The Collection and Allocation of Seigniorage Revenues

In China

by

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Abstract

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This dissertation explores the seigniorage problem (source and distribution) in China. The main conclusion is that in China seigniorage resulted from the rapid increase in the monetary base since economic reform of the 1980s.

When currency in circulation (M_0) is adopted as monetary base, monetary approach shows that on average seigniorage revenue is about 2.5 percent of GDP in China and opportunity cost approach shows that on average seigniorage revenue is merely 1.14 percent of GDP in China.

When broad money is adopted as monetary base, monetary approach shows that on average seigniorage revenue is 6.08 percent of GDP in China and opportunity cost approach shows that on average seigniorage revenue is 2.72 percent of GDP, these numbers are bigger than other countries.

In terms of the division of seigniorage revenue, seigniorage revenue has served as policy loans transferred from state banks to state owned enterprises, its main purpose is to subsidize those state–owned loss-making enterprises indirectly as well as to subsidize agriculture products. Foreign exchange reserves are used to support those state owned enterprises as well.

Seigniorage revenue is also increasingly used to invest in (domestic and foreign) financial assets.

The empirical estimation of the money demand function shows that demand for real money balance is sensitive to the interest rate and inflation rate. However the degree of sensitivity is small enough to afford China substantial flows of seigniorage at low or moderate inflation rates. The elasticity of real money balance with respect to income is greater than one in China; also the average rate of growth has been high. The resulting high demand for money provides an ideal environment for the government to collect seigniorage revenue.

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Chapter 1

Introduction

Seigniorage is an important source of government finance, particularly in a country like China where a modern and efficient taxation mechanism has not been established. In this paper we discuss the generation and distribution of seigniorage in China, using various definition and estimation techniques that have appeared in the seigniorage literature. These include "Chicago" monetary-flow measure of seigniorage, the opportunity cost approach, and an accounting framework proposed by Neumann (1996) and others.

In order to understand the distribution of seigniorage in China, we investigate the Chinese banking system and the structures and behaviors of state-owned enterprises, which are quite different from those of in Western countries. The intertwined nature of banks, government, and enterprises put the banking system in a role which uses seigniorage in a way that accommodates the revenue needs of both government and enterprises.

Economic reform in the past two decades has fundamentally altered the structure of ownership of enterprises (between state-owned and private-owned) in China. The government is no longer a monopolist in the economic system, but has ceded considerable control to the private sector and privatized some state-owned enterprises. As large numbers of state-owned enterprises suffer losses as a result of progressive decentralization, the government's traditional source of tax revenues from these enterprises has eroded.

Another feature of the Chinese economy is often underappreciated. Whereas in most countries a significant reliance on seigniorage is associated with substantial average rates of

inflation – that is, most of the revenue collected is in the form of an *inflation tax*, this is not the case in China. Rates of inflation in China have not approached anything like the average inflation rates of some countries in Latin America. As we shall show in this study, the basic parameters of China's demand for money favor seigniorage collection. The inflation rate elasticities of money demand prove to be relatively low. The income-elasticity of demand for money appears to be unity, and perhaps temporarily higher as China becomes financially mature. In addition, the rate of real growth in China seems to be on a high, long-run trend. Both these factors favor substantial seigniorage collection at moderate or even negative average inflation rates. China thus seems to be a counterexample to a consensus that use of seigniorage to finance deficits inevitably leads to high inflation (Dornbusch and Fischer [1986], pp. 1; Easterly, et al [1995], pp. 583).

Another feature of the China's economy and financial system which is conducive to seigniorage collection arises from the history of the country's transition from a socialist-planned economy. First, access to competitive markets for liquid assets has been suppressed, so that households and firms have been confined to holding bank deposits at low interest rates. This condition essentially made state-bank deposits, in part, a component of the monetary base of the country and enhanced the scope of seigniorage-collection capacity. Second, in the early reform years of the 1980s state banks took over the government's role in allocation of the nation's investment flows. The "loan" assets of these banks have gradually evolved, under financial reform, to become more like true loans on the books of the banks. But the process of marketization of bank lending is not complete, and the high portion of funding which passes through the banking system puts its allocation and its terms largely under the control of the authorities. Lending is still largely discretionary, rates

and credit-quality discriminatory. The result is a hidden, but obviously massive, flow of income transfers to various "borrowers" that has been financed by seigniorage.

This article is organized as follows. Part 1 contains a discussion of the various definitions of seigniorage and the interaction among seigniorage, deficit, inflation, and other related economic variables. Part 2 discusses the methodology to measure the sources and uses of seigniorage. Part 3 examines the money demand function in China in order to measure seigniorage-collection capacity up to maximum revenues.

§1.1. The Definition and Measurement of Seigniorage

I begin with a definition of seigniorage. The government retains the authority to finance its own expenditure by issuing money currency that the central bank supplies at very low cost. In the meantime, the private sector is also willing to hold paper money because it is useful as a form of liquidity. Thus, the government can buy goods and services that the private sector produces with money that is (almost) costless for the government to create. Alternatively, it can purchase assets and collect the return on them, or refund its own debt and relieve itself of the interest burden on its debt. The net real resources that the government has control over in this way is what is meant by its seigniorage revenue.

In the monetary economics literature there are various definitions of seigniorage used to measure seigniorage revenue in steady-state. One of these is

$$(1) \quad \pi^* m,$$

where π the inflation rate and m the level of real balances. This is the "inflation tax" component of seigniorage used by Friedman (1953, pp.254) and measures the resource flow money demanders expend keeping their real balances at the desired level. A more general measure of the revenue collected by the government is $(\Delta M/M)*(M/P) = \mu*m$ where μ is the rate of money growth. This differs, in steady state, from (1) in that it has the term (Δm), which is usually posited to be positive and due to trend economic growth.[1] In discrete time, this flow approach can be written as $(M_t - M_{t-1})/ P_t$, where M_t refers to the end of period t stock of money.

Most studies comparing seigniorage revenues across countries center on some variant of the version $(M_t - M_{t-1})/ P_t$ in (1) above. M is usually taken to be data on the country's monetary base. In order to account for country size differences and to avoid incomparabilities in currency values, this flow is scaled by real GDP, resulting in $(M_t - M_{t-1})/Y_t$.

