Determinants of Seigniorage Revenue

(A Case Study of Pakistan)

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A thesis submitted in partial fulfillment of the requirements for the Degree of Master of Philosophy/Science in Economics at the Faculty of Economics, International Institute of Islamic Economics, International Islamic University, Islamabad

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In the name of Allah, the most merciful and beneficent

Approval Sheet

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DEDICATION

I dedicate this thesis to my family, who has been a constant source of support and encouragement during the challenges of education and life. This research work is also dedicated to my supervisor Dr. Hafiz Muhammad Yasin whose good examples have taught me to work hard for the things that I aspire to achieve, and support me to complete this research study successfully.

ACKNOWLEDGEMENTS

First and foremost I would like to thank Almighty Allah for His providential guidance and analytical wisdom to put my best possible efforts towards the accomplishment of this thesis.

Thanks to prestigious International Islamic University Islamabad for providing us all possible research facilities that enabled us to come up with standardized research. I would also like to appreciate the efforts of our Department for making MS and Ph.D program successful.

I express my gratitude for my honorable and respectable supervisor Dr. Hafiz Muhammad Yasin for his support, insightful suggestions and endless patience in making this study possible. Indeed, it was his guidance that helped me to overcome difficult phases in this research. Further I would like to thanks Professor Attiq ur Rehman for their valuable guidance in estimation and analysis of results. I would also like to thanks Administrative Staff of IIIE for their valuable direction and support in completion of thesis.

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Abstract

The present study analyzes the trends of seignorage, inflation tax and inflation rate for Pakistan economy by using the data for a fairly long period, i.e. 1972-2014. The study uses the Cagan (1956) model as the starting point followed by its extended form like that suggested by Rao and Nallari (1996) to evaluate the determinants of seignorage revenue. Further, an attempt has been made to estimate the seignorage maximizing inflation rate for Pakistan economy through the Laffer's curve phenomenon.

It is found that changes in money income ratio and inflation tax are the significant determinants of seigniorage revenue. Data on Pakistan economy for the time period under reference shows that inflation and seignorage have positive correlation except for the periods of very high and very low inflation. The inflation rate that maximized the seignorage revenue is about 11% per annum on the average for Pakistan economy. In other words, the relationship between inflation and seignorage in Pakistan can be represented by the Laffer's curve.

The findings of study have important policy implications. The monetary authorities (SBP) should make their utmost efforts to keep inflation and money growth rate at some moderate level. Instead of maximizing the seignorage revenue and maintaining the high (two digit) rate of inflation, the money growth rate should be maintained somewhat nearer to the real GDP growth rate so that the seignorage is optimum and the rate of inflation is tolerable for the general public. After all, excessive reliance on deficit financing should be avoided as it leads to the inflationary spiral in the economy and consequently into the social unrest.

Chapter 1

INTRODUCTION

1.0 Background of the study

The governments of developing countries usually face fiscal deficits, which they try to finance in different ways. The first way is to generating additional tax revenues or cutting down some expenditure. The second option is borrowing domestically from the general public and commercial banks by floating bonds. The third option is seeking assistance from international agencies or friendly countries or borrowing from private sources by floating bonds in the international markets. While borrowing from the central bank or extra money creation is another option to finance budget deficit

Generating additional revenues through taxation is advisable but not always easy due to the following reasons: The first reason is that tax base is narrow and inadequate to allow sufficient enough revenue mobilization. The second one is that even if sufficient tax base exists, the tax administration is incompetent and corrupt. The third is high tax burden leads to possible resistance by masses and political opposition. The fourth cause is that Tax evasion practices on part of the elites are common

Thus, the effectiveness of this measure depends on the taxable capacity of the society and on the efficiency of the revenue department. Due to the possible opposition in the parliament and resistance of the masses, imposition of new taxes is always a difficult task for the government. Further it is not often sure that sufficient revenues will be generated through this measure to finance the entire deficit. Cutting down the un-necessary expenditure is always preferred and keeping the budget balanced is advisable but the governments in developing

countries often ignore this golden rule and insist on spending more under the label of public interest.

The second source (domestic borrowing) is comparatively narrow in developing countries due to under developed financial markets and limited private savings. Secondly, there is always the danger of crowding out of private investment if the public sector offers an interest rate above the market rate. Further, the government has to pay interest on the outstanding debt, which after all, has to be financed from the current budget. The resources are said to be transferred from poor to rich through this mechanism since most taxes are paid by the majority poor while bonds are purchased by the rich. The government may find an easy way to shift the existing debt liability to future generations, a phenomenon called the circular debt, i.e. refund the matured debt and raise new debt. Despite this tactics, the governments may not be in a position to finance the entire deficits through public borrowing.

Soon after the World War II, different consortia (committees of developed countries) were formed under the auspices of the UNDP for providing financial assistance to the LDCs for accelerating their economic development programs. The role of World Bank and the IMF is important in this context. However, many developing countries have also been relying on debt raising in the international markets (private sector) since 1980sto help finance their increasing budget and trade deficits. Foreign borrowing is very helpful in the short-run but burdensome in the long-run. In case the funds raised are cautiously utilized in income generating projects, then refunding the debt along with interest may not be a serious problem. However, if the funds are consumed rather than invested, and misappropriated, then the outstanding debt assumes the form of deadweight and gets unsustainable. An indebted country has to earn foreign exchange through exports to finance debt servicing and avoid default

Again, after the World War II and the Bretton Woods conference in 1944, it became possible for the governments to finance their budget deficits through new money creation as a short-run strategy. This is often referred to as bank borrowing (borrowing from the central bank) and considered as an effective and easiest mode on part of the government. In strict Keynesian sense, it is called deficit financing, advisable during the times of depression when other traditional instruments fail to work. In simple words, it involves printing of fiat money to fulfil the immediate needs of the government. Creation of money is a powerful tool and almost all the governments use it frequently to overcome financial constraints. It is assumed that the extra money created will be refunded back after completion of the development projects and expected increase in the tax revenues, and that inflation will remain under control. This strategy is apparently harmless and convenient since the governments could easily handle their financial needs without any need of parliamentary approval or resistance from the opposition. It is also convenient in the sense that there is no fear of mass resistance (as in the case of taxation) and the government is not bound to pay any interest (as in the case of borrowing). However there may be a constitutional upper limit for money creation. The developing countries also followed their Western counterparts in this strategy but they couldn't control inflation. In particular, when external funding started to shrink as a result of debt crisis (i.e. sizeable accumulation of outstanding debt and the problems of debt servicing) after 1990's, the only remedy left for the governments was to borrow from their central banks. Therefore, most governments shifted their deficit financing strategies to creation of extra purchasing power.

1.1 The Need for Seignorage

As discussed above, borrowing from the central bank is an easy and cheap source of filling the budgetary gaps but it is inflationary in the final effect. The public sector earns a profit by printing additional money since the cost of creating paper money is far less than the face value of the currency. This profit or purchasing power acquired due to monopoly/sole control on the issuance of new money is called seignorage. This is a sort of indirect tax that is unrevealed, and since it erodes the purchasing power of masses, it may be called inflation tax. Technically, this tax refers to changes in the rate of inflation due to changes in seignorage. It is the opportunity cost of holding cash balances since the purchasing power of masses goes on evaporating.

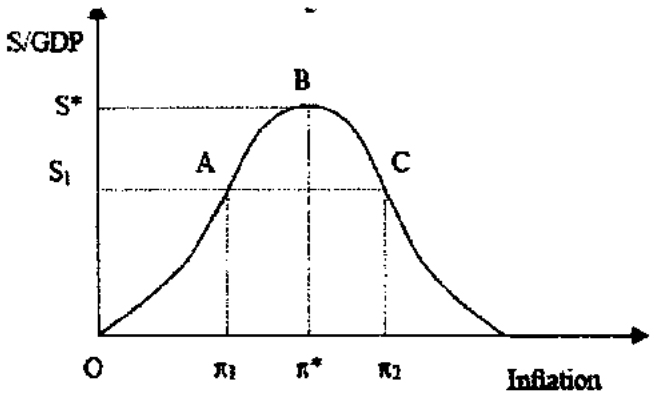
The effectiveness of this measure depends on the situation of the economy. If there is depression and under utilization /underemployment of resources, then an increased public expenditure supported by monetary expansion leads to increased aggregate demand, generation of income and enhanced employment. The increase in income results in raising the tax revenues and then the extra money once created by the government can be recovered. This is the Keynesian rationale for direct government intervention in the system. However, if the economy is in boom or there is full-employment, called the classical range, then deficit financing leads to inflation and suffering of common masses.

1.2 Relationship between Inflation and Seignorage

By expanding the rate of money supply more than the real income (GDP) growth rate, the process of inflation will set up. However given the real interest rate, high inflation rate will increase only the nominal interest rate: $r = i+\pi$, which causes people to reduce their holding of real money balances. Whether real seignorage increases or otherwise depends on the question whether an upsurge in inflation outweighs a decrease in real money supply. If inflation rate is

very low, then a slight increase in its rate increases the real seignorage revenue. On the contrary, if the rate of inflation is already high, then further increase in inflation will have no effect on real seignorage revenue or even the said revenue may decrease.

The above explanation implies that seignorage revenue generally increases with increase in inflation rate up to a certain point (point B in the diagram), beyond which it starts decreasing. This is in line with the well known Laffer's curve. This is because the society's demand for nominal money falls if people anticipate a decline in their purchasing power. In other words, people would like to hold their wealth in different forms other than cash balances or they will transform money balances held in domestic currency into other stable currencies (dollarization can occur). Real assets and goods can be hoarded for future consumption purpose or for trading.



Laffer curve: Source: David Romer(2006),[1]

Decrease in the nominal money balances demands decrease in the seignorage base and therefore further increase in money supply is needed to produce the equivalent revenues. This leads to starting of hyper inflation in the economy. Falling real balances require larger increase in money supply, which in turns lead to further inflation and higher inflation further necessitates more money creation for the government to finance the same level of fiscal deficits. Theoretically

[1] Advanced Macroeconomics ,4th edition

speaking, the government can continue financing budget deficits as long as the expansion of money supply rate /creation outpaces the rate of public adaptation of inflation. However, a threshold exists beyond which the people get convinced that deficits cannot be controlled, and that inflation will never end. This is the stage when currency collapse can occur almost instantaneously. In other words the local currency may lose the confidence of people to work as medium of exchange.

1.3 The Problem Statement

The seignorage remained an important source of income for the government to finance budget deficit throughout the past history of Pakistan, particularly after bifurcation of the country in 1971. Data on Pakistan economy for the period 1972 to 2011 shows that inflation and seignorage have positive correlation except for the periods of very high inflation.

As estimated by M. Farooq Arby (2006), total seignorage in Pakistan varied between 2.1 % of GDP (FY1972) to 8.8 % of GDP (FY 2005), with an average of 5.7 percent (see Table1.1).The results show that the overall seignorage and inflation rate remained positively co-related during the sample period except in two extreme cases of highest inflation (during the early 1970s) and lowest inflation (during the early 2000s).

During the early 1970s (ZA Bhutto regime), inflation and seignorage followed a negative relationship due to very high inflation (around 20 per cent). High inflation has decreased the power of the public sector to acquire real resources by expanding monetary base. In contrast, during the early 2000's (Martial law regime headed by Gen. Musharaf), again the seignorage and inflation were negatively related when inflation declined below 5 percent.

