insuring that the inflationary bias will be overcome. The period of trial in the Rogoff's model (1985) as follows: Inflation expectation π^e was set (wage contract were signed) and then shock (μ) appear. The central bank set the inflations (π) the central bank seeks to minimize the following single period loss function:

$$V = \frac{1}{2} \lambda (y - y_n - k)^2 + \frac{1}{2} \pi^2 \dots\dots\dots(2)$$

The main feature of loss function is the parameter k , the constant k show that there is no effect on central bank decision. It rises from political pressure on central bank decision. In this model, y represent central bank place on output expansion to inflation stabilization. The main assumption of this loss function is that central bank desire to stabilized output and inflation, the expected value of V rivet the variance of output.

In this economy, output given by a Lucas approach aggregate supply function

$$y = y_n + \alpha(\pi - \pi^e) + e \dots\dots\dots(3)$$

In the equation π stands for the inflation rate, y is the output, π^e is the expected inflation rate, α is positive indicating that output will increase if the inflation rate turns out to be greater than expected. In this equation y_n is trend or the full employment. The term e is a random shock.

Monetary authority's actual policy mechanism,

$$\pi = \Delta m + v \dots \dots \dots (4)$$

Δm Shows the growth of the money supply (the first difference of the log nominal money circulation in the economy), v is a velocity disturbance. In setting Δm , the central bank will take it as given, assumed that the central bank observed e (not v) former to setting Δm . In conclusion, we assume that e and v are not correlated.

It assumed that distortions or imperfections in the labor market result in some wage or price stickiness and cause the natural rate of employment to be "too low." This assumption justifies k being greater than unit in equation (2) is, and allows the loss function to comprise with a government's objective to seek to raise output above the natural rate. In this context, the expectational Phillips curve results from distortions or imperfections in the labor market rather than from imperfect information.

Substitution of equations (3) and (4) in the central bank objective function

$$U = \lambda[\alpha(\Delta m + v - \pi^e) + e] - \frac{1}{2}(\Delta m + v)^2 \dots \dots \dots (5)$$

The first order condition that Δm , e and π^e are given

$$\alpha\lambda - \Delta m = 0$$

Or

$$\Delta m = \alpha \lambda > 0 \dots \dots \dots (6)$$

$$\pi^e = E[\Delta m] = \alpha \lambda$$

At equilibrium, when the central bank setting, Δm produces a positive inflation rate equal to $\alpha \lambda$ and it had no effect on output. The larger α , showed that the central bank more independent in policy implication.

In the conventional central banker approach of Rogoff, the loss represented by higher inflation rates can be reduced if the central bank permitted to develop a status or if the monetary policy is entrusted to a person or institutions that weight inflation deviations more than society as a whole.

In the principal-agent approach of Person and Tabellini (1993) and Walsh (1995), the inflationary bias is reduced by formulating a contract that induces the central banker to behave conservatively by imposing costs on him in case inflation deviates from the optimal level. In both cases, the monetary authority must be independent from the fiscal authority. In the case of a conventional central banker, monetary authority must be able to ensure its preferences about inflation over society's preferences; if the central banker's behavior is bound by a contract, the monetary authority must be allowed to take action and follow the contract without the interference of the fiscal authority.

Rogoff's conservative central banker has control over the monetary policy and seeks the goal of price stability according to its own loss function, having therefore, both instrument and goal independence.

Chapter 4

Data and Variable Construction

4.1 Introduction

The focus of this chapter is to present different variables used in the estimation process and their construction, definition and sources from where they have been collected. Study hereby utilizes the panel data set from 1981 to 2010 for selected SAARC regions (India, Nepal, Pakistan and Sri Lanka)⁴. The next section will elaborate the construction and sources of different variables used in the estimation process in detail. In the last, we will briefly give overview the central bank independence.

4.2 Source of Data

The data of Deficit to GDP ratio is obtained from World Development Indicator (WDI). Inflation data (percent per annum) is obtained from the International Monetary Fund (International Financial Statistics). The data of Central Bank Independence (CBI) is taken from the Cukierman A. *et al.* (1992). The data of growth rate of money is obtained from Financial Statistics (International Monetary Fund). Real GDP growth rate data is obtained from International Financial Statistics (International Monetary Fund).

4.3 Construction of Variables

4.3.1 Deficit to GDP

The explained variable is the government budget deficit. It is deficit to GDP (DFT)⁵. In measuring budget deficit to GDP interest payment were excluded and probably it is most appropriate measure of fiscal authority. From an econometric point of view, this measure

⁴ The data of Bangladesh, Bhutan and Maldives were not available from Cukierman *et al.* (1992)

⁵ Aghion *et al.* (2007) use the first difference of debt divided by GDP, which is same as the budget deficit over GDP.

permits us to avoid a potential simultaneity bias between the dependent variable and the explanatory variable.

4.3.2 Inflation

Sargent and Wallace, (1981) identified that more independent central bank then inflation would be low. While the countries have less independent central bank, inflation is high. The annual percentage of inflation (π) is transformed using the inflation tax transform, i.e.

$$Inflation = \frac{\pi}{(100 + \pi)}$$

This method of measuring inflation reduces heteroskedasticity and it is preferable from a theoretical point of view⁶.

4.3.3 Real GDP Growth Rate

Real GDP growth rate (GRTH) which used as a proxy for economic activity in the regression analysis. The government budget balance is linked to economic fluctuations. Certainly, when government expenditures are high and revenue collection is low it adversely affects the government budget. On the other hand, privileged growth improved the budget balance. Thus, the expected sign of the coefficient of economic growth negative as the economic growth increase reduces the budget deficit. Talvi and Végh, (2000) identified that fiscal policy in developing countries were be procyclical. In developing countries, political authority pressurized to increase public expenditure in higher economic growth.

4.3.4 Growth Rate of Money Supply

⁶ Christopher Crowe and Ellen E. Meade (2007) used this Index

Woo (2003) taken the growth of money (GM2) of the as a proxy for the financial market development, "financial depth." He defined that "countries with highly developed financial markets can more easily finance the fiscal deficit by issuing bonds without having to resort to inflationary finance."

4.3.5 Central Bank Independence

The main explanatory variable is the central bank independence (CBI) which is measured by two indices i.e. *de jure* independence (CWN) and *de facto* independence (TOR) indicators.

Cukierman A., Webb S. B and Neyapti B. (CWN Index): This index is used as proxy for *de jure* independence. The CWN Index is to be used by the number of pragmatic studies, as it is the most comprehensive. Certainly, as compare to other indices CWN Index mainly focus on the four legal aspects of central bank independence, outlined in the Appendix A. Furthermore, CWN Index is "*comprehensive in terms of its elements and is relatively easy to replicate and provide coding to the various subcomponents*" (Crowe and Meade, 2008).