An alternative approach is the "opportunity cost approach"

$$(2) \quad i*m,$$

where i is the nominal rate of interest. Phelps and Marty (1972, pp.176) show that this measures the flow of seigniorage in the special case that the government issues money only by

[1] That is, $\Delta m = \mu*m - \pi*m$, or $\mu*m = \Delta m + \pi*m$. The term Δm is sometimes called "voluntary" seigniorage (Kime [1998], pp. 12) and interpreted as a willing increase in desired real money which the government can exploit (getting real resources at no cost). This interpretation can hold whether agents are in steady state. The term $\pi*m$ is sometimes called "involuntary" in the sense that it reflects a tax on outstanding real balances at the "tax rate" π. To "pay" the tax in steady state, agents accumulate new (intrinsically worthless) nominal balances so as to preserve the real value m which they have chosen.

means of open market operations and uses the proceeds from seigniorage only to purchase assets. Drazen (1985, pp.328) shows the Chicago approach and the opportunity cost approach are, effectively, as special cases of each other.

A third approach measures the flow of seigniorage as

$$(3) \qquad w*m,$$

where $w = \Delta P / (1+\Delta P)$ and ΔP is the time derivative of the log price level. w is the form which arises in time-optimization models which maximize representative utility subject to a dynamic budget constraint. In discrete time application, w gets closer to π as the time interval shortens and as the inflation rate decreases. When the observed time series have long intervals (quarter-year, annual) relative to agents' likely decision intervals, the use of w may be problematic. The time series for w when inflation is high, tends to show high volatility. It may be more reasonable in practice to employ an average rate of inflation as measured by ΔP as an average measure of the shorter-run counterpart of w.

A fourth approach which includes the return on assets accumulated from past seigniorage is

$$(4) \qquad u*m + (r-n)*A$$

where r is the real rate of interest, and n is the population growth rate, and A is real assets accumulated from past seigniorage revenues. Under the assumptions mentioned for (2) above, this measure is close to (2)'s measurement (see Drazen, pp.328).

§1.1.1. Monetary Seigniorage in the Years 1986-1999

Seigniorage is earned from issuance of the monetary base, held as currency outside of banks or as reserves held by banks. Seigniorage may also accumulate through the banking deposit system when financial repression or monopoly suppress deposit interest rates (Siegel [1981], pp. 352). In that instance, the government can tax the profits of banks or, when they own the banks, simply receive the profits as government income. Seigniorage earnings on non-central bank deposits are significant in China because in China a large component of financial institutions are state–owned. Indeed, there are few clear distinctions between state banks and the People's Bank of China. In this case, in order to estimate seigniorage revenues, seigniorage earnings of state-owned banks should be included in the estimate. Klime (1998) for instance suggests including the issue of state-bank "sight deposits" in the estimate of seigniorage revenue.

Data Description

Tables 1.1 and 1.2 report some estimates of seigniorage revenue. The monetary data is sourced from the International Financial Statistics (IFS) CD ROM from years 1961 to 1999. Column (1) of Table 1.1 illustrates seigniorage collected only on currency as a percentage of

GDP (using the $(M_t - M_{t-1})/Y_t$ variant of (1) above). On average seigniorage was 2.46 percent of GDP, with a high of 4.63 percent in 1988 and a low of 1.03 percent in 1995. Average seigniorage on currency is high at 2.46 percent of GDP which is higher than average total seigniorage measures in most countries (see for example, Bali and Thurston (2000), Table 2, pp. 537).

In column 1: Total monetary base
= the change in high-powered money
(only currency outside banking institutions)

A broader measure which includes deposits bank reserves is illustrated in Table 1, column 2. The average of estimated seigniorage increases from 2.46 percent to 5.25 percent of GDP. The high is 8.17 percent in 1993, the low is –0.09 percent in year 1998.

In column 2: Total monetary base
= the change in high-powered money
(Currency outside banking institutions + Reserves of deposit-money banks)

A still broader concept includes deposit of other banking institutions, and is illustrated in column (3) of Table 1. We see that on average seigniorage is 4.71 percent of GDP. The high is 8.09 percent in 1996 and the low is –0.35 percent of GDP in 1998. The figure of 8.09 percent appears to be substantial in comparison to other countries.

In column 3: Total monetary base

= the change in high-powered money (Currency outside banking-institutions + Reserves of deposit money banks + Deposits of other banking institutions)

In column 4 of Table 4, reserves is used as monetary base, on average seigniorage is 6.08 percent of GDP. The high is 11.36 percent in 1993 and the low is 1.10 percent of GDP in 1998.

In column 4: Total monetary base

= Reserves Money (according to the IFS definition, Reserves-money includes Currency outside banking institutions, Reserves of deposit money banks, Deposits of other banking institutions, and Deposits of other sectors).

Table 1.1. Monetary Seigniorage

Year	(1)	(2)	(3)	(4)
1986	2.27%	4.64%	n.a.	5.23%
1987	2.04%	2.63%	n.a.	3.14%
1988	4.63%	5.85%	n.a.	5.44%
1989	1.28%	5.10%	n.a.	5.65%
1990	1.64%	7.32%	n.a.	8.03%
1991	2.49%	6.58%	n.a.	7.28%
1992	4.45%	5.26%	n.a.	4.99%
1993	4.20%	8.17%	n.a.	11.36%
1994	3.23%	7.26%	7.50%	8.72%
1995	1.03%	4.22%	4.96%	6.05%
1996	1.33%	7.93%	8.09%	8.97%
1997	1.84%	4.73%	4.42%	6.10%
1998	1.29%	-0.09%	-0.35%	1.10%
1999	2.74%	5.25%	4.71%	6.08%
Mean	2.46%	5.25%	4.71%	6.08%
Maximum	4.63%	8.17%	8.09%	11.36%
Minimum	1.03%	-0.09%	-0.35%	1.10%

Note: Sources: IFS CD-ROM.

The numbers listed above adopted the monetary approach, which only counts the change of monetary base to the gross domestic product (GDP).

§1.1.2. The Opportunity Cost Approach

This section employs the opportunity cost approach to measuring seigniorage revenues in China. Estimates are based on the one-year deposit interest rate and illustrated in Table 1.2. Using currency in circulation as the base, the average seigniorage is 1.14 percent of GDP.

The minimum percentage is 0.37 for year 1999, the maximum percentage is 1.84 in year 1993. When reserves is treated as monetary base, on average, the seigniorage increases to 2.74 percent of GDP. The minimum value is 0.95 percent for year 1999, the maximum value is 4.18 percent for year 1993.