In order to generate seignorage, the central bank has to enhance the monetary base or to print extra currency notes. Successive increase in money supply to finance budget deficits may

generate hyper inflationary spiral in the economy and may decrease the real value of seignorage revenue. Both the factors, namely the lower real value of seignorage and hyper-inflation have negative impacts on the economy. In such circumstances, the government may lose an important source of revenue: whereas additional revenue generation from other sources may not be always feasible. The above table (1.1) shows the trends of seignorage over time.

Table 1.1: Seignorage Revenue for Pakistan Economy - Time period (1972-2005)

Year	Seignorage as % of GDP	Year	Seignorage as % of GDP	Year	Seignorage as % of GDP	Year	Seignorage as % of GDP
1970-71	-	1979-80	5.9	1988-89	2.7	1997-98	5.7
1971-72	-	1980-81	4.4	1989-90	5.9	1998-99	2.5
1972-73	7.4	1981-82	3.7	1990-91	5.8	1999-00	3.8
1973-74	5.3	1982-83	8.1	1991-92	8.7	2000-01	3.7
1974-75	2.1	1983-84	4.1	1992-93	6.7	2001-02	6.5
1975-76	6.6	1984-85	4.4	1993-94	6.9	2002-03	7.9
1976-77	6.7	1985-86	5.3	1994-95	6.4	2003-04	8.8
1977-78	6.7	1986-87	5.1	1995-96	5.4	2004-05	8.7
1978-79	7.6	1987-88	4.3	1996-97	4.7	2005-06	-

Source: M. Farooq Arby (2006) "Seignorage in Pakistan"

Hence it is essential to estimate the threshold level of inflation rate after which the seignorage would be declining. In other words, we have to determine the threshold level in terms of inflation rate that maximizes the seignorage revenue for Pakistan.

1.4 Objectives of the Study

This study is intended to estimate the determinants of seignorage revenue in Pakistan based on a fairly long time series data (1972 to 2014). The specific objectives are as under:

1. Evaluating the relationship between seignorage revenue and its determinants such as inflation tax, change in money income ratio, and increase in the nominal money supply needed to maintain a constant money-income ratio in the face of real growth.

2. Estimating the threshold level of inflation that maximizes seignorage revenue. Implicitly, we have to test whether the Laffer's curve phenomenon holds for Pakistan or otherwise.
3. Calculating the seignorage revenue and inflation tax revenue for Pakistan economy.

1.5 Rationale and Significance of the Study

There is no comprehensive study on seignorage for Pakistan. The study by Arby (2006) and Nasir, Hamid Rao (2011) analyzed statistically the relationship between seignorage revenue and inflation rate. The studies are however limited in the sense that they have not focused on the determinants of seignorage and have not evaluated the revenue maximizing rate of inflation. The present study will not only focus on all the possible determinants of seignorage revenue but also try to investigate the exact relationship between these determinants. Further, the study will also discuss the adverse impacts of this strategy on the economy as a whole.

Almost all the governments in Pakistan have been relying on deficit financing and borrowing from the State Bank, particularly after the bifurcation of the country in 1971. However, the policies of different governments have been different in this regards. The findings of the present study might lead to important policy implications, and therefore might be helpful for the central bank and monetary authorities in determining the optimum money growth rate to generate sizeable seignorage and managing the inflation rate that will be tolerable for the society at large.

1.6 Organization of the study

The study is organized as under. After this introductory chapter, we review the available literature in chapter 2. Chapter 3 discuses the theoretical background followed by a discussion of the empirical models, estimation methodology and data used in the analysis in Chapter 4. Chapter 5 comprises estimation results, interpretations and their analysis. Chapter 6 is devoted to summary and conclusions as usual.

Chapter 2

REVIEW OF LITERATURE

2.0 Opening Remarks

As discussed in the introduction, seignorage is an important source of public revenues in almost all the countries including Pakistan. A detailed study for Pakistan in this regards is however not available. This study is therefore intended to estimate the determinants of seignorage revenue and to test various models in this regard for Pakistan economy. In this chapter, we review the available studies conducted for various countries to rationalize our point of view. For the sake of convenience, the studies are classified in three sections as under.

2.1 International Panel Studies on Seignorage

Samimi (1994) analyzed the relationship between inflation and seignorage by using annual data from 1965 to 1990 for different developing economies. The study concludes that Laffer curve relationship holds between inflation and seignorage for these countries. The results further imply that although the governments of developing countries have to rely on inflation tax to fill up their budgetary gaps, however, financing deficits through inflation tax is highly expensive.

Easterly et al. (1995) analyzed the relationship between money demand and inflation and also estimated the seignorage maximizing rate of inflation. They used annual data from 1960 to 1990for eleven high-inflation developing countries (Bolivia, Chile, Ghana, Israel, Mexico, Zaire, Argentina, Brazil, Nicaragua, Peru and Uruguay. The study, like many others, followed the Cagan's approach to explain the phenomenon[2]. The study under reference also tested the assumption of constant semi-elasticity of money demand function.

[2] This approach assumes that semi elasticity of money demand with respect to inflation is more or less constant.

The study develops a model of money demand, inflation and seignorage based on the actions of optimizing representative who have to face cash-in-advance constraint in meeting their consumption expenditure. The model relaxed the assumption of constant semi-elasticity of money demand due to inflation and incorporated the opportunity cost of holding cash in the face of inflation. The study also estimated the revenue-maximizing rate of inflation and tested if the Laffer's curve phenomenon holds under the Cagan's specification or otherwise.

The results of the study imply that semi-elasticity of money demand varies due to inflation, which stands in contrast to the assumption made by Cagan (1956). The results also revealed that the absolute value of the semi-elasticity rises with rise in inflation, which indicates that people substitute money with other assets as inflation increases. If the degree of substitution between money and bonds is higher in the customer portfolio, then greater is the probability that semi elasticity of money demand increases with inflation.

The results also confirmed that there existed a level of inflation that maximizes seignorage. The seignorage revenues generation grasps a highest of 4.0 percent of GDP at an inflation of 266 percent per annum. Thereafter, the revenue declines to 3.6 percent of GDP when inflation inclined to infinity. In contrast, under the Cagan model, the seignorage-maximizing rate of inflation varies widely between 42 percent and infinity, indicating that there is no Laffer curve.

The study conducted by Click (1998) investigated the average level of seignorage for a group of 90 countries by using annual data for the time period 1971 -1990.The study basically investigated the question as to why the seignorage revenues varied among different countries. The study used the OLS technique to test the relationship between seignorage and its determinants, such as the elasticity of money demand, per capita GDP and government spending.

The results revealed that seignorage is greater in countries where money demand is inelastic and per capita income is low. The relationship between government spending and seignorage is however insignificant.

A study by Samimi et al. (2012) considers a non- linear relationship between inflation tax and inflation rate. The study used panel data for 129 developing countries for the time period 2000 to 2008. The study employed the panel threshold regression model to test the existence of nonlinear relationship between the two variables by segregating the two regimes of low and high inflation.

The results reveal that the threshold level of inflation that maximizes seignorage is 6.7%. Below this rate, inflation has a significantly positive impact on seignorage but above this rate, the impact on seignorage is negative. The results imply the existence of Laffer's curve phenomenon so far as the relationship between inflation and seignorage is concerned.

Aisen and Veigh (2008) investigated the main economic, political and institutional determinants of seignorage revenue. The study used panel data for 100 nations for the time period 1960 to 1999. The results conclude that political instability is common countries with higher seignorage and having higher inflation rate as compared to moderate and low inflation countries. Moreover, the seignorage is higher in new emerging countries as compared to industrialized countries. This result may imply due to the following factors: (a) Greater social polarization; (b) Frequent central bank president turnover (c) Lower economic freedom (d) Higher debt-GDP ratio (e) Poor international credit-worthiness, and (f) Poor access to foreign trade.

The results of the study have important policy implications, particularly for high inflation and political instability. The countries enjoying good political stability have adopted policies of

greater income equality and central bank autonomy. They have less dependence on seignorage to finance their budget deficit.

2.2 Studies on Individual Countries

The study by Kiguel and Neumeyor (1995) analyzed the relationship between inflation, inflation tax and seignorage for Argentina. The authors utilized the monthly data on the variables concerned from 1978 to 1985 and used Cagan's model to determine the revenue maximizing rate of inflation and the consequent seignorage revenue. The results revealed the existence of a clear positive correlation between inflation and seignorage revenues if the inflation rate was below 18% while the revenue maximizing rate was 21.84% per month. In case the inflation rate exceeded this level, then the attempts on part of the government to raise inflation tax revenue further were not successful. The study concluded that the demand for money was unit-elastic at interest rates ranging from a low estimate of 17.20% per month (in the seasonal moving-average partial adjustment model) to a larger estimate of 22.22% (in the instrumental variables market-clearing model). The study implied that any serious stabilization effort should find an alternative source of revenue to replace the inflation tax.

Gökken (2001) analyzed the relationship between seigniorge revenue and inflation rate for Turkish economy by following Cagan's model(1956). The study used historical annual time series seigniorage estimates as dependent variable and the average inflation rate as independent variable for the period between 1990 and 2000. The results revealed that seignorage gains appear to be maximal at about 4% of GNP with 150% annual inflation rate. So Laffer's curve relationship holds between seigniorage and inflation.

Lopez (2001) analyzed the issue of seignorage for Colombian economy by utilizing the data from 1977 to 1997. The study was based on utility optimizing model, with money as an argument in the utility function of the consumers. According to this model, all the real variables do not change in response to variations in inflation rate under the steady state, when the per capita consumption, real money balances and population increase at a constant rate. The absolute value of semi-elasticity of money demand function rises in the beginning with increase in inflation rate, then it reaches a maximum and finally it decreases.

The steady state seignorage as ratio of GDP depended on the gross rate of variation in monetary base and real money balances demand. Greater is the demand for real money balances, higher will be the seignorage revenue and vice versa.

The results reveal that seignorage is a positive function of the rate of inflation. The government can generate additional revenues by expanding monetary base and inflation. When inflation rate reaches the level of hyperinflation (20% quarterly), seignorage revenue remains at a level of about 5% of GDP for Columbia. In case of low inflation rate, the revenues depict marked increases with growing inflation, however it reaches an asymptote. The results reveal that 20 % inflation rate per annum will produce a seignorage of about 3.1% of GDP. The relationship between seignorage revenue and inflation rate does not exhibit Laffer's curve.

Raju (2002) examined the concept of seignorage and inflation tax revenue for India by using the time series data for the period 1952-2000. The Cagan (1956) function was adopted to estimate the seignorage maximizing rate of inflation. The nominal seignorage revenue (S') and inflation tax revenue (I') was computed by following the Rao and Nallari (1996) methodology[3].

[3] For details, see the next chapter on theoretical debates.

The results revealed that the seignorage generated by the government till 1970s has been less than 1% of GDP except for the year 1956, when it was around 2.46 %. The revenues from seignorage have however increased thereafter, falling in the range of 1- 3 % of GDP during the period 1971 to 1990. For the period 1991-1996, the seignorage revenues have been quite higher, crossing 3 % of GDP in 1994. After 1997, however, seignorage revenues have declined considerably, lying between 1- 2 % of GDP. Likewise, the revenues collected by the government from inflation tax have varied over the period 1952-2000. Inflation tax revenues have been less than 1 % of GDP in many years during this period particularly till 1963-64, and over 2 % of GDP in a few years namely 1974-75, 1975-76, 1979-80, 1980-81 and 1991-92.