The CWN Index: In this study, we confine the analysis of CWN Index as *de jure* independence because many pragmatic studies have showed that it is a good proxy to evaluate the policy formulation Cukierman *et al.* (1992).

The CWN Index is constructed as; it is comprise in 4 categories and 16 sub-categories. The different weights are given to each four categories. In the first category, if the appointment of the chief executive was proposed by the central bank board not by the prime minister or finance minister, then the central bank is more independent and avoids political pressures [CEO 20% of the index]. In the second, central bank independence is high if policy decision were made without the government intervention [PF 15% of the index]. In the third, the central bank gains in independence if the central bank's main theme were the price stability is

the primary goal of monetary policy [OBJ 15% of the index]. In the fourth category, if the government's ability to lending from the central bank is limited, then central bank is more independence [LL 20% of the index].

As a final point, the "*overall index*" for each central bank of the countries obtained by calculating average of the variables.

Turnover Rate (TOR): In this study, we confine the analysis of Turnover rate as *de facto* independence because many pragmatic studies have showed that TOR is a good proxy to evaluate the policy implementation in particular for developing countries (Radzyner and Riesinger, 1997).

Turnover rate (TOR) defined as the average length of term of office of the central bank governors. It is calculated as dividing the central bank governors during a specified period by the number of reference period. Therefore, turnover rate is equal to 0.5 means that the change of central bank governors for every 2 years i.e. 0.5 for one year. As pointed out by the Cukierman (1992) that the average term of office of the central bank governor is four years. Turnover rate of 0.25 showed the more independent central banker. High turnover rate showed the less independence of the central bank governors.

These two central bank independence indices are used by the empirical studies (Neyapti 2003, Lucotte 2009, Dreher *et al.* 2007, and Harshana *et al.* 2011). Therefore, in this study, we decide to use these indicators to evaluate the influence of central bank independence on budget deficits in selected SAARC regions.

4.4 Overview of Central Bank Independence (Measurement)

After the 1990s, more attention was given to the central bank independence all over the world. Due to this, most countries of the world revised, their central bank polices. In this

way, political authority should not interference in the implementation of monetary policy (Goodman 1992). In the given literature of central bank independence, several methods are used to construct central bank independence index i.e. (Bade and Parkin 1988); (Grilli *et al.* 1991); (Alesina and Summers, 1993), (Eijffinger and Schaling, 1993); (Cukierman, 1992); (Fry *et al.* 2000 and Arnone, 2006). The most widely used index is (Cukierman *et al.* 1992).

Bade Parkin (B-P Index): The Central Bank Independence Index; first measured by Bade and Parkin (1988). In this index, they used the data of twelve advance countries. In which they formulate the index that the central bank is independent from the government or not. The government selected all or few the member of the central bank board. Central bank board members are the government representative or not. Parkin (1987) investigates the association between central bank independence and the budget deficit procedure. He established that more independent central bank has a smaller government budget deficit.

Grilli Masciandaro Tabellini (GMT Index): Grilli *et al.* (1991) construct an index of the central bank independence. They first time used the coding system in the construction of index. They used the eighteen industrialized countries. They describe two form independence; political independence and economic independence. Political independence is influenced by the number of variables like; the election of central bank governor, member of the board and term of office. Economics independence refers to central bank use appropriate monetary policy.

Alesina and Summers: Alesina and Summers (1988) applied the Bade and Perkin (B-P) arrangement but as a fundamental index by turning over a value to each category: one for the least independent and four for the most independent. They renovate the B-P ordinal types of index with cardinal property.

Fry, Julius, Mahadeva, Roger and Sterne⁷: An immense study by economists, they were working at the Bank of England. Centre for Central Bank Research build on but took much further the ideas of GMT and Cukierman. FJMRS define “*An overall measure of independence over a range of characteristics covering legal objectives, goals, instruments, finance of the government deficit, and term of office of the Governor.*” They also create a number of other indexes, which were intended to get at transparency and for an inflation target.

After studied these measures of Central Bank Independence (CBI), we reached on the conclusion that Cukierman *et al* (1992) is used in most of the studies of the independence of central bank.

⁷ <http://www.bankofengland.co.uk/education/Pages/ccbs/publications/mpfage.aspx>

Chapter 5

Methodological Framework

5.1 Introduction

This chapter provides the econometric methodology, which we are going to use for estimation procedure. In section 5.2, we will discuss in detail the empirical model developed by Neyapti (2003, 2013, Sikken and Haan 1998). In next section 5.3, the estimation technique that is to be employed, will be briefly discussed about its basic reasons and assumptions why to employ it? We also briefly discussed the instrumental variable and endogeneity of the budget deficit.

5.2 Empirical Model

Baltagi (2001) and Hsiao (1986) suggested that panel data model is used to control the individual heterogeneity, multicollinearity and estimation bias. In this study, for empirical estimation process, the model is established based on different studies. The specification of the econometric model for budget deficit, which is, modified model of Neyapti B. (2003, 2013), Sikken and Haan (1998).

$$DEF_{it} = \sum_{j=1}^q \beta_{1j} INF_{i(t-j)} + \sum_{j=1}^q \beta_{2j} GM2_{i(t-j)} + \sum_{j=1}^q \beta_{3j} GRTH_{i(t-j)} + \sum_{j=1}^q \beta_{4j} CBI_{i(t-j)} + \nu_{it}$$

Where $i, i = 1 \dots n$ and $t, t = 1 \dots t$ shows the country and time period respectively. q refers to the maximum lags. ν_{it} show the error term. Here DEF is the deficit to GDP in the selected countries, INF is the Inflation rate, GM2 is the growth rate of money, GRTH is the real growth rate of GDP and CBI is central bank independence.