Table 1.2. Seigniorage (Opportunity Cost Measure)

Year	(1)	(2)	(3)	(4)
1986	0.86%	1.71%	n.a.	2.00%
1987	0.89%	1.66%	n.a.	1.94%
1988	1.25%	2.10%	n.a.	2.34%
1989	1.61%	3.05%	n.a.	3.38%
1990	1.25%	2.72%	n.a.	3.01%
1991	1.13%	2.54%	n.a.	2.82%
1992	1.26%	2.49%	n.a.	2.70%
1993	1.84%	3.61%	n.a.	4.18%
1994	1.71%	3.46%	3.61%	4.05%
1995	1.48%	3.23%	3.42%	3.89%
1996	0.96%	2.47%	2.60%	2.94%
1997	0.77%	1.98%	2.05%	2.38%
1998	0.53%	1.24%	1.27%	1.53%
1999	0.37%	0.80%	0.82%	0.95%
Mean	1.14%	2.36%	2.29%	2.72%
Maximum	1.84%	3.61%	3.61%	4.18%
Minimum	0.37%	0.80%	0.82%	0.95%

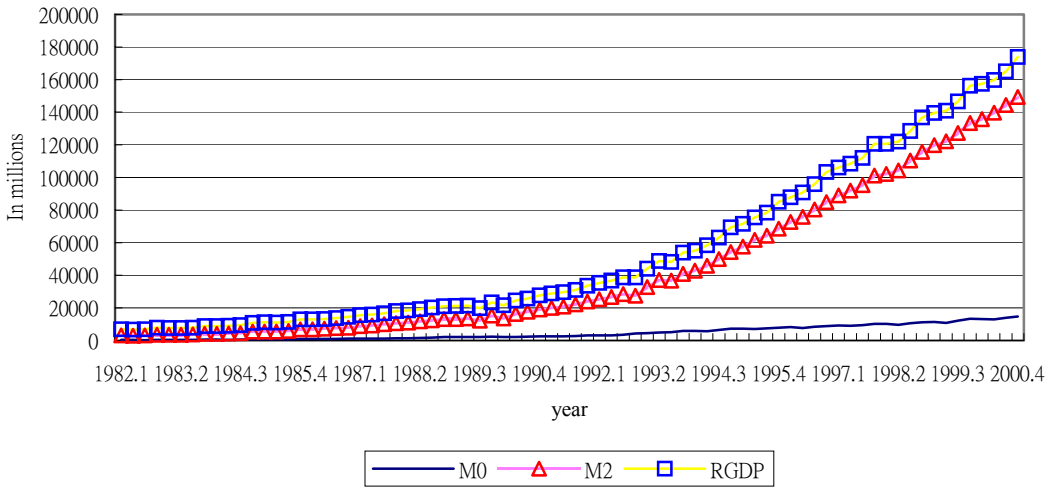
Note: Sources: IFS CD-ROM

§1.1.3. Why so much Seigniorage in China?

Why is China so apparently reliant on seigniorage income to finance its government operations? A first class of argument, referred to earlier, arises from the "efficient" government literature following Phelps (1973). As will be shown more technically in Chapter 5, the money demand parameters imply high Chinese seigniorage-collection capacity at low or moderate rates of inflation. In addition, the capacity to collect alternative forms of tax (property, household income, business) are poorly developed, implying high cost (including social cost) of these revenue sources. Although probably few would ascribe to the Chinese government "efficient" social choice, it seems obvious that the basic conditions favoring seigniorage collection are present.

In addition to the typical steady-state analysis, the recent economic reforms have pushed the growth of demand for the base on which seigniorage can be collected. See for example Chart 1.1, indicating the faster rates at which narrow and broad money have grown relative to GDP. While probably "temporary," this rapid growth has lasted more than a decade and is probably unfinished.

Chart 1.1: GDP,M0 and M2



China's history of funding investment nearly exclusively through the banking sector and its tendency to control these flows has favored policies of using seigniorage-based revenues to fund investment. The financial repression (which is indirectly evident in the money demand parameters estimated in Chapter 5) has generated income that is passed through the banking system in the form of loans, many of them directed to particular recipients on an administrative basis and on favorable terms. Thus, the financial structure reinforces the incentive to employ seigniorage in great volume (as well as in particular ways).

One indicator of repression in the banking system is evident in the history of interest rates on deposits and loans (Table 1.3). These interest rates have not just been managed by the authorities; they have managed so as to create low and often negative ex post rates on both loans and deposits. At the same time, the spreads between lending and borrowing rates has been rather narrow as compared with countries such as Russia, Hong-Kong, Indonesia, and the

Phillipines (Table 1.4). These tables thus reflect a tendency to "transfer out" funds from the banking system, in the sense that borrowers are not paying reasonable "market" rates on their loans.

Table 1.3. Interest Rate Structure in China

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
(1) Time deposit (1 year)	8.64	11.34	10.08	7.56	7.56	9.18	10.98	10.98	9.18	5.67
(2) Time deposit (3 year)	9.72	13.14	11.88	8.28	8.28	12.24	12.24	12.24	10.8	6.21
(3) Lending (I year)	9.00	11.34	10.08	8.64	8.64	9.36	10.98	10.98	10.98	8.64
(4) Lending (3-5year)	10.80	14.40	11.52	9.54	9.54	12.06	13.86	14.58	11.70	9.90
(5) Diff= (3)-(1)	0.36	0.00	0.00	1.08	1.08	0.18	0.00	0.00	1.80	2.97
(6) Diff= (4)-(2)	1.08	1.26	-0.36	1.26	1.26	-0.18	1.62	2.34	0.90	3.69
(7) Inflation rate	18.5	17.8	2.1	2.9	5.4	13.2	21.7	14.8	6.1	0.8
(8) Diff = (3)-(7)	-9.5	-6.5	8.0	5.7	3.2	-3.8	-10.7	-3.8	4.9	7.8
(9) Diff = (1)-(7)	-9.86	-6.46	7.98	4.66	2.16	-4.02	-10.72	-3.82	3.08	4.87
(10) Diff = (4)-(7)	-7.7	-3.4	9.4	6.6	4.1	-1.1	-7.8	-0.2	5.6	9.1
(11) Diff = (2)-(7)	-8.78	-4.66	9.78	5.38	2.88	-0.96	-9.46	-2.56	4.70	5.41

Note: Source: Almanac of China's Finance and Banking & IFS.