The study concluded with the remarks that the revenue-maximizing inflation rate was 172.59 % for India during the period 1972-2000. The results pointed out that change in money income ratio and inflation tax revenue are significant determinants of overall seignorage. The empirical analysis also concluded that one fifth of fiscal deficit was financed through seigniorage revenue.

The study by Korosteleva (2002) analyzed the effect of inflation on seignorage revenues and also determined the revenue maximizing rate of inflation for Belarus. The study followed the seminal work of Cagan (1956) for analysis and used the data from May 1995 to December 2002.

The results show that 1% rise in monthly inflation rate during 1995 to 2002 on the average leads to 7.8% fall in real money balances per month. Thus 70% of the economy was monetized on the average. The maximum seignorage varied between 7 to 10 % of GDP during 1995-2002, which was consistent with the findings of Cagan (1956) and Romer (1996)[4].Secondly, the actual growth rate of money in 1995 was higher than the revenue-maximizing rate and therefore a higher level

[4] Their results also reveal that the revenue-maximizing money growth rate varies around 300 % per annum.

of seignorage could be attained at the cost of rising inflation (calculated as period average). The revenue-maximizing rate remained lower than the actual rate of inflation in 1998, 1999 and 2000 (where the revenue-maximizing money growth was75 per cent).Nominal money growth rate remained lower than the actual inflation rate while these two variables stayed at a level less than revenue maximizing money growth rate. This fact must not be considered as measure to get maximum seignorage as society will bear the cost in form of hyperinflation.

The policy of monetary expansion led by Belarus government was aimed to avoid output contraction and also to strengthen the State-owned enterprises .As a result, the private sector and households had to bear a loss. After 2002, the Belarus government adopted contractionary monetary policy, as it realized the cost of excessive money creation.

The study by Nkurunziza (2004) investigated the responsiveness of money demand to inflation rate and the degree to which the public sector relied on inflation tax for revenue collection during the war period for Burundi economy. It utilized the quarterly data for the period 1980 to 2002.The study determined the revenue maximizing rate of inflation by following the Agenor and Montiel (1994) framework for the purpose.

The results show that government's revenues from traditional sources such as taxes, international aid and excise duty had declined during the war of 1993. Therefore, the government tried to fill the gap in revenues from inflation tax. Before war, the inflation tax in total revenue remained below 4% on the average. Owing to government efforts, the inflation tax increased to 18 % in 1996 but dropped back to its pre-war level in 1999.The increase in inflation tax was just transitory. Thus the economy of Burundi lied on the wrong side of the Laffer's Curve during the war period. The public reacted against the government strategy by decreasing holding of

domestic currency. The long-run semi-elasticity of demand for money increased from 6.9 to 19.3 that reflected a phenomenon called as flight from domestic currency. The study concluded that the Laffer's curve relationship holds for inflation and seignorage.

The study by Korap (2006) scrutinized the trends of inflation tax and seignorage revenue for Turkish economy by considering data from 1980 to 2005. The study finds that the Turkish economy remained on the right side of the Laffer's curve and therefore a positive relationship could be observed between seignorage revenue and inflation rate.

The study by Samimi et al. (2011) investigates the relationship between seignorage and inflation rate for Iranian economy. It follows the Cagan (1956) approach to explain the relationship between the two variables. For the sake of empirical investigation, it adopts the Hansen (1996, 2000) threshold regression model to determine the existence of a non-linear relationship between seignorage and inflation rate. The relationship is tested while considering two regimes of inflation (low and high rates) and using the time series data for seignorage revenue (dependent variable) and inflation rate (explanatory variable).

The study concludes that in low inflation regime (inflation rate < 15.24%), the inflation and seignorage are positively correlated while for high inflation regime (inflation rate > 15.24%), there exists a negative correlation between the two variables. Thus, an inflation rate of 15.24% is the threshold for the government to appropriate maximum revenue in Iran. The study also concludes that Laffer's curve relationship between the two variables holds for Iranian economy.

Another study conducted by Samimi et al. (2012) explores the interrelationship between inflation and seignorage for Iranian economy. The study uses time series data for the period 1973 -2007 and adopts the model of revenue maximizing rate of inflation and money demand function based

on Agenor and Montiel (1996). The results reveal that there exists a unique optimizing inflation rate for each year. The inflation rate that maximizes the inflation tax falls in range of 22%-78% in Iran while the rate which maximizes the seignorage revenue is 78% per annum.

The study concludes that Laffer's curve relationship holds between inflation and seignorage revenue in the Iranian case. The research highlights an important policy implication for the policy makers. Although the government has been able to earn seignorage revenues by accommodating a higher rate of inflation but it created uncertainty in the economy, which may negatively influence the productivity of government policies.

Dogru (2013) analyzed the relationship between seignorage, inflation tax and inflation for Turkish economy. The study used annual time series data from period 1981 to 2011.The study calculated inflation tax by multiplying inflation tax with previous year monetary base. Seignorage revenue is obtained by dividing change in monetary base with inflation rate.

The study concludes that Inflation tax and seignorage revenue have been in the range 1.55to 3.95 % of GDP during period 1981-1989, and remained around 1 to 1.5 % of GNP during the decade of 1990s except the year 1994. The results further conclude that high inflation decreases real money balances that lead to lower seignorage revenue.

Neumann (1992) analyzed the phenomena of seignorage for USA by taking data from 1960 to 1990. The paper used a new approach for measuring and analyzing the monetary seignorage. According to this approach, the flow of seignorage consists of two parts. The first part is monetary seignorage, which arises through production of money; while the second part is the interest earned by the central bank on the stock of non-government debt. The study not only analyzed the flow of seignorage generated through money creation but also the distribution of seignorage among various uses. One of the important uses is obviously the financing of budget

deficit. The study also analyzed the relationship between monetary and fiscal seignorage (part used for budget financing). The analysis concludes that the level of inflation which maximizes fiscal seignorage is 7%. Another important conclusion is that fiscal seignorage was lower during the years when the rate of inflation was greater than 9% and higher during the years when inflation rate was lower than 4.5%.

The study by Neumann (1996) analyzed generation and distribution of seignorage for German and Japan economies. The authors used annual time series data for the period 1961-1991. They developed a comprehensive framework for measurement and uses of seignorage.

The study used three concepts of seignorage: (a). Total gross seignorage that measures the total flow of resources to the government generated through money creation, (b). Drazen measure showing the flow of real resources to the government, and (c). Fiscal seignorage, which represents the funds received by the government for financing budget. Total gross seignorage flow results from two sources; first source is monetary seignorage, second is the interest earning on the stock of non-government debt.

In general total seignorage is utilized for covering the expenses on printing of money or the central bank operations for financing budget deficit. The study reveals that interest earning on non-government debt is the significant source of seignorage and its average share is about 33% percent in Japan and 43% percent in Germany. Thus, monetary seignorage contributes little to the total flow of seignorage. The study finds strong evidence that monetary seignorage dominates the fiscal seignorage by a large margin. For Japan, the fiscal seignorage falls short of monetary seignorage by about 35% percent on the average across the sample period. while for Germany the difference is about 75%

Cardoso (1998) analyzed the relationship between seignorage and inflation for Brazil economy. using the annual time series data for the period 1950 to 1995. After the mid 1994, a stabilization plan was implemented in Brazil to control the inflation rate. This plan used three types of reforms; tight fiscal policy, tight monetary policy and exchange rate appreciation.

In order to tighten monetary policy, the required reserves-to-deposit ratio was increased from an average of 26 % during January–June 1994 to an average of 64 % during November 1994–April 1995. The seignorage collected by central bank decreased with the stabilization policy but that accrued to commercial bank increased. The share of central bank in total seignorage was 1.8% of GDP during the peak inflation year of 1993. It rose to 3 % in 1994 (the year of the Real Plan), while it decreased to 2 % during the high-inflation period in 1995. In contrast, the share of central bank in total seignorage rose from an average of 60 % during January–June 1994 to an average of 84 % during November 1994–April 1995. This evidence supports the view that a fall in the rate of inflation could be achieved through a tight monetary policy. On the other hand, a tight fiscal policy was not successful to attain stabilization objectives since budget financing through seignorage collection didn't decrease.

Kenneth and Baba (2013) studied trends of seignorage, inflation and inflation tax by taking annual data from period 1980 to 2012 for Ghana economy. This study determined the rate of inflation that maximized seignorage and also investigated the validity of Laffer's curve. They used the models by Friedman and Cagan calculation of seignorage and inflation tax. Quadratic equation as proposed by Jafari was used to find the seignorage maximizing rate of inflation.

The data reveal that value of inflation tax remained positive during the sample period. The maximum is reflected for the year 1981, while the minimum for 1992. Seignorage revenue possesses both negative and positive values during the data period. Its value remains lower than

inflation tax throughout the sample period except for the year 1992 and 2007. The minimum seignorage collected during the period is 3.5% of GDP while maximum is 3.9% of GDP. The rate of inflation that maximized seignorage revenue is 180% per annum.

The results of the study have important policy implications. The government can depend on seignorage and inflation tax revenue to a maximum of 3.0%. Higher level beyond a certain threshold results in potential decrease in inflation tax and holding of domestic money balances by the public. All inflation rates till the date of research are quite below the seignorage maximizing rate of inflation, which suggests that public sector can consider inflation tax as a source of revenue. The Laffer's curve relationship between the variables concerned holds for the economy of Ghana.

The study conducted by Selquk (2001) analyzed the effect of currency substitution on rate of inflation that maximized the seignorage revenue. The study used quarterly data from year 1987 to 2000. The study used Euler's equations and Cagan's money demand function to estimate the seignorage maximizing rate of inflation.

The result of the Euler's equation concludes that higher the degree of currency substitution, lower will be the seignorage collected at higher inflation rate. Euler's equation estimates show that seignorage maximizing rate of inflation is 5% if the ratio of currency substitution is high. The results of Cagan function show that the quarterly rate of inflation that will maximize seignorage is roughly 60 % (over 500 % yearly) for the Turkish economy. These estimates of the rate of inflation in Turkey are comparatively higher by many folds than the world inflation rate. This finding is deceptive since it overlooks the likelihood of currency substitution.

2.3 Studies on Pakistan

The literature concerning the relationship between seignorage and inflation rate in case of Pakistan is very limited. We find only two studies summarized below:

Arby (2006) analyzed the relationship between seignorage revenue and inflation rate for Pakistan economy by considering the data for 1972 to 2005. The paper uses the traditional definition of seignorage, i.e. the real value of newly created money. The study also investigates whether Laffer's curve relationship holds for Pakistan or otherwise?

The results show that the overall seignorage and inflation rate remained positively co-related during the sample period except in two extreme cases of very high and very low inflation (1970s and 2000s). During early 1970s (ZA Bhutto regime) when inflation was above 20% per annum, the rate of inflation and seignorage showed negative correlation. High inflation had reduced the power of the public sector to generate real resources by expanding monetary base. On the other hand, during early 2000s (Martial law regime headed by Gen. Musharaf), when inflation fell below 5 percent, seignorage and inflation again depicted negative relationship. The paper concludes that Laffer's curve relationship for the two variables holds for Pakistan, i.e. rising inflation leads to higher revenues up to a certain threshold beyond which the revenues start to decline owing to a fall in the tax base (public holding of money balances).