The model in extended form could be written as

$$DEF_{it} = \beta_1 INF_{it} + \beta_2 INF_{i(t-1)} + \beta_3 INF_{i(t-2)} + \beta_4 GM2_{it} + \beta_5 GM2_{i(t-1)} + \beta_6 GM2_{i(t-2)} + \beta_7 GRTH_{it} + \beta_8 GRTH_{i(t-1)} + \beta_9 GRTH_{i(t-2)} + \beta_{10} CBI_{it} + \beta_{11} CBI_{it} * INF_{it} + \beta_{12} CBI_{it} * GM2_{it} + DUM_{it} + \varepsilon_{it}$$

DEF= Deficit to GDP ratio

INF= Annual Inflation rate

GM2= Growth rate of money

GRTH= Real GDP growth rate

CBI= Central Bank Independence

The lag of inflation is included in the model to control persistence in inflation, affect the budget deficit. When central bank is independent reduces the deficit then the simplified model as

$$DEF_{it} = \beta_1 INF_{it} + \beta_2 INF_{i(t-1)} + \beta_3 INF_{i(t-2)} + \beta_4 CBI_{it} + \nu_{it}$$

Current period and lag period growth of money influence the budget deficit, when central bank is independent then the simplified model as

$$DEF_{it} = \beta_1 GM2_{it} + \beta_2 GM2_{i(t-1)} + \beta_3 GM2_{i(t-2)} + \beta_4 CBI_{it} + \nu_{it}$$

Economic growth also effect the budget deficit with the view the nature of the central bank independence

$$DEF_{it} = \beta_1 GRTH_{it} + \beta_2 GRTH_{i(t-1)} + \beta_3 GRTH_{i(t-2)} + \beta_4 CBI_{it} + \nu_{it}$$

Similarly, the independent central bank influences the budget deficit. When central bank is more independent in the supply of money and increases the inflation then the model is

$$DEF_{it} = \beta_1 INF_{it} * CBI_{it} + \beta_2 GM2_{it} * CBI_{it} + \beta_3 CBI_{it} + \nu_{it}$$

5.3 Estimation Technique

This study used the GMM estimation technique. Random Effect gives the spurious result as given in the Appendix⁸. This section would give detail insight the method for parameter estimation known as generalized method of moments (difference GMM). Lars Peter Hansen (1982) developed this technique. It has become one of the foremost statistical tools for the analysis of economic and financial data. The GMM estimator belongs to a class of estimators known as M-estimators that are defined by minimizing some criterion function.

$$DEF_{it} = \sum_{j=1}^q \beta_{1j} INF_{i(t-j)} + \sum_{j=1}^q \beta_{2j} GM2_{i(t-j)} + \sum_{j=1}^q \beta_{3j} GRTH_{i(t-j)} + \sum_{j=1}^q \beta_{4j} CBI_{i(t-j)} + \nu_{it}$$

Where $i, i = 1 \dots n$ and $t, t = 1 \dots t$ shows the country and time period respectively. q refers to the maximum lags. ν_{it} shows the error term. This Equation is a standard dynamic panel data specification. The presence of lagged variables and the country specific effects cause to be the Ordinary Least Squares estimator to be biased. The Fixed Effects estimators can eliminate the country specific effect. On the other hand, the bias caused by the insertion of lagged dependent variables remains. The bias of the Fixed Effects estimator, which influences all variables, is a function of t , and only when $t \rightarrow \infty$ will the Fixed Effects estimator is consistent (Nickel, 1981; and Kiviet, 1995). Since the average number of observations across countries in our sample is 120, the bias of the Fixed Effect estimator may be non-negligible. All explanatory economic variables are lagged by year to avoid simultaneity⁹.

⁸ Estimated result given in the Appendix C.

⁹ Axel Dreher, Jan E. Sturm and Jakob de Haan (2007)

In order to avoid these problems, we adopt the difference-GMM estimator developed for dynamic panel data by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). GMM estimator is our preferred method because it controls for the unobserved country specific effects as well as the bias caused by the lagged of the variables. For comparison, we will also report the results of the basic specifications using Fixed Effect. We follow the literature, also estimate that Budget Deficit an endogenous variable in estimating equation.

The starting point of GMM estimation is a theoretical relation that the parameters should satisfy. The idea is to choose the parameter estimates so that the theoretical relation is satisfied as “closely” as possible. Its sample counterpart replaces it and the estimates are chosen to minimize the weighted distance between the theoretical and actual values. GMM is a robust estimator in that, unlike maximum likelihood estimation, it does not require the information of the exact distribution of the disturbances. In fact, many common estimators in econometrics can be considered as special cases of GMM (e.g. the least squares estimator can be viewed as a GMM estimator, based upon the conditions that each of the right hand side variables is uncorrelated with the residual.)

5.3.1 Instrumental Variable Estimation

For our purpose, it is pleasant to show the intuition behind derivation of instrumental variable estimation according to the GMM estimation.

So, consider a linear model

$$y_t = x_t' \beta + v_t$$

where x_t' is a $(k \times 1)$ vector of explanatory variables. Suppose now that some of explanatory variables are endogenous, so that $E(x_t'v_t) \neq 0$. Let z_t be an $(r \times 1)$ vector of predetermined explanatory instrumental variables that are correlated with x_t' , but not correlated with v_t , $E(z_t v_t) = 0$. Baltagi (2000) suggested that we could use two periods lag of dependent and explanatory variables as an instrument.

5.3.2 Endogeneity of Budget Deficit

A latent evaluation of the results presented in the table, in the model that we treat the budget deficit variable as endogenous, although this may not be the case in reality. For example, both the budget deficit and the central bank independence could be affected by a common set of (unobserved) variables, such as political influence, geographic location, demographic, government policies, political instability, war, & drought, which are not included in our regression. In this case, our coefficient estimate of budget deficit would be biased. In particular, if the omitted variables correlate positively with budget deficit and negatively with central bank independence, or vice versa, there would be a downward bias, and possibly a false negative coefficient estimate on budget deficit. To avoid this omitted variable bias we used the Dummy variable i.e. Dummy=1 after the 1990, the trade relation between SAARC regions, 0 otherwise. We also used the interactive term to reduce the omitted variable bias.

5.3.3 Tests of Estimated Equations

For the estimations of the budget deficit equation, we perform a number of tests to evaluate regressions:

We begin with Histogram-Normality Test to test the normality of residuals. If the residuals are normally distributed, the Jarque-Bera statistic should be significant.

To observe the stationarity of the variable, we apply unit-root test. The assumption of the GMM is that the variable should be stationary.

Next, we test the models over identifying restrictions. When the number of orthogonality conditions exceeds the number of parameters to be estimated, the model is over identified. We employ the Sargan-test to determine to determine the appropriate the instrumental in GMM estimation¹⁰. We employ J-statistics to determine whether the use of instrument variables is appropriate. Under the null hypothesis that the over identifying restrictions are satisfied, or not. Then the p-value expresses whether the null hypothesis is rejected or not.

¹⁰ See Econometrics (Fumio Hayashi 2000) pp. 218-39

Chapter 6

Results and Discussion

6.1 Introduction

This chapter will give detail insight about results and their interpretation. Next section, 7.2, will show the unit root test to check stationary of data. It has three subsections, which provide complete detail of the models estimated in the study.