Table 1.4. Interest Rate Structure in Selected Countries

		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
China	(1) Deposit Rate	8.64	11.34	8.64	7.56	7.56	10.98	10.98	10.98	7.47	5.67	3.78	2.25
	(2) Lending Rate	9	11.34	9.36	8.64	8.64	10.98	10.98	12.06	10.08	8.64	6.39	5.85
	Diff (3) = (2)-(1)	0.36	0	0.72	1.08	1.08	0	0	1.08	2.61	2.97	2.61	3.6
Russia	(4) Deposit Rate	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	102	55.05	16.77	17.05	13.68
	(5) Lending Rate	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	320.3	146.8	32.04	41.79	39.72
	Diff (6) = (5)-(4)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	218.4	91.76	15.27	24.74	26.04
Hong-	(7) Deposit Rate	n.a.	n.a.	6.67	5.46	3.07	2.25	3.54	5.63	4.64	5.98	6.62	4.5
Kong	(8) Lending Rate	n.a.	n.a.	10	8.5	6.5	6.5	8.5	8.75	8.5	9.5	9	8.5
	Diff (9) = (8)-(7)	n.a.	n.a.	3.33	3.04	3.43	4.25	4.96	3.12	3.86	3.52	2.38	4
Indonesia	(10) Deposit Rate	17.72	18.63	17.53	23.32	19.6	14.55	12.53	16.72	17.26	20.01	39.07	25.74
	(11) Lending Rate	22.1	21.7	20.83	25.53	24.03	20.59	17.76	18.85	19.22	21.82	32.15	27.66
	Diff(12)= (11)-(10)	4.38	3.07	3.3	2.21	4.43	6.04	5.23	2.13	1.96	1.81	-6.92	1.92
Philippines	(13) Deposit Rate	11.32	14.13	19.54	18.8	14.27	9.61	10.54	8.39	9.68	10.19	12.11	8.17
	(14) Lending Rate	15.92	19.27	24.12	23.07	19.48	14.68	15.06	14.68	14.84	16.28	16.78	11.78
	Diff(15)= (14)-(13)	4.6	5.14	4.58	4.27	5.21	5.07	4.52	6.29	5.16	6.09	4.67	3.61

Note: Source: IFS

The issue of administrated lending naturally leads to the issue of political determination of who gets particular loans as well as the aggregate loan flow. One reasonable argument for the rapid rise in seigniorage during much of the 1990s stems from the pressure general economic reform has had on the balance sheets of State Owned Enterprises. As these firms have faltered, political pressure at the local level has influence local branches of the People's Bank of China to accommodate the firms by means of "policy lending" more from purely state-owned banks than from joint stock banks who as a result hold the bulk of China's

outstanding non-performing loans (NPL) (Li [2001]).[1] Such lending was financed largely through seigniorage income arising from the expansion in the monetary base required to make these loans. In response to fears of excessive money growth and inflation, the PBOC introduced open market operations in order to offset the excess growth in reserves. In addition, the central bank instituted a number of institutional reforms designed to centralize the Bank's control over aggregate bank loans.[2] A very large outstanding stock of NPLs – estimated in early 2005 to represent a U.S. dollar value of more than $500 billion – is an unfortunate but expected consequence of this history.

§1.2. Seigniorage as a fiscal tool to the government

In general, the government could finance its own fiscal expenditure either through taxing the public, issuing government bonds or collecting seigniorage revenue.

When seigniorage is adopted as a tool to finance fiscal deficits. There are two different schools of thought offering different viewpoints.

1. The Optimal Taxation View

In most under–developed countries an efficient tax mechanism has not been established. There are high costs associated with tax collection. If the rate of inflation can be maintained at a low level, then an inflation tax (that is, seigniorage) will be a good option to adopt to collect revenue. This assumes that the efficiency losses (cost) of the inflation tax are low.

[1] pp. 85.
[2] One of these was to reduce the number of local branches of the PBOC (one in each province).

Mankiw (1987)[1] reported a positive correlation between the tax burden and inflation rate in the U.S. which implies that the higher the collection costs of conventional taxes, the higher the rate of inflation, as a result, seigniorage revenue will increase as well.

2. The Fiscal Dominance Hypothesis

The government finances fiscal expenditures by issuing bonds. With its debt burden, government can either borrow from commercial banks or abroad (foreign financial institutions). Apparently, these solutions are not widely available in China where regulation of the financial sector is still tightly controlled.

Sargent (1981) mentioned that in an economy where the real interest rate exceeds the rate of economic growth in the long run, the rate of debt growth would expand more rapidly than that of economic growth.

As government debt reaches a certain (high) level, the public will not be willing to accept and absorb additional government debt. The deficit issues get worse, as a result, the main method left to finance government deficits is through money creation.

§1.3. Seigniorage and The government budget constraint

In this section, how does seigniorage play a role in financing the fiscal deficit of the government? We establish a model to explore the government budget identity where the budget constraint of the government can be defined as follows.

1. Government finances its own fiscal shortage (G-T) at current fiscal year (t).

[1] See Mankiw, pp. 338. 1987.

2. Fiscal subsidy (SD): including price subsidies to agriculture products, subsidies to state-owned enterprises and other sectors.

3. Paying back the incurred interest (iB_{t-1}) from previous time-periods through the following three channels. 3.1. The government can issue bond (B_t) at each period (t). 3.2. Because of the authority to issue currency, government can print the high powered money (M_t) to finance its fiscal needs at each period (t). 3.3. The government imposes a flat tax rate (T) from the public.

Government Budget Constraint:

$$G_t + SD_t + iB_{t-1} = (B_t - B_{t-1}) + (M_t - M_{t-1})*Q_t + T*(1-w_{t-1}) \quad (1)$$

where: $(M_t - M_{t-1})*Q_t$: $Q_t = 1/P$ is the money's value in terms of units of the consumption good with given units of money (Haslag,1998)[1].

$(M_t - M_{t-1})*Q_t$: is the unit(s) of the consumption goods that can be purchased with one unit of money at time period (t), that is the seigniorage (S_t) revenue of the government.

According to the conventional definition, the gross growth rate of money will be ($u \geq 0$), thus:

$$M_t = \mu * M_{t-1} \quad (2)$$

Substituting eq(2) in eq (1).

$$G_t + SD_t + i*B_{t-1} = (B_t - B_{t-1}) + M_t*(1 - (1/\mu))*Q_t + T*(1-w_{t-1}) \quad (3)$$

[1] Haslag, pp. 11.

Let $S_t = M_t*(1-(1/\mu))*Q_t$.