Rao (2011) computes seignorage revenue for Pakistan by taking time series data over the period 2001 to 2011. The study uses the Neumann and Klein approach to calculate seignorage. This method computes seignorage revenue both from its source side and use side.

From the source side, total seignorage is obtained by adding monetary seignorage and interest rate seignorage; while the from the use side, seigniorage is obtained by adding different uses.

like its use for covering the cost of coinage and printing of notes, its use for net investment by SBP in its portfolio of non-government debt, and its use for financing the budget deficit.

According to Neumann and Klein approach, monetary seignorage does not give a credible measure of government revenue from printing of money. Total of fiscal seignorage and central bank operational cost will surpass monetary seignorage under the following conditions:

(a) If the real rate of interest is greater than real growth rate of the economy.

(b) If credit to the private sector and net foreign assets are significant sources of money growth.

However, monetary seignorage will be the correct measure of revenue if created under the following conditions:

(i) If credit to the public sector is the only main source of money creation.

(ii) If the real rate of interest is equivalent to the real growth rate of the economy.

The study concludes that seignorage in Pakistan obtained through various sources varies between Rs -20 billion to Rs 374 billion from FY00 to 2011, with an average of Rs 164 billion per annum. The total seignorage from source side varies from 0.5 percent to 3.9 percent of nominal GPD, with an average of 2.1 percent per annum.

On the other hand, the total seignorage computed by adding up its uses varies between Rs -70 billion to Rs 358 billion from FY00, with average of Rs 168 billion per annum, in other words the seignorage remained between -6.1 percent to 6.8 percent of nominal GDP. The study claims that the methodology useqw1ed in estimation is superior to other concepts as it is consistent with theoretical definition and empirical measurement.

2.4 Gap in the Literature

The study conducted by Arby (2006) and Rao (2011) analyzed relationship between seignorage and inflation rate for Pakistan economy. These studies are limited in the sense that they have not investigated the determinants of seignorage revenue and also have not evaluated the revenue maximizing rate of inflation. Further the sample size is also small. The present study intends to fill up this gap by considering a relatively larger sample size. It not only analyzes the relationship between inflation and seignorage but also investigates other possible determinants of seignorage. In addition, the study also determines the revenue maximizing rate of inflation for Pakistan. We summarize the achievements in different studies in Table 2.1 below.

Table 2.1: Summary of Literature Review

Country	Author	Methodology	Results
Pakistan	Arby (2006)	Seignorage is measured as real value of newly issued money.	Relationship b/w Seignorage and inflation follows Laffer curve phenomena.
Pakistan	Rao (2011)	Neumann and Klein (1990) approach	Positive relationship exists between monetary seignorage and inflation during sample period.
Iran	Samimi et all (2012)	Agenor and Montiel (1996) approach	Laffer curve relationship holds between inflation and seignorage. Laffer curve is acceptable for Iranian economy.
Iran	Samimi et all (2011)	Cagan (1956) model and Hansens (1996, 2000) threshold regression model.	Laffer's curve relationship holds between inflation and seignorage.
Turkey	Gokken (2001), Korap (2006)	Cagan model (1956)	Turkish economy remains on the correct side of the Laffer's curve
Burundi	Nkurunziza (2004)	Agenor and Montiel (1994)	Laffer's curve relationship holds between inflation and inflation tax.
India	Swati raju (2001)	Rao and Nallari model (1996) and Cagan model (1956)	Inflation tax revenue and change in money income ratio are significant determinants of seignorage revenue. Laffer's curve holds between seignorage and inflation.
Belarus	Korosteleva (2002)	Cagan Model (1956)	The results reveal that the revenue-maximizing money growth rate varies around 300 % per annum. Further if the actual rate of money growth remains higher than the revenue-maximizing rate, then seignorage revenue can be increased at the cost of hyperinflation
Colombia	Martha (2001)	Optimizing model with money in the utility function	Seignorage is an increasing function of the rate of inflation. Relationship between seignorage and inflation does not exhibit the Laffer's curve phenomenon.
Brazil	Cardoso (1998)	Comparing the impacts of tight monetary and fiscal policies or their relative importance.	Inflation rate reduced through monetary reforms results in higher seignorage revenue
USA	Neumann (1992)	Seignorage revenue arises from two sources (a) Monetary seignorage (b)Interest earned on stock of non government debt	Level of inflation that maximized seignorage revenue is 7%
Japanand Germany	Neumann (1996)	Neumann and Klein (1990) approach	Monetary seignorage dominates fiscal seignorage

Turkish economy	Dogru (2013)	Seignorage revenue is calculated by dividing change in monetary base with inflation index	Higher inflation results in lower seignorage revenue
Ghana(2013)	Keneth,Baba(2013)	Friedman and cagan model	Rate of inflation that maximized seignorage revenue is 180%
Argentina	Kiguel ,Neumeyer (1995)	Cagan function used.	In case the inflation rate exceeds 21% per month, then government attempts to raise seignorage revenue will not be successful
Turkey	Selquk(2001)	Cagan function and Eulers equation	Rate of inflation that maximized the seignorage revenue is 5%
General Panel	Samimi et al (1994)	Panel threshold regression model	Laffer's curve relationship holds between seignorage and inflation.
General panel	Aisen and Veigh (2008)		Political instability leads to larger seigniorage revenue
Panel of eleven high-inflation developing countries	Easterly et al (1995)	Cagan (1956) model used.	Result from the conventional Cagan model show that Laffer's curve relationship does not hold between inflation and seignorage However if the assumption of constant semi-elasticity of money demand w.r.t. inflation is relaxed, then Laffer's curve relationship holds.
General Panel	Samimi et al (2012)	Panel threshold regression model	The results reveal that threshold level of inflation that maximizes seignorage revenue is 6.7%. Below this rate, inflation has a significantly positive impact on seignorage. Conversely, when inflation rate is greater than 6.7%, it has a negative impact on seignorage

Chapter 3

THEORETICAL CONSIDERATIONS

3.0 Theoretical Framework

As discussed in the very beginning, the term seignorage refers to the revenue generated implicitly by the government by the virtue of its monopoly on the creation of money. This is because the extra money created is not backed by real reserves in the form of gold, silver or foreign exchange, as was the case before the Bretton Woods system. However, this action on part of the government is always associated with inflationary trends, if the extra money created is not used carefully (in income generating projects).

There are basically three alternate viewpoints on the relationship between the seignorage and inflation rate. The Laffer's curve phenomenon has been employed in the literature to discuss these views. The first view assumes that the economy remains on the "efficient" part of the Laffer's curve and rising inflation results in higher seignorage. The second view argues that the economy can attain an equilibrium point while remaining on the "wrong" part of the Laffer's curve. If that is the situation, then fiscal deficits (and extra money creation) are not the only reasons of inflation. From a fiscal point of view, cutting down the rate of inflation can bring about more seignorage revenue for government. Both the views believe in high inflation as a stable long run equilibrium phenomenon The third view deems high inflation as an unstable equilibrium. The main cause of such high inflation rate is the attempt on part of the government to raise seignorage by creating new money at a rate greater than the money demand. According to this view, as the economy attains this point, inflation will increase speedily and ultimately reach the levels of hyperinflation. This view is also supported by the Friedman's contention (as

discussed below) that the growth rate of money supply over and above the real growth rate of the economy (output) eventually leads to inflation[5]

3.1 The Quantity Theory of Money

The relationship between seignorage and inflation rate can simply be explained through the quantity theory of money in its crude form or the equation of exchange due to Fisher (1922) given by: MV=Py or M = k•Py. where 'M' is the quantity of money in circulation and 'V' is the velocity of circulation: k=1/V. $Py=\Sigma P_i y_i$. (where i =1,2.....n) is the total value of output (nominal income) that may be used as proxy for the total value of transactions.

The equation of exchange in its crude form reveals that the price level increases in proportion to increase in the money supply since velocity is considered as behavioral constant and real output is assumed to remain somehow nearer to the full employment level (Classical view):

$$dM = k \bullet y \bullet dP \rightarrow dM/P = k \bullet y \bullet dP/P = m \bullet \pi, \text{ since } m=M/P=k \bullet y \quad \ldots\ldots(3.1)$$

Now if the government covers the budget deficit by creating money, then people view the bank borrowing policy equivalent to taxation. The "tax revenue or seignorage" equals the product of the rate of inflation (tax rate) and the money supply or monetary base (tax base). The economic agents holding money have to pay the tax by losing their purchasing power with the passage of time. This may be called the inflation tax.

3.2 The Friedman Model

Milton Friedman (1956) restated the 'Quantity Theory' with many important modifications. The money demand function, as proposed by Friedman may be written in the general format as:

$M^d = P \bullet y \bullet V(.....)$, where 'V' is the velocity of money that depends on many observable factors, including the permanent income, the rate of inflation, the rate of return/interest on equities and

[5] Fischer and Bruno(1990)

bonds etc. The velocityfluctuates slightly within a limited range but remains stable, rather than being a behavioral constant. This stability of the velocity, according to Friewdman, is essential for the money to perform its basic function of being a medium of exchange. Taking total differentials and dividing through M, we get:

$$dM = \left(\frac{\partial M}{\partial P}\right).dP - \left(\frac{\partial M}{\partial y}\right).dy - \left(\frac{\partial M}{\partial V}\right).dV \quad \rightarrow \quad \frac{dM}{M} = \left(\frac{\partial M}{\partial P}\frac{P}{M}\right).\frac{dP}{P} + \left(\frac{\partial M}{\partial y}\frac{y}{M}\right).\frac{dy}{y} \ldots\ldots dV \cong 0$$

or $M\hat{} = \eta_{m,p} P\hat{} + \eta_{m,y} y\hat{}$ .... (where the terms $\eta_{p,y}$ and $\eta_{m,y}$ denote partial elasticities) .....(3.2)

Thus monetary expansion is translated into two components, the growth of real income and inflation. Friedman advocated a formula based monetary policy (in contrast to discretionary policy) if the objective is to ensure economic and financial stability. Keeping in view this proposition and assuming inflation to be nearly zero (stable prices) then,

$M\hat{} = \eta_{m,y} y\hat{} \rightarrow dM = \eta_{m,y} y\hat{} \cdot M \rightarrow dM/P = \eta_{m,y} y\hat{} \cdot M/P \rightarrow S = y\hat{} \cdot m = m \cdot g$ ..... (3.2.1)

(assuming$\eta_{m,y}$=1) and g= dy/y= growth rate of real GDP).

This is the optimal (and safe) level of seignorage revenue that can automatically accrue to the government without the danger of inflation. The monetarists therefore prescribe a rule of thumb or the formula based monetary policy; i.e. if inflation has to be controlled, then the growth rate of money should be linked to the growth rate of real income. In other words, a discretionary monetary policy should be avoided if the objective is financial stability in the economy.