6.2 Normality Test

We employed Normality Test to test the normality of residuals. If the residuals are normally distributed, the Jarque-Bera statistic should be significant.¹¹ In the study, it is shown that residual are normally distributed.

6.3 Unit-Root Test

The analysis begins by testing the set of variables for the presence of unit roots and the possibility of an ordinary stochastic trend among them. In order to avoid spurious regression, test the stationarity of the variable Sikken and Haan (1998). One of the assumptions of GMM estimation is the stationarity of time series; we employ unit root tests to test this hypothesis. Three test statistics are to be used, the Augmented Dickey-Fuller test (Fisher) (ADF), the Phillips-Perron test (PP) and Levin, Lin and Chu test (LLC). The most common is the ADF-test, which allow for series with a deterministic component. It also makes it possible to include a high number of lags, which is useful for high frequency series. The null-hypothesis (H_0) denotes the presence of a unit root in each variable. When (H_0) is rejected, the variables are stationary.

¹¹ Details is given in the Appendix B

Table 6.1 Unit Root Test Result

| Variables | LLC test statistics | | PP | | ADF | |
|--------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | test-stat ^a | test-stat ^b | test-stat ^a | test-stat ^b | test-stat ^a | test-stat ^b |
| Deficit | -2.01 [*] | -0.23 | 29.45 [*] | 40.17 | 11.36 ^{**} | 10.46 |
| Inflation | -4.65 [*] | -5.88 | 29.48 [*] | 47.87 | 32.16 [*] | 4.36 |
| GDP Growth | -1.28 [*] | -6.34 | 15.98 ^{**} | 60.63 | 57.07 ^{**} | 53.27 |
| Money Growth | -4.52 [*] | -3.58 | 7.91 ^{**} | 51.65 | 37.22 ^{**} | 50.33 |
| CWN | -1.05 ^{**} | -0.70 | 6.12 ^{***} | 1.15 | 3.48 ^{***} | 1.25 |
| TOR | -0.20 ^{**} | -0.35 | 7.05 ^{**} | 5.71 | 4.45 ^{***} | 4.49 |

Note: - superscript a show test-equation on levels and individual intercept, superscript b show test-equation on level, including intercepts and trend. Null Hypothesis all panels contains unit root, asterisks: *, **, *** show 1%, 5%, and 10% respectively,

We use three unit root tests in order to compare results. As we can observe from the table, results are statistically significant at 1%, 5% and 10% respectively and conclude that there is no unit root exists in all variables used in the study.

6.3 Descriptive Statistics

Table 6.2 Descriptive Statistics

| Variables | Observation | Mean | Median | Std. Dev | Minimum | Maximum |
|------------|-------------|---------|---------|----------|---------|---------|
| Deficit | 120 | 0.02811 | 0.02640 | 0.02966 | -0.0439 | 0.0999 |
| Inflation | 120 | 0.98700 | 0.76822 | 0.92428 | 0.02193 | 5.0915 |
| GDP growth | 120 | 5.03694 | 5.02885 | 2.24160 | -2.9780 | 9.6812 |
| M2 Growth | 120 | 16.8607 | 16.9963 | 5.59057 | 2.65916 | 38.841 |
| CWN | 120 | 0.36000 | 0.34000 | 0.15275 | 0.18000 | 0.6700 |
| TOR | 120 | 0.25000 | 0.20000 | 0.16449 | 0.0000 | 0.6000 |

Table 6.2 gives the summary statistics of all the variables used in the estimation procedure. Our sample period is comprises 1981-2010 and we use the SAARC regions (India, Nepal, Pakistan and Sri Lanka). We also show Median in our Table that there is no outlier in our variables. The table reveals that there is as no more variation in variable only GDP growth and Money supply growth have some variation in it. GDP growth shows the negative in minimum value, this is in case of Sri Lanka.

Table 6.3 the GMM Estimation: central bank independence (CWN)

| Variables | Model I | Model II | Model III | Model IV | Model V |
|---------------------|--------------------|----------------------|------------------------|-----------------------|------------------------|
| Inflation | -0.012 (0.067) | | | | 0.0175 (0.0151) |
| Inflation(-1) | 0.043** (0.029) | | | | -0.0071** (0.0051) |
| Inflation(-2) | -0.002 (0.011) | | | | -0.0041 (0.0094) |
| Money Growth | | -0.0075* (0.0031) | | | 0.0039* (0.0017) |
| Money Growth(-1) | | -0.0061 (0.0069) | | | 0.0020 (0.0035) |
| Money Growth(-2) | | -0.0040 (0.0044) | | | -0.0021* (0.0021) |
| GDP Growth | | | -0.0137* (0.0050) | | -0.0070* (0.0036) |
| GDP Growth(-1) | | | 0.0021 (0.0045) | | -0.0033** (0.0019) |
| GDP Growth(-2) | | | -0.0045** (0.0024) | | -0.0025 (0.0021) |
| CWN | -1.483* (0.542) | -0.9775* (0.3220) | -1.9382*** (1.3853) | 1.8989** (1.1410) | -0.1619** (0.1075) |
| CWN*Money Growth | | | | 0.0013*** (0.0008) | 2.3062* (0.5180) |
| CWN*Inflation | | | | -0.0279* (0.0106) | -0.1025* (0.0411) |
| Dummy | | | | | -0.1199*** (0.1075) |
| Sargan test | 1.6848 (0.6403) | 0.2813 (0.8687) | 0.3464 (0.8409) | 12.53 (0.0027) | 0.8627 (0.6496) |
| J-stat | 0.0686 (0.7934) | 1.0355 (0.5958) | 0.2722 (0.8727) | 0.8261 (0.8432) | 0.0928 (0.9926) |
| F-test | 5.2396 (0.000) | 5.4696 (0.000) | 5.8162 (0.000) | 3.3084 (0.005) | 6.7266 (0.000) |
| Number of Countries | 4 | 4 | 4 | 4 | 4 |
| Number of Years | 30 | 30 | 30 | 30 | 30 |

Note: Dependent variable is deficit to GDP. Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instrument validity. In 2SLS and GMM estimation, we used two periods lagged as instrument of dependent as well as explanatory variables. Standard errors are given in parenthesis and indicate *, ** and *** are significant at 1%, 5% and 10% respectively. Periods 1981-2010, and included countries are: India, Nepal, Pakistan and Sri Lanka. Dummy variables show that after 1990 when concentration was given to the central bank independence and trade between SAARC regions.