Thus, eq(3) can be rewritten in more compact form:

$$G_t+SD_t+i*B_{t-1}=(B_t-B_{t-1})+ S_t + T*(1-w_{t-1}) \quad (4)$$

where $T*(1-w_{t-1})$: T: is the conventional tax revenue that the government can collect. $(1-w_{t-1})$: is the fraction of the tax revenue wasted due to the inefficiency of tax collection with an example being collection costs. Most developing countries do not have a well-established tax system. High costs are incurred with tax collection. On the other hand, the cost to issue currency has to be almost zero. Inflation tax (seigniorage) does not carry any significant administrative costs.

Government‘s objective is to maximize the social welfare, that is, to minimize the total value of welfare loss (cost) incurred to society. In Phelps’ (1973) studies, from a public finance viewpoint, the goal of government is to minimize the expected present value of social losses subject to the constraint that the present value of receipts from taxation and seigniorage equals the present value of expenditures.

This first order condition satisfies that the marginal social costs of both instruments are set to be equal. Using a quadratic formula to represent the social loss function (Click,1998)[1]. The government‘s objective is to minimize the present discounted value of welfare costs:

$$\text{Min} \sum_{t=0}^{\infty} (1/2)*\beta^t*(\sigma*T_t^2+\omega*S_t^2) \quad (5)$$

[1] Click, pp.157.

where: β is the discount factor, 0<β<1. σ and ω are any coefficients. The government intends to minimize this welfare loss (cost) function (in eq(5)) subject to the budget constraint (in eq(4)) it faced.

The Lagrange multiplier function is as follows:

$$\Gamma = \sum_{t=0}^{\infty} (1/2)*\beta^t*(\sigma*T_t^2 + \omega*S_t^2) + \lambda(G_t + SD_t + i*B_{t-1} - B_t + B_{t-1} - S_t - T*(1-w_{t-1}))$$

From the first–order condition:

$$d\Gamma/dT = 0 \qquad \beta^t*(\sigma*T_t - \lambda*(1-w_{t-1})) = 0 \tag{6}$$

$$d\Gamma/dS = 0 \qquad \beta^t*(\omega*S_t - \lambda) = 0 \tag{7}$$

$$d\Gamma/d\lambda = 0 \qquad G_t + SD_t + i*B_{t-1} = (B_t - B_{t-1}) + S_t + T*(1-w_{t-1}) \tag{8}$$

As eq(6) divided by eq(7).

$$T/S = ((1-w_{t-1})*\omega)/\sigma$$

$$T = ((1-w_{t-1})*\omega)/\sigma)*S \tag{9}$$

Substituting eq(9) into eq(8). Seigniorage could be derived as

$$S = (G_t + SD_t + (1+i)*B_{t-1} - B_t) / (1 + \omega*(1-w_{t-1})^2)/\sigma) \tag{10}$$

Here, conducting comparative static analysis.

$$dS/dG = 1/(1+\omega*(1-w_{t-1})^2)/\sigma) > 0$$

As government expands fiscal expenditure there is a tendency to use seigniorage as a tool to collect revenue. Seigniorage is an increasing function of government expenditure.

$$dS/dB_{t-1} = (1+i)/(1+\omega*(1-w_{t-1})^2)/\sigma) > 0$$

Assuming in a two period model (t = 0, 1). Bonds will expire after the second period (t >1). Government issues bonds to finance its fiscal deficit at time (t =0). In the next period (t=1), in order to pay back the interest incurred in the previous period, seigniorage revenue can be adopted by government to finance the deficit.

$$dS/dB_t = -1/ (1+\omega *(1- w_{t-1})^2)/ \sigma) \quad < 0$$

In a complete market assuming no transaction costs, seigniorage revenue and bond revenue are perfect substitutes for one another. The larger the amount of the bond issued the less seigniorage will be required.

So if there is a sound capital market like the bond market, the government can finance its own short-term capital needs through those financial instruments relying less on currency issuance.

$$dS/dw_{t-1}=2*(G_t+SD_t+(1+i)*B_{t-1}-B_t)/(1+\omega *(1-w_{t-1})^2)/\sigma)^2*(\omega *(1-w_{t-1}))/\sigma) \quad >=< 0$$

where $G_t +SD_t+(1+i)*B_{t-1} - B_t \ >=< 0$

Suppose the government runs a budget deficit. ($G_t +SD_t+(1+i)*B_{t-1} > B_t$). Then, as loss (w_{t-1}) on collecting the deadweight conventional tax increases, the government turns to seigniorage revenue. On the other hand, when the government runs a budget surplus, ($G_t +SD_t+(1+i)*B_{t-1} < B_t$), the loss (w_{t-1}) on collecting the deadweight conventional tax increases, the government will no longer need to rely on seigniorage revenue. Seigniorage (S) would decline.

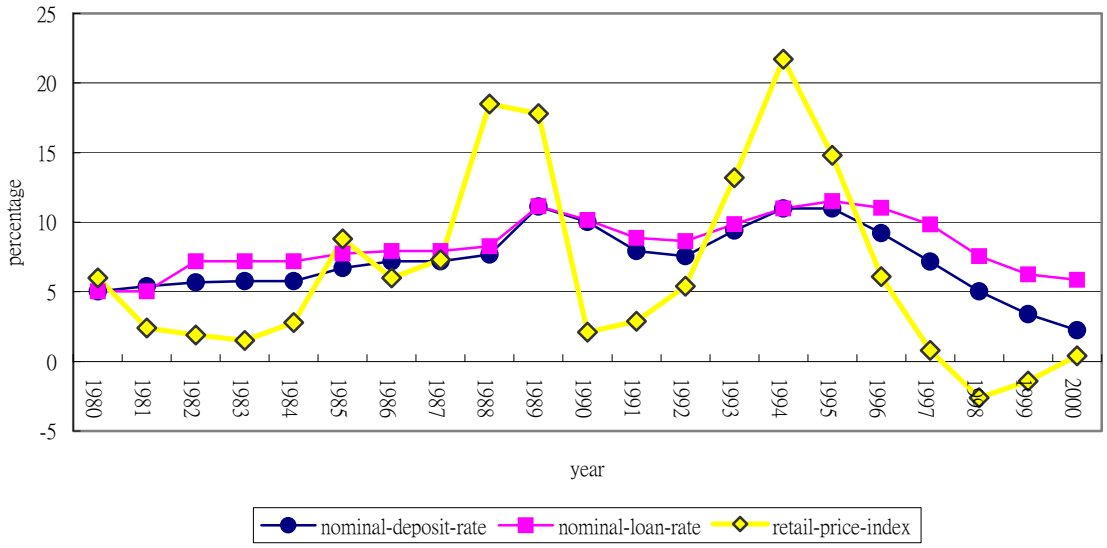
Poterba(1982) also points out that seigniorage would be utilized in such a case because conventional taxes are difficult to adjust immediately.