3.3 The Cagan Model

According to Cagan (1956), there are two sources of seignorage. The first is the "tax" on the stock of real money balances held by the public, since inflation erodes the purchasing power of money, which is siphoned by the government. The second part is due to the rising demand for real money balances as a result of increase in the real income so as to keep up with the growth of the economy – even if inflation is zero. These components can be easily worked out as under:

Seignorage is measured as the real value of newly created money in a given time period: S=dM/P

From equation 3.2, we may write the growth of money supply by assuming the price and income elasticities of the demand for money to be unity each: $M\hat{} = y\hat{} + P\hat{}$ or dM/M= (dy/y+dP/P). This assumption seems to be plausible, keeping in view the Friedman's contention that the demand for money is homogeneous of degree one in income and prices. The above function may be re-written as under:

$$\frac{dM}{M}\cdot\frac{P}{P} = \frac{dM}{P}\cdot\frac{P}{M} = \frac{dy}{y} + \frac{dP}{P} \quad \Rightarrow \quad \frac{dM}{P} = \frac{M}{P}\left(\frac{dy}{y} + \frac{dP}{P}\right) \quad \Rightarrow \quad S = m(g + \pi)$$

Or $S = S_1 + S_2 = m \bullet g + m \bullet \pi = m(g + \pi)$ ..... (3.3)

The first component (m.g) reflects the change in real money balances consequent upon a change in the real income and the second one ($m \bullet \pi$) represents inflation tax revenue.

Cagan considered the Keynesian demand function (Liquidity Preference function) for real cash balances: M/P=L(i, y), where 'i' stands for nominal interest rate and 'y' for real GDP ... (3.4)

The nominal interest rate equals the real interest rate and expected inflation. $i = r + \pi^e$

Thus equation (3.4) may be rewritten as: $M/P=L(r+ \pi^e, y)$ ..... (3.4.1)

Next consider the steady state situation where real output, real interest rate remain at equilibrium (constant) level, and the actual inflation and expected inflation remain the same or the rate of inflation equals the rate of growth of money supply: $\Delta M/M= g_m = \pi = \pi^e$..... (3.4.2)

As 'r' and 'y' remain constant under the steady state, the above function may be rewritten as:

$M/P=L(r+ g_m, y)$ ..... (3.4.3)

The seignorage revenue in this situation equals the real value of additional money: $S=\Delta M/P$

Multiplying and dividing by M, we get: $S = (\Delta M/M) \times (M/P) = g_m \bullet m = \pi \bullet m$..... (3.4.4)

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The gross revenues from money creation, as explained above, comprises two components but in the extreme situation ,i.e. if the real output, real rate of interest and real money supply remain unchanged, then seignorage comprises only inflation tax: $S = m \cdot \pi$ (The first component only).

The above equation may be rewritten to define seignorage revenue as a fraction/percentage of real GDP: $S_n = S/y = \Delta M/P/y = \Delta m/y + \pi \cdot m/y$

$S_n = S/y = \Delta M/Py = \Delta(M/P)/y + \pi \cdot (M/P)/y$

$S_n = S/y = \Delta M/Py = \Delta(M/Py) + \pi \cdot (M/Py) = \Delta m_n + m_n \cdot \pi$ ..... (3.4.5)

Where $m_n = M/Py$ shows the money-income ratio

Δm_n =change in money balances as fraction/percentage of nominal GDP

$m_n \cdot \pi$ = inflation tax revenue as fraction/percentage of nominal GDP

Next looking at the supply side, where the total money supply is given by: M = Cu + D (currency in circulation and deposits with the commercial banks). The commercial banks are obliged to keep a fraction of the deposits with the central bank as reserves: R = zD, where z=R/D is the required reserve ratio. Then the inside money (inside the commercial banks) is given by: (1-z) D and the outside money (money circulating in the economy plus commercial banks reserves held by the central bank) is H = Cu + R, called the high powered money or monetary base. As such, the seignorage is divided between the central bank and commercial banks proportionately:

$S = S_c + S_b$, where $S_c = \Delta H/P$ and $S_b = (1-z)\,\Delta D/P$ ..... (3.5)

Keeping in view the above considerations, Cagan (1956) suggested the following demand for money function (Keynesian function in log form):

$\ln (M/P) = a + \alpha \ln y - \beta i$, where $i = r + \pi = r + g_m$ ..... (3.6)

The parameter 'α' is the income elasticity of the demand for money ($\eta_{m,y}$) and 'β' is the interest semi-elasticity of the demand for money($\eta_{m,i}$). Units are selected such that α=1.

Taking anti-logs, the function assumes a semi-Cobb Douglas format:

$M/P = m = y\, e^{a-\beta(r+\pi)}$ ..... (3.6.1)

On substituting for 'm', Eq. 3.4.4($S = g_m \cdot m$) may be rewritten as:

$S = g_m \cdot y\, e^{a-\beta(r+g_m)}$ ..... (3.6.2)

If the level of income and the real rate of interest remain constant, the seignorage is given by:

$S = g_m \cdot y^* \cdot e^{-\beta g_m} \cdot e^{a-\beta r^*} = A\, \pi\, e^{-\beta \pi}$ ..... (3.6.3)

Where $A = y^* e^{(a-\beta r^*)}$ (all the constant terms)

Differentiating with respect to π ($= g_m$), Cagan (1956) derived the condition for maximal seignorage revenue: $dS/d\pi = (1-\beta\pi)\, Ae^{-\beta\pi} = 0 \rightarrow (1-\beta\pi) = 0 \rightarrow \pi = 1/\beta$ ..... (3.6.4)

3.4 Formulation by Rao and Nallari (1996)

According to Rao and Nallari (1996), seignorage is an implicit tax imposed by the government and consists of the amount of real resources generated by the government by changing money supply. Their formulation is similar to Cagan (1956) model except the addition of another term dm. The seignorage revenue denoted by S_n can be defined as:

$S_n = \Delta M/Py = \Delta M/Y = \Delta M/M.M/Y = g_m \cdot m_n = \Delta m_n + m_n \cdot \pi + d_m$ ..... (3.7)

The terms $S_n = \Delta M/Py = \Delta M/Y$ are the same as used in the formulations discussed above and represent the seignorage revenue as fraction of GDP. The term $g_m \cdot m_n$ explains the value of resources (as fraction of GDP) obtained by the government as sum of three components:

(1) Δm_n = represents change in money balances as fraction of nominal GDP.

(2) $m_n \cdot \pi$= presents inflation tax revenue (ITR) as fraction of nominal GDP.

(3) d_m = represents change in nominal money supply needed to maintain constant money income ratio in face of real growth.

However only in a stationary state (with Δm and gm = 0) will the seignorage revenue be equal to inflation tax revenue.

3.5 Other Theoretical Debates

Obviously, if the money supply grows in line with growth of real income/output, inflation will be zero but seignorage will still be positive. Modern research indicates that increase in the money supply can bring variation in the real output only in the short run. However, the output will eventually return overtime to its 'normal' level compatible with the natural rate of unemployment. The long run impact of an increase in the money supply is mainly reflected into increase in the general price level.

The question arises as to which of these explanations can best explain the actual behavior of a particular economy? The answer depends on whether the elasticity of money demand with respect to inflation is greater than unity or otherwise; and whether the long-run fiscal deficit is greater or smaller than the maximum long-run revenue expected from money creation.

Next is the question as to who finally pays the inflation tax? Obviously, the general public, both households and firms (production sector) have to pay the inflation tax. The empirical evidence for Ukraine shows that enterprises paid a major share of the inflation tax, especially during 1993. In Burundi, high inflation inflicted due to government reliance on money creation and repeated devaluations drastically decreased the purchasing power of citizen during the war period. However, the cost of substituting foreign assets for domestic currency was high due to govt. restrictions on such transactions. Given this constraint, people invested heavily in real estates to safeguard themselves from the adverse impacts of inflation and currency depreciation. But this variation in portfolio behavior had only partial success. During the war period of 1993 - 1997, the average ratio of capital flight almost doubled, granting certain credibility to the supposition

that capital flight can be one of the tactics exercised by economic agents to protect their assets from inflation tax and other war associated consequences[6]

The cost of inflation stems from the fact that money essentially serves three purposes:

(i) It is the most convenient medium of exchange, (ii) It is a unit of account, and (iii) It is a store of value as also the usual standard of value. All these functions of money are adversely affected during high inflation. The relative prices of goods are highly variable and it is difficult to use money for the assessment of their values. Likewise, the relationship between money and value of other commodities gets distorted and money cannot be used as a unit of account. Finally, the people feel uncomfortable in storing their wealth in the form of money if its own value is questionable. As such, money loses its credibility and confidence of masses. This phenomenon was observed after the World War-I, when the German Mark lost its basic functions and also in the recent past when the Afghan currency was seldom acceptable to the masses during the 1990s. The real incomes of the fixed income groups (like the daily wage earners, pensioners and people working in the informal sector) are eroded. The cost of living rises at high speed but incomes remain somewhat constant or lagging behind since indexation of incomes with inflation is often slow and incomplete. The creditors/lenders generally lose while the debtors/borrowers gain from inflation. The suppliers and entrepreneurs may gain from high inflation since they may get raw material at relatively cheap prices, whereas the prices of finished products rise continuously. Consequently, the peasants, cultivators and persons engaged in the production of primary commodities lose during high inflation. In general, the distribution of income gets more unequal and poverty increases during the periods of high inflation.

[5] Nkurunziza.(2004)

Chapter 4

MODEL, METHODOLOGY AND DATA

4.0 The Empirical Models

Keeping in view the discussion in Chapter-3, the present study intends to make use of the basic model by Cagan (1956) and further extended by Rao and Nallari (1996). The objective is to empirically estimate the important determinants of seignorage in Pakistan and also to test the existence of Laffer curve phenomenon, in other words to evaluate the relationship between seignorage and inflation. We discuss the empirical considerations as under:

4.1 Estimation of Seignorage via the Cagan model (1956)

The seignorage function shown as equation (3.4.5) in chapter 3 can be written in the empirical format as: $S_n = \alpha_0 + \alpha_1 \Delta m_n + \alpha_2 m_n \bullet \pi + u_t$ ..... (4.1)

In the above relation, S_n represents the seignorage revenue as percentage of nominal GDP, Δm_n shows the change in money-income ratio (monetary aggregates/nominal GDP), $m_n.\pi$ depicts the inflation tax revenue as percentage of nominal GDP. Consequently, the coefficients α_1 and α_2 represents the percentage change in seignorage revenue due to percentage change in money and in the inflation tax respectively, where α_0 is the intercept term and u_t is the stochastic term with usual properties of zero mean and constant variance.

4.2 Estimation of Seignorage via the Rao and Nallari model (1996)

The seignorage function given by equation (3.7) in chapter 3 may be reproduced in the stochastic form as under: $S_n = \beta_0 + \beta_1 \Delta m_n + \beta_2 \pi \bullet m_n + \beta_3 dm + u_t$ ..... (4.2)

The variables S_n, Δm_n, $m_n \bullet \pi$ are the same as defined in 4.1 above; and 'dm' shows the change in nominal money supply required to maintain a constant money-income ratio in line with the real growth of the economy. The only difference between 4.1 and 4.2 is the absence/presence of dm term. As discussed in the theoretical framework, the Cagan model and other extensions are in fact the variants of the basic model suggested by Friedman.

4.3 Estimating the Rate of Inflation that Maximizes Seignorage

The present study also tries to evaluate the seignorage maximizing rate of inflation, in other words to test the existence of the Laffer's curve phenomenon with reference to data from Pakistan. In this context, we follow the model suggested by Ahmed Jafari Samimi (1997) which uses a quadratic function to explain the relationship between seignorage and inflation, given as:

$$S_t = \mu_0 + \mu_1 \pi_t + \mu_2 \pi_t^2 + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.3)$$

In the above relation, S_t stands for the seignorage revenue expressed as percentage of GDP, and π is the rate of inflation where μ's are the coefficients of inflation.