The Table reveals that previous period of inflation influence the budget deficit when central bank is independent in policy formulation, the results are statistically significant. However, theory suggests that there is a negative relationship between budget deficit and inflation. While, Campillo and Miron (1997) identified that central bank independence did not play role

in determining inflation outcome, if the other factor held constant. Baldini and Ribeiro (2008) identified that there is a negative correlation between government budget deficit and inflation in African countries for the period 1980-2004. Estimating growth of money over deficit, the results showed that the one unit increase in growth of money leads to 0.0075 unit decrease in government budget deficit. Money growth reduces the deficit. Further, result reveals that the lag of real GDP growth reduces the budget deficit. In our final model we also introduced the interactive term of central bank independence and use the dummy variable. Dummy variable shows that after 1990 the concentration was given to the central bank independence. A more independent bank from the political influence than inflation outcome will be low. As our study comprise on SAARC regions and after 1990 there is free trade in these countries. Dummy variable is statistically significant; it shows that after 1990 when there is a free trade in the selected countries reduces the budget deficit. It showed that one country policy influence the other country policy. In the final model our results shows that the lag of inflation reduces the budget deficit in the view that when the central bank is independent in monetary policy formulation. Moreover, lag of growth of money reduces the deficit in the selected countries rather than current period growth of money. The coefficient of interactive with inflation is negative and statistically significant; it showed that when central bank is more independent and increase in inflation through the monetary policy decreases the government budget deficit. Increase in money supply increases inflation, as Milton Friedman quoted *"Inflation is always and everywhere a monetary phenomenon."* In our models we have also analyzed that when central bank is independent in creation of money reduces the deficit. As the coefficient of interactive term of money growth is significant at 5% level.

Table 6.4 GMM Estimation: Central Bank Independence (TOR)

| Variables | Model I | Model II | Model III | Model IV | Model V |
|---------------------|----------------------|-----------------------|-----------------------|--------------------|----------------------|
| Inflation | 0.0082 (0.0236) | | | | -0.0163 (0.1154) |
| Inflation(-1) | 0.0739* (0.0187) | | | | -0.0060 (0.127) |
| Inflation(-2) | -0.0273* (0.0108) | | | | -0.0051* (0.0025) |
| Money Growth | | -0.0212** (0.0126) | | | 0.0048 (0.0034) |
| Money Growth(-1) | | -0.0043 (0.0126) | | | -0.0051 (0.0048) |
| Money Growth(-2) | | 0.0061 (0.0042) | | | -0.0031* (0.0011) |
| GDP Growth | | | -0.0058 (0.0244) | | -0.0091 (0.0175) |
| GDP Growth(-1) | | | -0.0319** (0.0164) | | -0.0046 (0.0074) |
| GDP Growth(-2) | | | -0.0019 (0.0075) | | -0.0013 (0.0030) |
| TOR | -1.1484 (1.4532) | -0.2759 (0.4969) | -0.0124 (1.4199) | 0.5944 (0.4444) | 0.0765 (0.2279) |
| TOR*Money Growth | | | | 0.0008 (0.0013) | 4.5845* (0.9642) |
| TOR*Inflation | | | | 0.0036 (0.0092) | -0.0165 (0.3654) |
| Dummy | | | | | 0.0003 (0.1884) |
| Sargan test | 0.3693 (0.8313) | 0.3895 (0.5325) | 0.7276 (0.6950) | 3.0598 (0.3839) | 0.0926 (0.6683) |
| J-stat | 1.4207 (0.4915) | 0.0506 (0.9750) | 2.8707 (0.2380) | 1.1635 (0.7617) | 0.5203 (0.9143) |
| F-test | 5.0955 (0.000) | 3.5269 (0.009) | 4.1206 (0.0005) | 1.9396 (0.081) | 5.4847 (0.000) |
| Number of Countries | 4 | 4 | 4 | 4 | 4 |
| Number of Years | 30 | 30 | 30 | 30 | 30 |

Note: dependent variable is deficit to GDP. Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instrument validity. In 2SLS and GMM estimation, we used two periods lagged as instrument of dependent as well as explanatory variables. Standard errors are given in parenthesis and indicate *, ** and *** at 1%, 5% and 10% respectively. Periods 1981-2010, and included countries are: India, Nepal, Pakistan and Sri Lanka. Dummy variables show that after 1990 when concentration was given to the central bank independence and trade between SAARC regions.

The table reveals that lag of inflation reduces the budget deficit and results are statistically significant. One unit increase in inflation leads to 0.027 unit decreases in budget deficit, theoretically it is true there is negative relationship between budget deficit and inflation, but the coefficient of TOR is not significant. It shows that the central bank is not independent in

policy implementation. Further finding shows that the current period money supply reduces the budget deficit. Money supply is the key through which the deficit is linked to the inflation as explored by many empirical studies (Catao and Terrons; 2005), and also monetarist school of thought present money supply as main cause of inflation. The TOR is not statistically significant it shows that in SAARC regions (*de facto* independence) is not significant, the central bank is dependent, and it is under political influence. As it is shown in the table, that lag of Economic growth reduces the budget deficit hence its coefficient is significant. We used the interactive term of *de facto* independence to see how it play role in explaining the budget deficit. The coefficient of interactive of (TOR) with inflation is negative and statistically significant, it shows that the when central bank is more independent and increase in inflation through the monetary policy decrease the budget deficit. The Dummy variable is not significant, it shows that more independent central bank reduces the inflation have no role-playing in the reduction in budget deficit due to political influences.

Estimated results showed that central bank independence (*de jure* independence) reduce the budget deficit, as it is statistically significant. Lag of inflation, growth of money and economic growth influence the budget deficit in the selected SAARC regions. The given result showed that the central bank policies are better but due to political influence, central banks are failing to implementation of the monetary policy.

Chapter 7

Conclusion and Policy Recommendation

7.1 Concluding Remarks

Primarily, this study keeps focus on identifying the influences of central bank independence on budget deficit and further effects of lag of inflation, money supply/growth, and real GDP growth on budget deficit are investigated. Evidences are observed from SAARC regions via using data from 1981 to 2010.

Three hypotheses are formulated which are: 1) analyzing the de jure independence (which shows the actual policy of the central bank), 2) analyzing the de facto independence (concerning practice), and 3) analyzing the effect of lag of macroeconomic variable. Our first and third hypotheses are found to be significant, while second one is found to be statistically insignificant.