In China, decentralization and reform have led a fast-growing share of the economy beyond the reach of the government and have deteriorated the state's ability to tax effectively even those portions of the economy that are still state-owned. Thus, turning to seigniorage revenue is a potential benefit without direct taxation.

§1.4. Seigniorage, Reserve Ratio and Inflation

In China, from the early 1950s to 1990s, inflation was held in check and controlled at under 10%, (the only exceptions were inflation rates of 18.5% in 1988 and 17.8% in 1989). Starting in 1993, inflation appears to rise again, it was 13.2% in 1993, 21.7% in 1994, and 14.8% in 1995. In Chart 1.2. These rates of inflation are unlike those figures exhibited in Latin American countries which experienced high inflation rates in the three digits in the 1990s.

Chart 1.2: Rate of deposit, loan, and Inflation



The Control of Inflation

How could China generate fairly high seigniorage earnings and still successfully control the inflation level. The possible answers are:

1. Still–socialist structure of China's banking system:

In comparison with most western countries, the Chinese government still highly regulates deposits and lending rates. Public access to financial instruments is still quite limited. In a centrally-planned system, the government maintains strict control over cash allowing very limited cash holdings and payments that must be made through state bank transfers.

Bai et al (1999) mentions that the government required all transactions of more than 30 yuan in value to be made through state bank transfer from the 1950s to 1970s. Government

gradually reduced control over the use of cash since economic reform in the 1980s. Cash in circulation as a percentage of GDP increased from less than 6 percent in 1978 to 17 percent in 1993.

2. Economic reform has been in progress since 1979. The rate of growth in the Chinese public's demand for money is consistently high which enables the government to meet fiscal demand by issuing money currency with little constraint.

In general, financial institutions are required to hold reserves with the central bank in most countries, which forms a significant part of seigniorage revenues to the central bank. In China, a reserves requirement system was first established in 1984, with the required reserve ratio set for state-owned banks at 10 percent in 1985[1]. State-owned banks were forced to hold high reserves during the 1990s. This formal reserve ratio has gradually declined to 8 percent in 1998 and 6 percent in 1999.

By definition reserves would be counted as part of seigniorage of the banking system. Those state-owned banks keep required reserves as well as excess reserves, when required reserves cannot meet the demand of drawing, excess reserves are served to maintain the stability of the banking system. The PBOC had to pay the interest for required reserves and excessive reserves. At times, those interest rates are even higher than the rate of deposits. In Table 1.5[2] below, some of the interest rates for required and excessive reserves are listed in selected years.

[1] See James, pp.15.
[2] Data: Zhang, pp.150.

Table 1.5. Interest rates for required and excessive reserves

Date	Required reserve	Excessive reserve
Apr,1991	6.12	6.12
Jul.1993	9.18	9.18
Aug,1996	8.28	7.92
Oct,1997	7.56	7.02
Mar,1998	5.22	5.22
Jun,1999	2.07	n.a.

Note: Sources: Almanac of China's Finance and Banking.

We adopt a model proposed by Siegel (1981) to relate seigniorage, reserve requirement and inflation together, and estimate the seigniorage income based on the model. The model could be specified as follows:

Case1: Central bank receives no revenues from banking institutions

Assume that the central bank does not extract revenues from financial institutions, the central bank finances all financial needs by issuing the high-powered money. Currency in circulation (C) is simply a function of the inflation rate, and Deposit (D) is a function of the inflation rate and market interest rate.

$C = f(\pi)$

$D = g(\pi, r)$

where: (π) is the inflation rate. (r) is the deposit rate.

$df/d\pi < 0$, $dg/d\pi < 0$, and $dg/dr > 0$.

The above two equations can be set up as a linear equation.

$C = f(\pi) = \alpha_1 - \alpha_2 * \pi$

$D = g(\pi, r) = \beta_1 - \beta_2 * \pi + \beta_3 * r$

Central bank seigniorage (S_{CB}) can then be expressed as:

$S_{CB} = \Delta M/P = (\Delta M/M)*(M/P) = \pi * m(\pi, r)$

$S_{CB} = \pi * m = \pi * (C + rr * D) = \pi * (\alpha_1 - \alpha_2 * \pi) + \pi * rr * (\beta_1 - \beta_2 * \pi + \beta_3 * r)$

where (rr) is the reserve ratio imposed by central bank, (m) is real demand for high-powered money which has two components. One is currency in circulation (C) and the other is demand deposits (D).

Hence, the maximum amount of seigniorage can be collected occurred when the first order condition is obtained.

$dS/d\pi = 0$

$dS/d\pi = (\alpha_1 + rr * \beta_1 + \beta_3 * r * (rr)) - 2 * (\alpha_2 + \beta_2 * (rr)) * \pi = o$

$d^2S/d\pi^2 = -2 * (\alpha_2 + \beta_2 * (rr)) < 0$

Second order condition satisfied the relative extremia condition only when those two coefficients are positive (iff $\alpha_2, \beta_2 > 0$). Seigniorage increases at a decreasing rate as inflation increases. Laffer curve can be applied to this situation.

From equation (11), Maximum amount of seigniorage could be collected by government when inflation rate is as follows.

$\pi = (\alpha_1 + rr * \beta_1 + \beta_3 * r * (rr)) / (2*(\alpha_2 + \beta_2 * (rr))$

Performing comparative static analysis:

$d\pi/drr = (\alpha_2 * \beta_1 - \alpha_1 * \beta_2 + \alpha_2 * r * \beta_3) / (2*(\alpha_2 + rr * \beta_2) \quad >= < 0$

As the reserve ratio changes, the change in inflation rate is ambiguous and depends on the coefficients of the numerator.

$(\alpha_2 * \beta_1 - \alpha_1 * \beta_2 + \alpha_2 * r * \beta_3) >= < 0$

Case2: Central bank with revenues from banking institutions

In this section assume that the central bank collects revenues from banks by imposing revenue tax (t). Total profits (R) generated by all financial institutions (including state banks, non-state banks, and other non-bank financial institutions) are:

$R = (1 - rr) * \pi * D(\pi, r) - r * D(\pi, r)$

$R = (1-rr) * \pi * (\beta_1 - \beta_2 * \pi + \beta_3 * r) - r * (\beta_1 - \beta_2 * \pi + \beta_3 * r)$

where (r) is interest rate paid on demand deposit.