The estimated function may be written as: $S = \hat{\mu_0} + \hat{\mu_1}\ \pi + \hat{\mu_2}\ \pi^2$,which may be maximized w.r.t. the rate of inflation:

$$\frac{dS}{d\pi} = \hat{\mu_1} + 2\hat{\mu_2}\,\pi = 0 \quad \Rightarrow \quad \pi^* = -\frac{\hat{\mu_1}}{2\hat{\mu_2}} \quad \ldots\ldots\ldots\ldots\ldots \quad (4.4)$$

The seignorage maximizing rate of inflation is readily obtained from the first order condition. The second order condition may be checked for consistency, and which should be negative. The model is useful to capture the non-linearity in the relationship between inflation and seignorage

4.4 Methodology

All the models suggested above fit well with the OLS specifications. However, there is one problem of practical nature. Since we are using the time series data on different variables, it is necessary to check if the variables are stationary or otherwise before carrying out the estimation. A time series data is said to be stationary if it converges to equilibrium after some disturbance. Alternatively, the series is said to be non-stationary if it contains a unit root. The value of the variable concerned at a given point of time may be somehow related to its past or future values. For instance, the simplest case is that the difference between two successive values is constant;

$\Delta Y_t = (Y_t - Y_{t-1}) = C$ or $\Delta Y_t = (Y_{t+1} - Y_t) = C$. Alternatively, the said values may be related with each other through some well ordered functional relationship or through some stochastic relationship. We may write a simple first-order difference equation in the general format as:

$Y_{t+1} = \alpha Y_t + C$ or $Y_{t+1} - \alpha Y_t = C$. ..... (4.5)

Alternatively, the RHS may be a time dependent variable: $Y_{t+1} - \alpha Y_t = g(t)$

Assuming the simplest case, i.e. the RHS is constant, we proceed as under:

At equilibrium, $Y_t = Y_{t+1} = Y_{t-1}$. Therefore, $Y_e = \frac{C}{(1-\alpha)}$, which is the equilibrium value.

Next, the deviation from equilibrium at any point of time may be represented by the complementary solution. The trial solution may be given as: $Y^c = A\lambda^t$, where 'λ' is called the characteristic root and 'A' is some constant, to be determined with the help of information on the initial conditions. The complementary solution is then given by:

$$Y^c = A\lambda^{t+1} - \alpha A\lambda^t = 0 \Rightarrow A\lambda^t(\lambda - \alpha) = 0 \Rightarrow \lambda = \alpha \quad \text{..... (4.5.1)}$$

The value of the variable at a given point of time can be represented by the final solution:

$$Y_t = Y^e + Y^c = \frac{C}{(1-\alpha)} + A(\alpha)^t \quad \text{..... (4.5.2)}$$

For stability of equilibrium, it is necessary that the absolute value of the characteristic root should be less than unity: $\lambda < 1$. It implies that the deviations or distortions will eliminate with the passage of time and the variable will return to its equilibrium value. In the opposite case, the variable is likely to diverge (go away) from the equilibrium or the time path will be divergent/explosive. Further, the sign of the characteristic root determines the nature of the time path. A positive sign implies that the time path is monotonic and a negative sign means that the path is oscillatory. It is therefore necessary to check for the existence of 'unit root' in the data before carrying out estimation.

For this purpose, we apply the Ducky Fuller (1979) test on the variables to ensure that they are stationary, i.e. there are no unit roots in different series. The Dickey Fuller (DF) test is an appropriate and simple method for testing the order of integration. If the variables are stationary then ols can be safely applied for further investigation

4.5 Data Considerations

We intend to use the time series annual data for Pakistan economy from 1972 to 2014. The variables include the Consumers Price Index (CPI) as a proxy measure of inflation, M2 as measure of money supply, and the Gross Domestic Product (GDP) at current market prices. The data is will be taken from World Development Indicators, Pakistan Economic Survey, the Statistical Bulletins of the State Bank of Pakistan and other reliable sources.

Using the methodology followed by Rao and Nallari(1996), the following variables are constructed, which will be employed in the study:

Seignorage revenue (S_n) =ΔM/GDP, where M2 component of money supply is used as proxy for money supply. .

Inflation tax revenue (ITR)= $\pi^* m_n$, where m_n= M/GDP (money-income ratio) and π is the rate of inflation. For the construction of variable (dm), the mean value of the series: m_n=M/GDP computed above is used as a proxy for constant money-income ratio. Given this constant, the new nominal money supply is computed that would be needed to maintain this ratio. The change in nominal money supply (in proportion to GDP) from one period to the next is calculated that will maintain the constancy of money income ratio. The variables so constructed are shown in the following table, which will be used in the subsequent analysis.

Table 4.1: Construction of Variables

Years	S_n as % of GDP	ITR as % of GDP	dm as% of GDP	Δm_n as% of GDP
1972-73	7.629398	2.659235	2.813538	4.540210
1973-74	*5.724283	10.88844	8.161890	-4.107300
1974-75	-0.437410 ?	9.572666	9.797914	-11.29484
1975-76	*5.892523	7.038108	9.641190	-2.234491
1976-77	9.215909	2.708666	6.381419	4.171500
1977-78	5.988661	3.987957	5.033399	1.516859
1978-79	6.628651	2.457628	6.438979	0.678777
1979-80	6.913110	3.564179	4.079951	3.078050
1980-81	5.630074	4.953983	7.158695	-1.616288
1981-82	4.031690	4.634924	6.685522	-2.481998
1982-83	7.309653	2.408196	6.039116	1.777684
1983-84	*7.587839	2.791461	4.702063	3.084386
1984-85	*1.770049	2.426043	5.622191	-4.021814
1985-86	5.225550	2.283066	4.722747	0.806233
1986-87	5.997139	1.518618	3.507684	2.648421
1987-88	6.385213	2.121110	4.311159	2.001356
1988-89	*2.958473	3.655850	6.489729	-3.945639
1989-90	*2.686149	3.057770	5.220905	-2.384462
1990-91	4.081732	3.542742	4.289190	0.156143
1991-92	6.241792	4.620987	6.735263	0.052795
1992-93	9.687074	4.064937	6.660819	3.558226
1993-94	7.008329	4.553672	4.084473	2.908836
1994-95	6.772259	5.659581	6.222228	0.102195
1995-96	5.286931	5.378202	6.957770	-2.188309
1996-97	7.695457	4.776235	5.107570	2.470444
1997-98	8.004326	5.483356	5.404619	2.161947
1998-99	*3.435692	2.936518	3.966131	-1.053006
1999-00	*1.853675	1.856741	3.779153	-2.329975
2000-01	4.173611	1.685301	9.882055	-6.225558
2001-02	4.074755	1.232584	3.882540	0.556554
2002-03	6.235382	1.423137	2.322302	4.100660
2003-04	6.925713	1.352894	3.695088	3.173330
2004-05	8.232214	3.600341	5.775931	1.936380
2005-06	7.217781	4.457935	5.630143	0.824889
2006-07	5.643877	3.529254	8.897479	-4.631318
2007-08	7.813742	3.604277	4.718482	2.877712
2008-09	*2.346298	8.833734	5.597255	-3.887201
2009-10	5.179555	5.496427	8.266597	-3.272244
2010-11	5.382526	5.710623	4.776509	0.865978
2011-12	4.026296	4.465905	7.961355	-3.663635
2012-13	5.808026	3.865797	3.828604	2.439279
2013-14	5.2775619	3.1612733	4.354756	1.196456
2014-15	3.888009	2.919063	4.568811	-0.522046

As evident from the above series, there are certain outliers in the data. For instance, the seignorage (as % of GDP) is very low for the years 1984-85, 1988-89, 1989-90, 1998-99, 1999-2000, and 2008-09 and the change in money supply (Δm_n as% of GDP) is negative. Still for the year 1974-75, the seignorage is negative but the inflation tax is very high.

4.6 Tests for Stationarity

As discussed above, we are dealing with the time series data on monetary variables and therefore it is necessary to test the series for stationarity before these could be used for formal analysis. The data on the variables concerned are therefore confronted to the ADF tests and the results are shown below:

Table 4.2

Variable	ADF t-statistics	Probability	Result
Δm_n	-6.3	0.00	I(0)
$m_n.\pi$	-3.5	0.0111	I(0)
Dm	-5.8	0.00	I(0)
S_n	-5.6	0.00	I(0)

As evident from the above, the probability for all the variables is $P<0.05$, and so they exhibit integration of order I(0), which means that all the variables are stationary. In this case, there is no need to apply further the co-integration tests and the OLS method can be safely applied for further analysis.

Chapter 5

ESTIMATION AND ANALYSIS OF RESULTS

5.0 Empirical Results

After discussing the model and data in detail and after passing through the necessary tests regarding the health of data, we are now in a position to proceed towards estimation. We discuss and analyze the results of different model briefly.

5.1 Estimated Results using the Cagan Model

The empirical version of the Cagan model discussed in chapter-4 (Equation 4.1) is reproduced below for ready reference: $S_n = \alpha_0 + \alpha_1 \Delta m_n + \alpha_2 m_n \bullet \pi + u_t$ ..... (4.1)

The results of regression are shown below in Table 5.1.

Table 5.1: Dependent Variable: Seignorage as percent of GDP
Method: Least Squares, Sample: 1972 2014, Included observations: 43

Variables	Coefficient	Standard errors	T statistics	F prob
Δm_n	0.589566	0.064236	9.178172	0.0000
$m_n \bullet \pi$	0.266062	0.100705	2.641984	0.0117
C	4.595106	0.436327	10.53134	0.0000

R-squared	0.689184	**Mean dependent var**	5.568130
Adjusted R squared	0.673643	**S.D. dependent var**	2.105119
S.E. of regression	1.202605	**Akaike info criterion**	3.274071
Sum squared resid	57.85034	**Schwarz criterion**	3.396946
Log likelihood	-67.39253	**Hannan-Quinn criterion**	3.319384
F-statistic	44.34672	**Durbin-Watson stat**	2.115504
Prob(F-statistic)	0.000000		

The estimated function is given as: $S_n = 4.59 + 0.58\ \Delta m_n + 0.26\ m_n.\ \pi$

It is evident from the results that both the variables are significant. An increase in the inflation tax ($m_n \bullet \pi$) by 1% pushes forward the seignorage revenue (S_n) by 0.26%. Likewise, an increase in the money-income ratio (Δm) by 1% will lead the seignorage to increase by 0.58%. The results show that a direct (exogenous) increase in the high powered money induces inflationary trends, which in turn generate the seignorage for the government. In other words, Δm_n and $m_n \bullet \pi$ are significant and positive determinants of seignorage revenue

Raju (2002) estimated a similar model for Indian economy and calculated seignorage and inflation tax revenue by following Rao and Nallari methodology. Their results show a positive correlation between the inflation tax revenue and inflation rate during the sample period. Further, changes in the money-income ratio, inflation tax revenue and changes in nominal money supply are significant determinants of seignorage revenue. Therefore, the results obtained in the present study are consistent with those of other researchers following the same methodology.