First hypothesis shows that the budget deficit is lower and results are significant. Theoretical literatures argued that central bank independence affect the design of fiscal policy in the sense that a higher independence is correlated with lower budget deficit. The main hypothesis of this is that a de jure independence. In this study we also showed that the lag of money growth reduces the budget deficit and lag of inflation influence the deficit of the selected countries. Further, empirical findings showed that countries policies influence each other policies, which is shown in our dummy variable and it is significant.

Our second hypothesis shows that term of office of central bank governors reduces the deficit but the results are not statistically significant, which shows that the central bank is not independent in policy implementation. The study result reveals that the lag of inflation reduces the budget deficit. Moreover, lag of growth of money reduces the deficit. One

country policy influences the other countries policies, as we have seen in the in the dummy variable and found significant, the trade among the SAARC region.

In this study, we have used the Augmented Dickey Fuller and Phillips Perron test for the presence of unit root in the variables and found significant result on level. This study employs Generalized Method of Moments (GMM-IV) technique.

7.2 Policy Recommendation

Our empirical result suggests that there exist a negative relationship between budget deficit and central bank independence. The main conclusion from empirical studies is that in SAARC regions, the central bank is independent in policy formulation, but central bank is influenced by the fiscal authority in implementation of the policy. Therefore, the fiscal authority should not interfere in the implementation of monetary policy.

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Appendix A

| | Description of variables | Variable | Weight | Score |
|-----------|--|------------|-------------|--|
| 1) | Executive independence | CEO | 0.20 | |
| a) | <i>Length of governor's term of office</i> 8 years Between 6 and 8 years 5 years 4 years Less than 4 years or at the discretion of appointer | Too | 0.05 | 1.00 0.75 0.50 0.25 0.00 |
| b) | <i>Who appoints the governor?</i> Appointed by the board of the central bank Appointed by a board composed of members of executive branch, parliament, and the board of the central bank <i>iii.</i> Appointed by the legislative branch <i>iv.</i> Appointed by the executive branch <i>v.</i> Appointed by one or two members of the executive branch | App | 0.05 | 1.00 0.75 0.50 0.25 0.00 |
| c) | <i>Dismissal of governor</i> No provision for dismissal Only for reasons not related to monetary policy At the discretion of the central bank board At legislative branch's discretion for reasons related to monetary policy Unconditional dismissal possible by the legislative branch At executive branch's discretion for reasons related to monetary policy Unconditional dismissal possible by the executive branch | Diss | 0.05 | 1.00 0.83 0.67 0.50 0.33 0.17 0.00 |
| d) | <i>Possibility for governor to hold government office</i> Governor prohibited by law from holding government office Prohibited unless authorized by the government No prohibitions of law in this matter | Off | 0.05 | 1.00 0.50 0.00 |
| 2) | Monetary policy formulation | PF | 0.15 | |
| a) | <i>Who formulates monetary policy?</i> Central bank alone has this authority Authority is shared by government and central bank Central bank has advisory role in setting policy government has this power | Monpol | 0.05 | 1.00 0.67 0.33 0.00 |
| b) | <i>Government directives and conflict resolution</i> Central bank has final authority on matters explicitly defined by law as its objectives | Conf | 0.05 | 1.00 |

| | | | | |
|-----------|---|------------|-------------|------|
| | Government has ultimate authority only on policy matters not explicitly defined as objectives of the central bank, or in the event of internal conflict within the central bank | | | 0.80 |
| | In case of conflict, the final decision lies with a body comprising members of the central bank, the legislative branch, and the executive branch | | | |
| | Legislative branch has final authority in policy matters | | | 0.60 |
| | Executive branch has final authority in policy matters, but is subject to possible opposition by the central bank | | | |
| | Executive branch has unconditional final authority | | | 0.40 |
| c) | <i>Does central bank has advisory role in formulating government budget?</i> | | | 0.20 |
| | Central bank plays an active role | | | |
| | Central bank has no influence | | | 0.00 |
| | | Adv | 0.05 | 1.00 |
| | | | | 0.00 |
| 3) | Objectives of the central bank | OBJ | 0.15 | |
| | Price stability is the sole/main objective; takes precedence if conflict with other government objectives (e.g. full employment, economic growth) | | | 1.00 |
| | Price stability is the only objective | | | 0.80 |
| | Price stability is mentioned together with other objectives that do not conflict with it | | | 0.60 |
| | Price stability mentioned together with other objectives that may potentially conflict with it | | | 0.40 |
| | Central bank law does not include objectives of this type | | | |
| | Central bank law identifies objectives but not price stability | | | 0.20 |
| | | | | 0.00 |
| 4) | Limitations on lending to the government | LL | 0.50 | |
| a) | <i>Limitations on advances</i> | Lla | 0.15 | |
| | Advance lending to the government is prohibited | | | 1.00 |
| | Advances are possible with strict limits (e.g. up to 5% of government revenue) | | | 0.67 |
| | Advances are possible but subject to more accommodating limitations (e.g. over 15% of government revenue) | | | 0.33 |
| | No legal limitations on advances; amount is periodically negotiated between the central bank and the government | | | 0.00 |
| b) | <i>Limitations on guaranteed loans to the government</i> Same distinctions as for Lla | Lls | 0.10 | |
| c) | <i>Who has authority to control terms and conditions of loans to the government?</i> | Ldec | 0.10 | |
| | Central bank | | | 1.00 |
| | Terms and conditions specified by the central bank law | | | 0.67 |
| | Terms and conditions agreed between the central bank and the executive branch | | | 0.33 |