Central bank can generate revenues either from currency issuance or from the banking systems. Combining (11) and (12), seigniorage will be:

$S = S_{CB} + t * R$

where (t) is the portion of revenues that the central bank levied on the banking industry.

$S = \pi * (C + rr * D(\pi, r)) + t * ((1 - rr) * \pi * D(\pi, r) - r * D(\pi, r))$

$= \pi * (\alpha_1 - \alpha_2 * \pi) + \pi * rr(\beta_1 - \beta_2 * \pi + \beta_3 * r) + t * ((1 - rr) * \pi * (\beta_1 - \beta_2 * \pi + \beta_3 * r)$

$- r * (\beta_1 - \beta_2 * \pi + \beta_3 * r))$

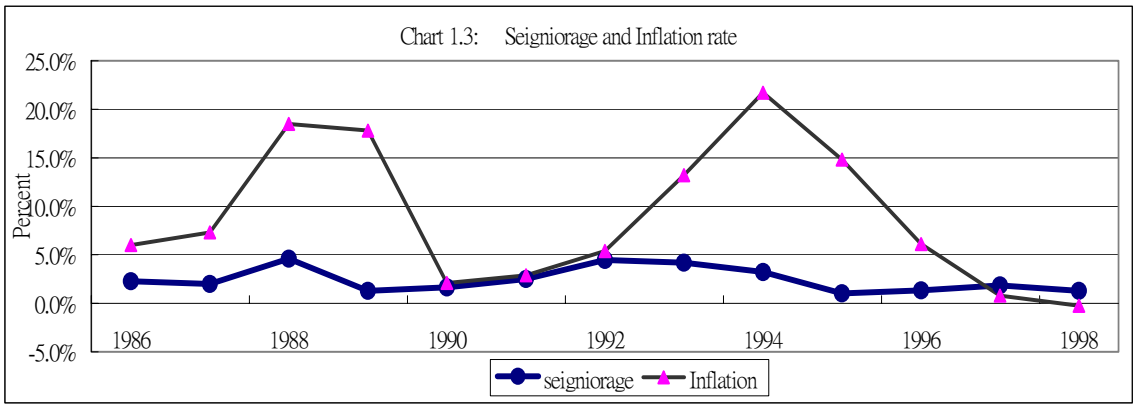
$$dS/d\pi = (\alpha_1+\beta_1* t +\beta_3*r -\beta_2* tr +(1-t) *(rr)*\beta_1 +(1-t)*\beta_3* r*(rr))$$

$$- \quad 2*\pi*(\alpha_2 +\beta_2*t +\beta_2 *(1-t)*(rr)) =0$$

$$d^2S/d\pi^2 = - 2(\alpha_2 +\beta_2* t + \beta_2 *(1-t)*(rr)) \quad < 0$$

When the inflation rate increases, seigniorage increases at a decreasing rate. If banking institutions are included in this model, segniorage can then be collected by the government when the inflation rate is:

$$\pi = (\alpha_1+\beta_1 +\beta_3*r +\beta_2* r) / (2*(\alpha_2 +\beta_2))$$



Central bank without revenues from banking institutions:

$\pi = (\alpha_1 + rr*\beta_1 + \beta_3 * r * rr) / (2*(\alpha_2 + \beta_2 * rr))$

Seigniorage $= \pi*m = (\alpha_1 + rr*\beta_1 + \beta_3 * r * rr) * m / (2*(\alpha_2 + \beta_2 * rr))$

Central bank with revenues from banking institutions:

$\pi = (\alpha_1 + \beta_1 + \beta_3 * r + r*\beta_2) / (2*(\alpha_2 + \beta_2))$

Seigniorage $= \pi*m = (\alpha_1 + \beta_1 + \beta_3 * r + r*\beta_2) * m / (2*(\alpha_2 + \beta_2))$

Data Description

Data ranges from year 1999-2003. Inflation rate is the percentage change of retail price, and interest rate is the one-year time deposit rate. We conduct an estimation based on the model listed above, the results are that when central bank collects no revenues from banking institutions, on average seigniorage revenue is about RMB 26.2 billion yearly, and it is about RMB 74.2 billion yearly when central bank collects revenue from banking institutions.

§1.5. Seigniorage and Political Instability

China is still under a highly controlled and structured economic system. Politically, it has witnessed major movements like the Cultural Revolution and Tiananmen events. Cukierman (1992)[1] developed a model that links political instability and seigniorage together, the OLS regression output is the following.

$$\begin{aligned}(\text{Seigniorage}) &= 0.027+0.006(\text{agriculture})-0.04(\text{trade})- 5.77*10^{-4}(\text{GDP per capita}) \\ &+0.001(\text{urban})- 0.039(\text{industrialized}) + 0.128(\text{political instability}) \\ &- 0.040(\text{DDGNP})\end{aligned}$$

where (seigniorage) is change in reserve money divided by total revenue of central government, (agriculture) is the share of GDP produced in the agriculture sector, (trade) is imports plus exports as fraction of GDP, (urban) is urban population as a percentage of total population, (political instability) is the estimated frequency of government change, (DDGNP) is domestic debt to GNP ratio.

As the political circumstances become unstable, the government will tend to use seigniorage as a fiscal tool. Political instability reflects a temporarily interruption to the collective decision process. Due to the fact that the central bank does not function independently and is under the control of the government, the more unstable the government is the higher the incentive to use seigniorage. In some sense, seigniorage reflects the inability to reach any policy decision rather than being due to costs of enforcing and administering tax

[1] Cukierman adopted data in 48 countries.

collections. Politically unstable societies tend to rely relatively more on seigniorage than do stable and homogenous societies. Click (1994) also came to the conclusion that higher turnover of the central bank governor is consistently associated with higher seigniorage.

§1.6. Dis-inflation, local government deficit, and enterprises

Inflation is the main concern of the central bank, which will determine the amount of seigniorage revenues that the central bank can collect. Inflation is a key factor in determining the conduct of monetary policy and the amount of money currency issued.

In this section we will review how the government implements policy to control inflation in China. In 1986, The Price Reform Research Group of the Chinese Academy of Social Sciences proposed the following methods to stabilize the price level.