5.2 Estimated Results using the Rao & Nallari Model (1996)

We have also tried to estimate the model proposed by Rao and Nallari (1996). The model adds an extra explanatory variable 'dm' to the original Cagan model. As a result of this modification, the R-squared increases from 64% to 96% which indicates that the variable concerned is highly significant. The model has been discussed in chapter-4. We reproduce below the model (Equation 4.2) for ready reference:

$$S_n = \beta_0 + \beta_1\ \Delta m_n + \beta_2 \pi \bullet m_n + \beta_3 dm + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.2)$$

We tested the model for Pakistan and the results are shown in Table 5.2 below. The estimated function is given as:

$$S_n = -0.01 + 0.90 \Delta m_n + 0.08\ \pi.m_n + 0.94 dm$$

Table 5.2: Dependent Variable: Seignorage as percent of GDP
Method: Least Squares, Sample: 1972 2014, Included observations: 43

Variable	Coefficient	Standard errors	T statistics	F prob
dm	0.946050	0.068424	13.82623	0.0000
Δm_n	0.904651	0.039075	23.15148	0.0000
$m_n . \pi$	0.081572	0.042295	1.928637	0.0613
C	-0.019766	0.292810	-0.067504	0.9465
AR(1)	0.645328	0.140667	4.587627	0.0000

R-squared	0.966444	**Mean dependent var**	5.568130
Adjusted R squared	0.962912	**S.D. dependent var**	2.105119
S.E. of regression	0.405411	**Akaike info criterion**	1.141115
Sum squared resid	6.245619	**Schwarz criterion**	1.345906
Log likelihood	-19.53398	**Hannan-Quinn criterion**	1.542912
F-statistics	273.60692	**Durbin-Watson stat**	1.542912
Prob(F-statistic)	0.000000	**Wald Statistics**	336.8904

All the explanatory variables are significant at 5% level as indicated by the t-statistics. The results intimate that if inflation tax ($m_n\pi$) increases by 1%, the seignorage revenue (S_n) is likely to increase by 0.08%. Likewise, if the money-income ratio (Δm_n) increases by 1%, the seignorage increases by 0.90%, and if d_m increases by 1%, the seignorage increases by 0.94%. In other words, the impact of money-income ratio and the change in ratio (dm) on the seignorage is very significant. The R-squared shows that 64% of the variation in dependent variable is explained by variation in independent variables.

Our results are also consistent with those derived by other researchers. As discussed in the literature review, the models by Rao and Nallari (1996) and Swati (2002), both estimated for

Indian economy indicate that the extra explanatory variable 'dm' in the original Cagan model improves the goodness of fit. They found that all the three variables are significant determinants of seignorage revenue.

5.3 The Rate of Inflation and the Maximum Seignorage

Finally, we estimate the relationship between seignorage and inflation according to the relationship discussed in chapter-4 and reproduced below:

$$S_t = \mu_0 + \mu_1 \pi_t + \mu_2 \pi_t^2 + \varepsilon_t \quad \ldots\ldots\ldots\ldots \quad (4.3)$$

As explained earlier, we have introduced the square term to capture the non-linearity in the relationship between seignorage and inflation rate. The results are shown in Table 5.3.

The estimated equation is given by: $S = 4.12 + 0.377\pi - 0.018\pi^2$

Table 5.3: Dependent Variable: Seignorage as percent of GDP
Method: Least Squares, Sample: 1972 2014, Included observations: 43

Variables	Coefficient	Standard errors	T statistics	F prob
Π	0.377711	0.212549	1.777052	0.0832
π^2	-0.018295	0.007704	-2.374743	0.0224
C	4.125988	1.209105	3.412432	0.0015

R-squared	0.187989	**Mean dependent var**	5.568012
Adjusted R squared	0.147389	**S.D. dependent var**	2.105119
S.E. of regression	1.943802	**Akaike info criterion**	4.234383
Sum squared resid	151.1347	**Schwarz criterion**	4.357257
Log likelihood ratio	-88.03924	**Hannan-Quinn criter.**	4.279695
F-statistics	4.630222	**Durbin-Watson stat**	1.460235
Prob(F-statistic)	0.015532		

The first order condition is straight forward that will give the seignorage maximizing level of inflation: given $S = 4.12 + 0.377\pi - 0.018\pi^2$, then $\partial S/\partial\pi = 0.377 - 0.036\ \pi = 0$, which implies that $\Pi^* = 0.377 / 0.036 = 11\%$. The second order condition is negative, which confirms the maximization principle.

It is clear from the above that the seignorage maximizing rate of inflation for Pakistan economy during the study period is 11% per annum on the average. However, this is only a rough estimate. Inflation is a complex phenomenon and there are so many internal and external determinants of inflation. Increase in high powered money is one source of inflation but it is not the only source.

We have also tried to estimate the money demand function (equation 3.6 in section 3.3), originally suggested by Cagan (1956) to find the revenue maximizing rate of inflation. The results indicate that the rate of inflation capturing maximum seignorage revenue is 145% per annum. However, this result is not consistent with the conditions prevailing in Pakistan. Further the Cagan model only captures the linear relationship between inflation and seigniorage. In order to capture the non linear relationship between inflation and seigniorage, the alternative model as suggested by Jafari Samimi (explained below) is used. In case of Pakistan, the government does not depend entirely on money creation to finance its expenditure.

Samimi (2012) analyzed the relationship between inflation and seignorage for Iranian economy. The study used a simple quadratic model (shown in the beginning) to find the rate of inflation that maximized the seignorage revenue. The study concludes that the requisite rate of inflation is 78% per annum while Laffer curve relationship holds between seignorage and inflation. In contrast, the present study finds that seignorage maximizing rate of inflation for Pakistan is 11%.

Likewise, the studies conducted by Samimi (2011), Korap (2006). Nkurunziza (2004) Neumyor (1995) also conclude that Laffer curve relationship holds between inflation and seigenorage revenue. The present study also concludes that inflation and seignorage follows Laffer curve phenomena. We further discuss the practice of generating seignorage in Pakistan over the long run and by all the governments, whether authoritative or democratic.

5.4 Seignorage: Theory and Practice – A Comparative Analysis

We have calculated the Seignorage revenue (S_R) and the Inflation Tax revenue (ITR) for the Pakistan economy over the long run i.e. from 1973 to 2014. We also show the real GDP growth rate and the corresponding optimal seignorage that follows from Friedman formulation (zero inflation as discussed in chapter-3): $S=dM/P=y^{\bullet}m = (dy/y)*(M/P)$. The results are shown in Table 5.4. The decade-wise position of average seignorage during the sample period is also summarized.

It is evident from the table that during 1970s, seignorage remained about 5.9% of GDP on the average. Obviously, the larger ratio of seignorage during the period under reference (Bhutto regime) was due to a greater reliance of the government on monetary expansion and drastic devaluation of the currency. Due to nationalization of banks in 1970, the government earned a larger amount of seignorage.

In the era of 1980s, total seignorage remained about 4.8 per cent of GDP. This figure remained low as compared with the position of 1970s and 1990s. During the 1980s, government received a larger amount of capital inflows in the form of grants, aids and remittances. These inflows might have decreased the reliance of the government on printing of money for resource generation.

Table 5.4 Actual and Optimal Seignorage

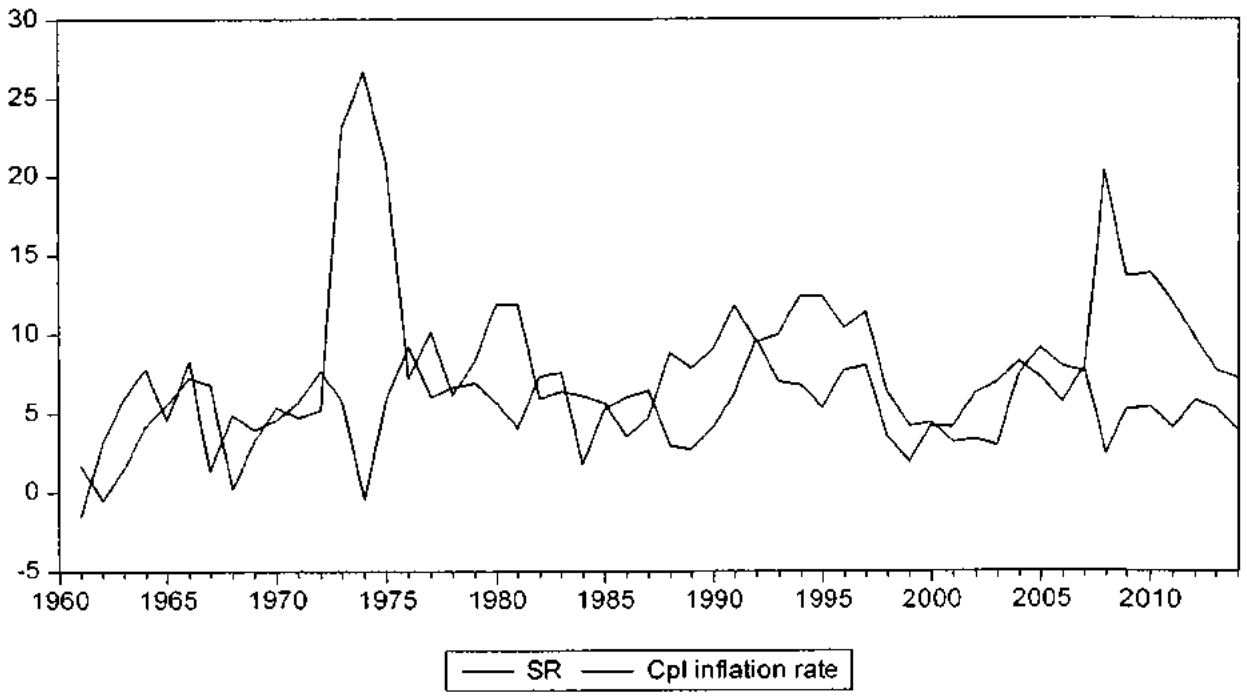
Years	S_n as % of GDP	ITR as % of GDP	INFLATION RATE (CPI)	GDP Growth Rate	Optimal Seignorage as % of GDP
1972	7.629398	2.659235	5.183237645	2.3	0.024796
1973	*5.724283	10.88844	23.07008403	6.8	0.066202
1974	-0.43741 ?	9.572666	26.66303485	7.5	0.078057
1975	*5.892523	7.038108	20.90450946	3.9	0.044551
1976	9.215909	2.708666	7.158323731	3.3	0.042292
1977	5.988661	3.987957	10.13296769	2.8	0.035161
1978	6.628651	2.457628	6.138692667	7.7	0.104283
1979	6.91311	3.564179	8.267046976	5.5	0.066355
1980	5.630074	4.953983	11.93823091**	7.3	0.092549
Average	5.91%	5.31%	13.4%	5.2%	0.061
1981	4.031690	4.634924	11.87991359**	6.4	0.08086
1982	7.309653	2.408196	5.903528784	7.6	0.095338
1983	7.587839	2.791461	6.36203350	6.8	0.088198
1984	*1.77004997	2.426043	6.08716673	4	0.053852
1985	5.22555	2.283066	5.61483922	8.7	0.10266
1986	5.997139	1.518618	3.50641425	6.4	0.055335
1987	6.385213	2.12111	4.68121854	5.8	0.046714
1988	*2.95847397	3.65585	8.837937023	6.4	0.060586
1989	*2.68614997	3.05777	7.844264738	4.8	0.046587
1990	4.081732	3.542742	9.052131553	4.6	0.047981
Average	4.82%	2.84%	6.91%	6.2%	0.678
1991	6.241792	4.620987	11.79127034**	5.6	0.059658
1992	9.687074	4.064937	9.509041462	7.7	0.083319
1993	7.008329	4.553672	9.97366476	2.3	0.023915