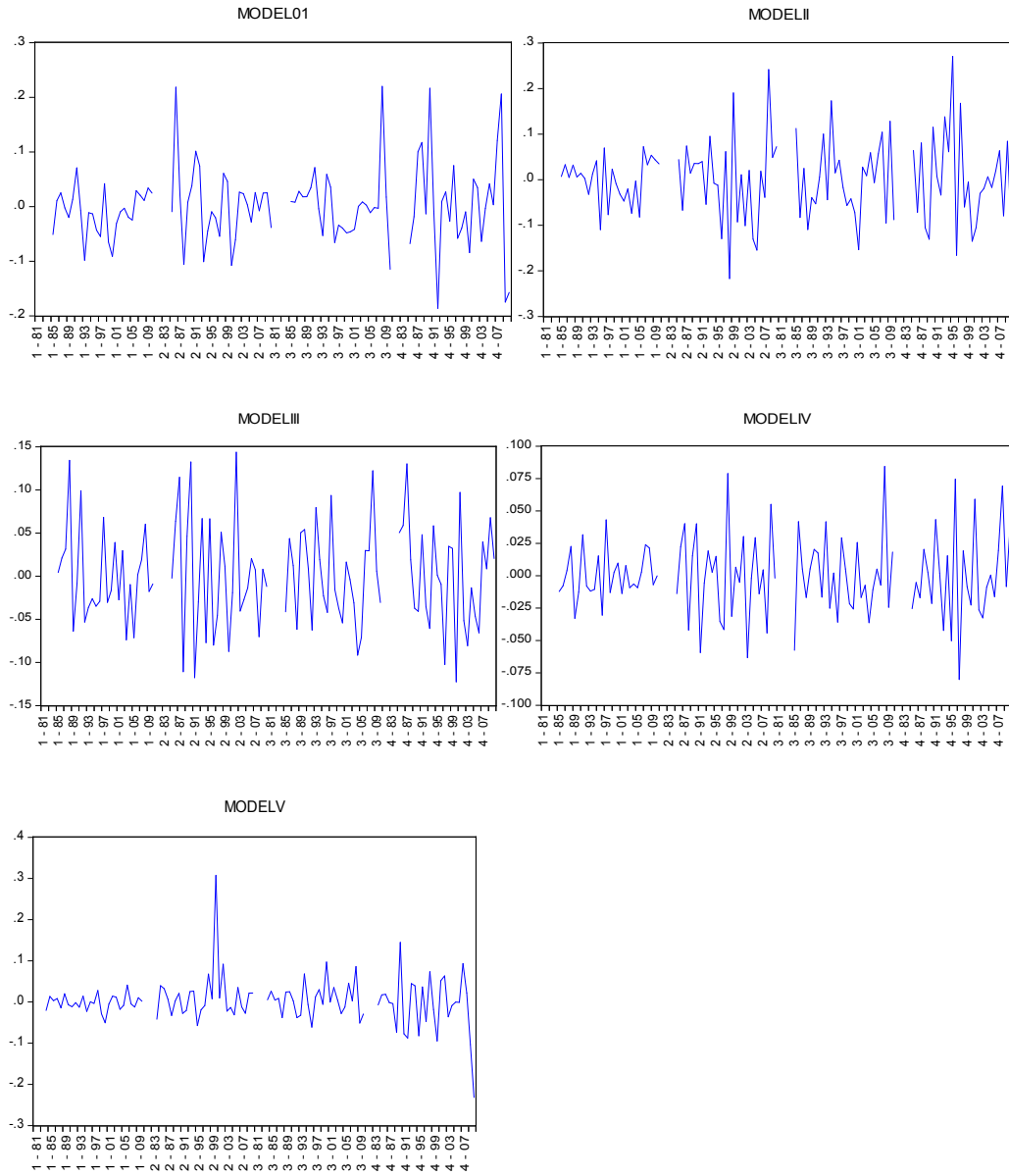
| | | | | |
|----|---|--------|-------|------|
| | Terms and conditions decided by the executive branch alone | | | 0.00 |
| d) | <i>Who has access to loans granted by the central bank?</i> | Lwidth | 0.05 | |
| | Only the central government | | | 1.00 |
| | All levels of government | | | 0.67 |
| | All levels of government and public enterprises | | | 0.33 |
| | Public and private sector | | | 0.00 |
| e) | <i>Types of limitations on loans, where limits exist</i> | Ltype | 0.025 | |
| | Limit on loan amount is prescribed in absolute terms | | | 1.00 |
| | Limit on loan amount is prescribed in terms of capital or other liabilities of the central bank | | | 0.67 |
| | Limit on loan amount is prescribed in terms of percentage of government's revenues | | | |
| | Limit on loan amount is prescribed in terms of percentage of government expenditures | | | 0.33 |
| f) | <i>Maturity of possible loans</i> | Lmat | 0.025 | |
| | Less than 6 months | | | 1.00 |
| | Less than 1 year | | | 0.67 |
| | More than 1 year | | | 0.33 |
| | No legal limit on maturity | | | 0.00 |
| g) | <i>Limitations on interest rates applicable to loan by central bank</i> | Lint | 0.025 | |
| | Loan is possible only at market rates | | | 1.00 |
| | Minimum level applies to interest rates paid by the government | | | 0.75 |
| | iii. Ceiling applies to interest rates paid by the government | | | 0.50 |
| | iv. No explicit legal provisions on interest applied to loans by the central bank | | | 0.25 |
| | v. Law does not provide for the government to pay interest on loans from the central bank | | | 0.00 |
| h) | <i>Prohibitions on lending on the primary market</i> | Llprm | 0.025 | |
| | Central bank prohibited from underwriting public debt securities on the primary market | | | 0.10 |
| | Central bank may underwrite public debt securities on the primary market | | | 0.00 |

Source: Cukierman, Webb, and Neyapti (1992).