1994	6.772259	5.659581	12.36819439**	4.5	0.051282
1995	5.286931	5.378202	12.34357852**	4.1	0.050659
1996	7.695457	4.776235	10.37380859	6.6	0.079634
1997	8.004326	5.483356	11.37549289	1.7	0.021731
1998	*3.43569227	2.936518	6.228004154	3.5	0.048641
1999	*1.85367527	1.856741	4.142637181	4.2	0.011297
2000	4.173611	1.685301	4.366664513	3.9	0.010179
Average	6.01%	4.10%	9.20%	4.41	0.044
2001	4.074755	1.232584	3.148261446	2	0.005036
2002	6.235382	1.423137	3.290344726	3.1	0.00761
2003	6.925713	1.352894	2.914134701	4.7	0.011451
2004	8.232214	3.600341	7.444624693	7.5	0.020039
2005	7.217781	4.457935	9.06332737	9	0.024329
2006	5.643877	3.529254	7.921084401	5.8	0.015496
2007	7.813742	3.604277	7.598684411	6.8	0.018115
2008	*2.346298	8.833734	20.28612109	7.2	0.020142
2009	5.179555	5.496427	13.64776506**	-1.6	-0.00465
2010	5.382526	5.710623	13.88113926**	3.8	0.010901
Average	5.90%	3.92%	8.90%	4.83%	0.01264
2011	4.026296	4.465905	11.91676947**	3.84	0.01059
2012	5.808026	3.865797	9.68505341	3.65	0.007055
2013	5.27756196	3.16127326	7.68950366	4.03	0.000806
2014	3.888009	2.919063	7.191671	4.24	0.009251
Average	4.75%	3.60%	9.10%	3.94%	0.006

During the period of 1990s, the total seignorage remained about 6.0 per cent of the GDP. The government increased its dependence on printing of money to finance its budget deficit during the decade. In addition, the government also borrowed substantially from the commercial banks along with SBP during this period. Likewise, the seignorage revenue during the decade of 2000s remained about 5.9% percent of the GDP.

Table 5.4 shows that the overall seignorage in Pakistan has been in the range of 1.7% to 9.6% of GDP during the sample period (1973-2014), ignoring the outliers for the year 1974. The average seignorage rate is about 5.5% of GDP during the sample period. The overall seignorage and inflation rate remained positively co-related during the sample period except in case of very high and low inflation (see Figure 5.1).

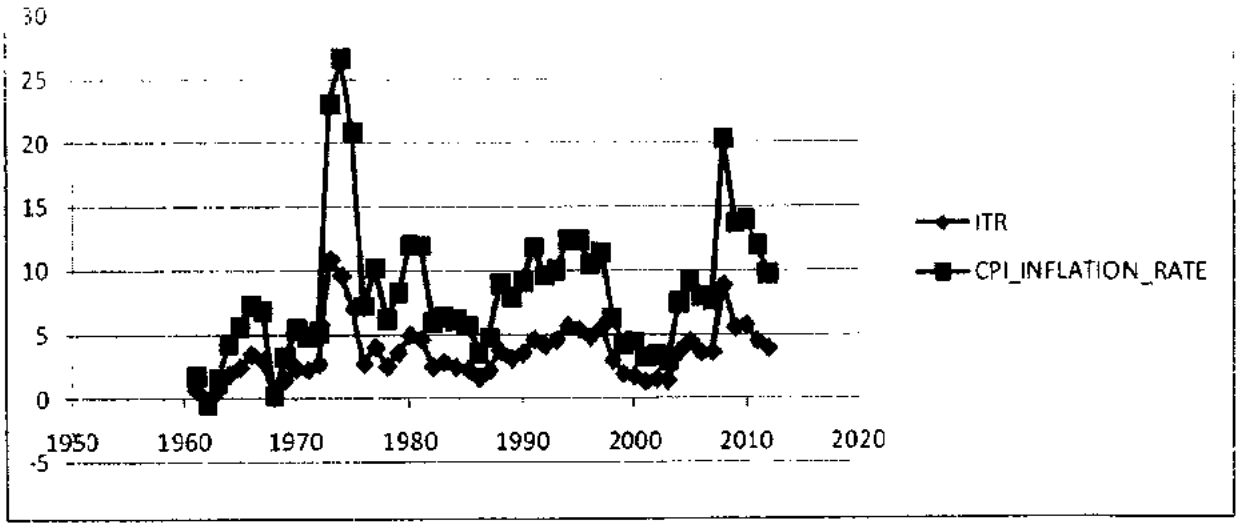
Figure 5.1 Trends of seigniorage and inflation in Pakistan from 1972 to 2014



During the years 1973, 1975, and 2008, the seignorage revenue decreased as inflation was very high (around 20%). On the other hand the seignorage showed a rising trend during the years 2000, 2001, 2002, and 2003, when inflation rate was below 5%. This leads to the conclusion that

the seignorage and inflation follows the Laffer's curve phenomenon to a large extent,i.e. rising inflation leads to high revenue up to a certain level beyond which the revenues tend to decline. Likewise, the Inflation Tax revenue has been in the range of 1.2 % of GDP to 10% of GDP during the whole sample period with an average of 3.9% of GDP. The overall rate of inflation and inflation tax revenue show a positive relationship during the sample period except in the case of very high inflation during 1973 to 1974. During this period, when inflation rate increased from 23 % to 26%, the inflation tax revenue decreased from 10.8 % to 9.5 % (see Figure 5.2).

Figure 5.2 Trends of inflation tax and inflation



It would be interesting to compare the estimates of inflation tax and seignorage revenue of the present study with those of other studies. The study conducted by Arby (2006) for Pakistan economy concludes that inflation and seignorage show positive correlation during the sample period (1972-2005) except in two extreme cases of very high and very low inflation. During the early 1970s, seignorage revenue decreased as inflation was rising above 20% and in early 2000, seignorage revenue increased when inflation was below 5%. The present study also concludes that seignorage revenues decreased during the years 1973-1975 when inflation was high (around 20%) while the revenues showed an increasing trend during early 2000 when the inflation was

low, i.e. below 5%. It is interesting to note that the 'credit' of high inflation periods goes to the PPP governments, headed by Prime Minister Z.A. Bhutto (1973-75) and again the periods headed by Mr. Asif Ali Zardari (2008-10), whereas the credit of low inflation periods goes to the Martial Law governments, headed by General Zia-ul-Haq (1980-85) and again headed by General Musharraf (2000-2004).

According to Arby, the overall seignorage remained at about 5.7% of the GDP on the average while inflation tax remained at about 1% of the GDP during the sample period. According to the estimations of the present study, the average seignorage remained at about 5.5% of the GDP during the sample period. Thus, our empirical results are in line with those of Arby (2006).

5.5 Summary of Empirical Findings

The above results indicate that the inflation tax revenue, the change in money-income ratio, and change in nominal money supply needed to maintain a constant money-income ratio in face of the real growth constitute the important determinants of the seigniorage revenue. The seignorage maximizing rate of inflation estimated for Pakistan is around 11%, which is consistent with the rate prevailing in practice.

The results show that seignorage in Pakistan remained around 5.5% of GDP on the average during the sample period (1973 to 2014). Further the statistical relationship between seignorage and inflation rate for Pakistan economy shows that both remained positively correlated during the sample period except in the few years when inflation was either too high or very low. In general, the findings imply that the relationship between the two variables follows the Laffer's curve phenomenon; i.e. rising inflation leads to high revenue up to a certain critical level beyond which the revenue tends to decline.

Chapter 6

CONCLUSIONS AND POLICY IMPLICATIONS

6.0 Background Summary

The governments of developing countries usually face the budget deficit problem. This is mainly because of the inefficient taxation system on the one hand and the ever-increasing needs of the governments on the other, particularly on the plea of accelerating the process of growth and development. There are also socio-political reasons for heavy budget deficits besides purely economic reasons. Inefficiency of the government machinery and the wide spread corruption in all tiers of the civil and military bureaucracy stand at the top. The governments have to rely on different sources including internal and external borrowing as also bank borrowing to finance the fiscal gaps. Borrowing from the central bank is easier for the government as compared to other sources of financing the deficits but it is inflationary in the final effect.

The government makes a profit when it borrows from the central bank because the cost of producing new fiat (paper) money is far lesser than its face value. This gain on new money creation is called seignorage. This revenue increases with rise in the rate of inflation up to a certain point beyond which it starts decreasing. This is because the demand for nominal money balances falls if people expect a decrease in their purchasing power. The relationship between seignorage and the rate of inflation is well explained by the Laffer's curve.

The seignorage remained a significant source for the governments to finance the budget deficits throughout the past history of Pakistan. Data for the time period 1973 to 2011 shows that inflation and seignorage have positive correlation except for the periods of very high inflation. It was therefore considered important to evaluate the determinants of seignorage revenue as also to evaluate the critical inflation rate beyond which the seignorage would be declining.

6.1 Conclusions

The present study has used the Cagan (1956) model as the starting point for the purpose followed by its variants like that suggested by Rao and Nallari (1996) to evaluate the determinants of seignorage revenue in Pakistan. Further, an attempt has also been made to estimate the seignorage maximizing rate of inflation for the economy via the Laffer's curve phenomenon.

The results revealed that the inflation tax revenue, the change in money-income ratio, and change in nominal money supply needed to maintain a constant money-income ratio consistent with the real growth constitute the important components of the seigniorage. The seignorage maximizing rate of inflation estimated for Pakistan is around 11%, which is consistent with the rate prevailing in practice. The results show that seignorage in Pakistan remained around 5.5% of GDP on the average during the sample period (1973 to 2014). The statistical relationship between seignorage and inflation rate for Pakistan economy shows that both remained positively correlated during the sample period except in the few years when inflation was either too high or very low. As such, the analysis concludes that the relationship between the two variables follows the Laffer's curve phenomenon.

The present day inflation is a complex phenomenon. There are many sources of inflation, both external and internal. However, the excessive reliance of the government on extra money creation to fill up the budgetary gap has been one of the most important sources of inflation. The study also evaluates the optimal seignorage, which would have been available to the governments even at minimal inflation (creeping /tolerable) if money creation was endogenously determined and linked to the real growth rate of income.

6.2 Policy Implications

The findings of study have important policy implications. The monetary authorities (SBP) should make the utmost efforts to keep inflation and money growth rate at some moderate level in order so as to avoid the inflationary spiral in the economy leading to social unrest. It is important for the policy makers to be very careful while exercising their authority of money creation and using the seignorage as a source of revenue. The inflation rate ought to be tolerable for the society at large and must not be cumbersome to the poor segments of the society.

Efforts should therefore be made to generate more revenues from the traditional sources by making the taxation system efficient. Unnecessary public expenditure should be cut down and the menace of widespread corruption curtailed. Likewise, reliance on borrowing and money creation should be minimized as far as possible. Instead of looking at the seignorage maximizing rate of inflation, which is around 11% per annum, efforts should be made to curtail inflation by following the rule of thumb and keeping the money growth rate in the close vicinity of the real growth rate of the economy. After all, high rate of inflation badly affects the lower-income segments of the society and leads to social unrest, uncertainty among the economic agents, and ultimately to political instability. These factors, in turn, can adversely affect the efforts of the government directed towards development and prosperity.

6.3 Limitation of the study

The study has tried to investigate possible determinants of seignorage revenue but there exist some other indirect determinants such as public debt, fiscal deficit, interest rate etc., which have not been investigated due to data and time constraint. Trying to model the effects of these variables on seignorage can open an interesting area for future research.

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