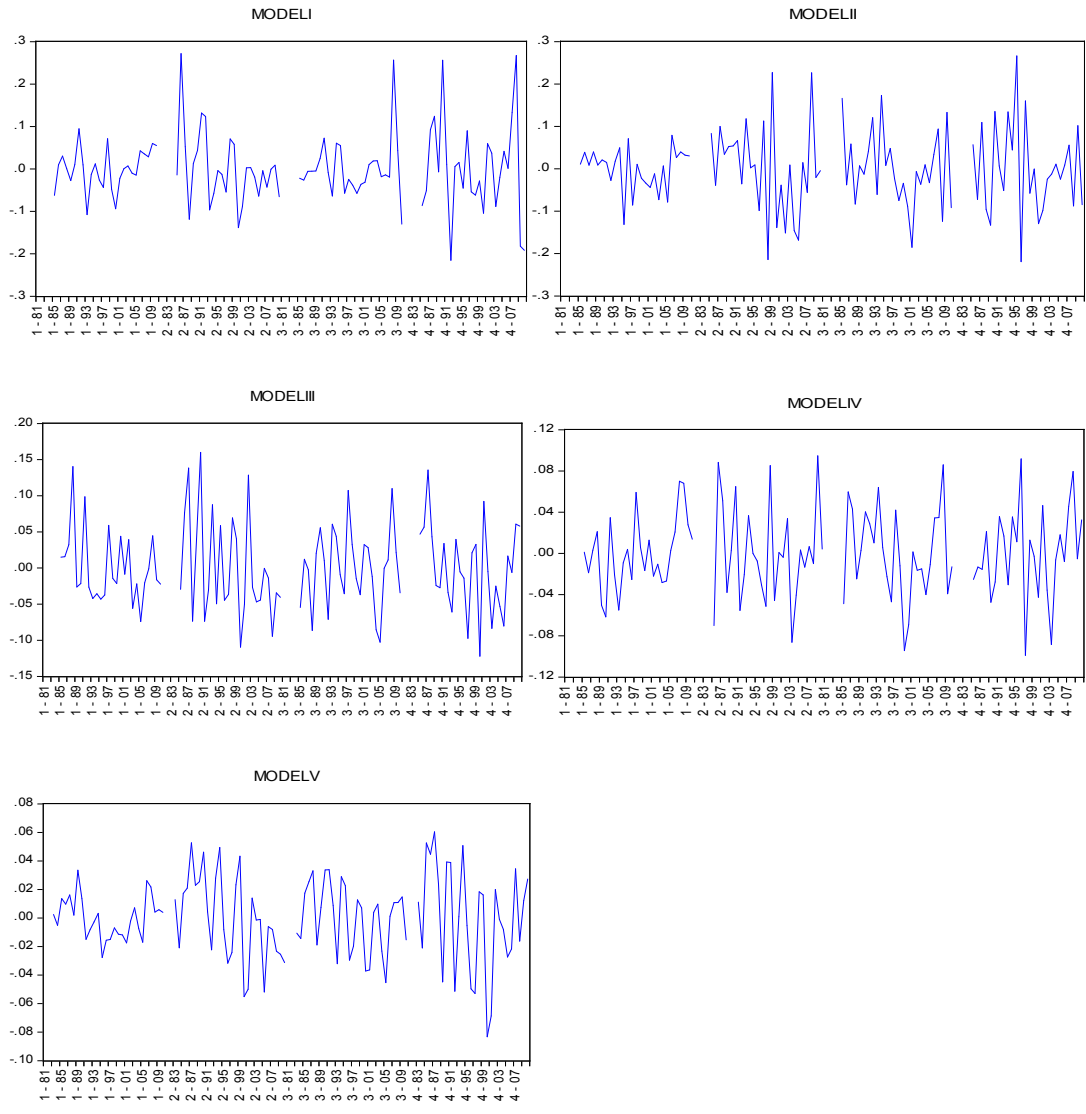
Appendix B

Normality of the residuals of the models

Central Bank Independence (CWN)



Central Bank Independence (TOR)



Appendix C

Central Bank Independence (CWN)

| Variables | Model I | Model II | Model III | Model IV | Model V |
|---------------------|-----------|-----------|-----------|-----------|-----------|
| Intercept | 0.04691 | 0.06827 | 0.05811 | 0.0354 | 0.02869 |
| | (0.01003) | (0.01553) | (0.01316) | (0.00687) | (0.00963) |
| Inflation | 0.00026 | | | | 0.00298 |
| | (0.00296) | | | | (0.00397) |
| Inflation(-1) | 0.00371 | | | | 0.00532 |
| | (0.00304) | | | | (0.00205) |
| Inflation(-2) | 0.00142 | | | | 0.00559 |
| | (0.00304) | | | | (0.00231) |
| Money Growth | | 0.00029 | | | 0.00134 |
| | | (0.00047) | | | (0.00059) |
| Money Growth(-1) | | -0.0076 | | | -0.00073 |
| | | (0.00048) | | | (0.00021) |
| Money Growth(-2) | | -0.00027 | | | -0.00031 |
| | | (0.00048) | | | (0.00072) |
| GDP Growth | | | -0.00044 | | -0.00041 |
| | | | (0.0011) | | (0.00131) |
| GDP Growth(-1) | | | -0.01337 | | -0.00093 |
| | | | (0.00119) | | (0.00098) |
| GDP Growth(-2) | | | 0.00096 | | 0.00124 |
| | | | (0.00119) | | (0.00042) |
| CWN | -0.06832 | -0.07803 | -0.07401 | 0.000417 | 0.01902 |
| | (0.02049) | (0.01987) | (0.01987) | (0.00103) | (0.02046) |
| CWN*Money Growth | | | | 0.00041 | -0.00192 |
| | | | | (0.00103) | (0.00142) |
| CWN*Inflation | | | | 0.01394 | -0.00058 |
| | | | | (0.00681) | (0.01024) |
| Dummy | | | | | -0.01982 |
| | | | | | (0.00428) |
| R ² | 0.2185 | 0.2291 | 0.2186 | 0.0475 | 0.2492 |
| Number of Countries | 4 | 4 | 4 | 4 | 4 |
| Number of Years | 30 | 30 | 30 | 30 | 30 |

Central Bank Independence (TOR)

| Variables | Model I | Model II | Model III | Model IV | Model V |
|---------------------|----------------|-----------------|------------------|-----------------|----------------|
| Intercept | 0.01635 | 0.0301 | 0.0248 | 0.0291 | 0.0273 |
| | (0.00736) | (0.01395) | (0.01146) | (0.00498) | (0.01935) |
| Inflation | 0.0011 | | | | -0.0067 |
| | (0.0031) | | | | (0.0071) |
| Inflation(-1) | 0.0044 | | | | 0.0043 |
| | (0.0031) | | | | (0.00318) |
| Inflation(-2) | 0.00406 | | | | 0.00391 |
| | (0.00311) | | | | (0.0031) |
| Money Growth | | 0.00474 | | | 0.0013 |
| | | (0.00019) | | | (0.0009) |
| Money Growth(-1) | | -0.00067 | | | -0.0007 |
| | | (0.00025) | | | (0.0005) |
| Money Growth(-2) | | 0.00007 | | | -0.0004 |
| | | (0.0007) | | | (0.0005) |
| GDP Growth | | | -0.00017 | | 0.0038 |
| | | | (0.0012) | | (0.0012) |
| GDP Growth(-1) | | | -0.0011 | | -0.00033 |
| | | | (0.00126) | | (0.0012) |
| GDP Growth(-2) | | | 0.00156 | | 0.00199 |
| | | | (0.00124) | | (0.00122) |
| TOR | 0.0059 | 0.0016 | 0.0036 | -0.0034 | 0.0207 |
| | (0.01812) | (0.0393) | (0.0128) | (0.0277) | (0.046) |
| TOR*Money Growth | | | | -0.00024 | -0.0025 |
| | | | | (0.0013) | (0.0025) |
| TOR*Inflation | | | | 0.0041 | 0.0333 |
| | | | | (0.0115) | (0.0271) |
| Dummy | | | | | -0.2325 |
| | | | | | (0.0059) |
| R ² | 0.1359 | 0.1149 | 0.1148 | 0.1205 | 0.3033 |
| Number of Countries | 4 | 4 | 4 | 4 | 4 |
| Number of Years | 30 | 30 | 30 | 30 | 30 |