1. The establishment of a price ceiling.
2. Organizing a special market for trading key commodities.
3. Adjusting demand and supply indirectly via monetary and fiscal policy.
4. Using state trading companies to stockpile commodities for release onto the market.

In China, anti-inflation is the main concern of macroeconomic management since the 1990s. Masson (1998) claimed that those countries (New Zealand, Canada, Sweden, and Australia) which adopted inflation targeting successfully, in order to implement a successful inflation targeting regime, the central bank would meet the following prerequisites:

1. Independence: central bank should have a high degree of independent operation.

2. No-fiscal dominance: the conduct of monetary policy should not be constrained by purely fiscal considerations.

3. Inflation targeting has always been associated with a high degree of exchange rate flexibility.

4. Sound financial and capital market: government can easily finance public debt through financial markets and not just rely on revenue from excessive money issuance - that is seigniorage.

5. In those countries that adopted inflation targeting, past experience shows that inflation targeting was introduced only when the rate of inflation was already less than 10 percent. This reduces the risks of either announcing a very dramatic reduction in inflation or setting targets for inflation that might have been perceived as too high.

As we observe in China the first three conditions are not met. The central bank is still closely tied with the local government adversely affecting the conduct of monetary policy which can greatly deteriorate its policy targets. Next, exchange rate policy is targeted by the government which leads to instability in monetary policy. Due to these factors, inflation targeting will be hard to sustain in the long run with potential inflation a risk in the future.

As Masson also mentioned that central banks can pursue inflation targeting only when certain rules are obeyed:

1. Explicit inflation targets for some period or periods ahead.

2. Clear indication that attaining those inflation targets is the overriding objective of monetary policy.

3. A model for forecasting inflation that uses relevant variables and information indicators.

4. A forward-looking operating procedure in which the setting of policy instruments depends on assessing inflationary pressures and where inflation forecasts are used as the main intermediate target of monetary policy.

Contract Responsibility System and Inflation

Another reason to explain why inflation can be held under control is to adopt the so-called contract responsibility system for most enterprises in China, Qian (1995) pointed out that almost 80% of state-owned enterprises adopted the contracting system in 1987. Enterprises can retain certain profits under the contract responsibility system with typical contracts lasting for a period of 3-5 years. Local governments rely heavily on the tax incomes from state-owned enterprises (SOE) and the contracts between them. These contracts are negotiated on an enterprises-by-enterprises basis, there is negotiation over the terms of the contract and then over what to do when those enterprises do not meet profit targets. The contract responsibility system then undermines the goals of enterprise reform. Under these contracts, enterprises are committed to paying a fixed level of enterprise income tax. If profits are below the contracted level, the enterprise is supposed to make up the difference from its own funds. The government would not back them up. On the other hand, if it achieves a higher level of profit, it will pay a lower rate of tax (often zero) on the additional profits.

The system exhibits macroeconomic instability by reducing the share of tax revenues to GDP during boom periods when increased taxes are adjusted to reduce the risk of inflation.

Chapter 2

Sources and Divisions of Seigniorage

In this section, we estimate the sources and allocation of seigniorage in China. Haslag(1998)[1] estimated the seigniorage in over 67 countries. On average, he pointed out that seigniorage revenue to output is only about 2 percent. On the other hand, conventional tax receipts are 23 percent of average output. Tax receipts are 11 times higher than seigniorage revenues. Seigniorage does not seem to be the primary source of government revenues for those 67 countries.

Eduard(2001) also estimated seigniorage in three eastern European countries (Czech Republic, Hungary and Poland). In Czech Republic, seigniorage never reached beyond 3% of GDP in 1990s, In Hungary, seigniorage varies from a high of 7.37% of GDP in 1995 to a low of 1.08% of GDP in 1997, and seigniorage falls between 2% and 6% of GDP during 1990s in Poland.

Klein and Neumann(1989) estimated seingiorage revenues in both Germany and Japan. Their finding is as follows. In Germany, seigniorage was 0.9 percent of GNP in year 1960-1973 and 0.7 percent in 1973-1978. In Japan it was 1.4 percent in 1960-1973 and 1.2 percent in 1973-1978.

In the U.S. this number is smaller, it was only 0.4 percent in 1960-1973 and 0.5 percent in 1973-1978. All these industrialized countries did not seem to rely heavily on segniorage revenue as a fiscal tool.

[1] See Haslag, pp.14, 1998.

In China, reviewing data over the period 1986-1999: on average, when monetary seigniorage approach (broad money(M_2) as the base) is adopted, seigniorage revenue to output is 6.08 percent, which is much higher than those 67 countries. The maximum amount is 11.36 percent in 1993 and the minimum is 1.10 percent in 1998. On average, government tax revenue is 14 percent of average output, this figure is smaller than those 67 countries. The Chinese government seems to rely more on seigniorage revenue as a fiscal tool than other countries. Traditional tax revenue still seems to not play a major role for financing government expenditures.

Selected 67 Countries

	Mean	Standard-deviation	Maximum	Minimum
Seigniorage revenue (67 countries):	0.02	0.02	0.12	0.002
Tax Receipt (67 countries):	0.23	0.10	0.56	0.05

Note: Sources: Seigniorage revenue: Real seigniorage / real GDP
(Money stock: uses high-powered money as the base).
Tax receipt : Tax revenue/ GDP.
Data retrieved from Haslag(1998), 67 countries are included.

China

	Mean	Standard-deviation	Maximum	Minimum
Seigniorage revenue (1986-1999)	0.068	0.23	0.1136	0.011
Tax Receipt (1978-1998):	0.1399	0.032	0.2277	0.109

Note: Sources: Seigniorage revenue: monetary seigniorage / GDP
Money stock: uses broad money as the base).
Tax revenues: (Government tax revenues+ Grants) / GDP.

2.1. Sources of Seigniorage

In order to estimate the sources and allocations of seigniorage in China, a more detailed accounting framework proposed by Klein and Neumann would be employed in this section. The model incorporated all assets and liabilities of the government and financial institutions. Simplifying the estimation of profits (or losses) incurred from exchange rate changes, the model makes an assumption that the exchange rate is fixed over the entire observation periods

§2.1.1. The Data and Financial Institutions:

We begin with an overview of the structures and composition of financial institutions in China, This analysis is based on balance sheet and sources and uses accounts of the financial institutions. In this section, the goal is to understand the composition of financial institutions, to derive the sources and uses of seigniorage.

A brief summary of the Chinese banking system is listed below.

Effective 1997, financial statistics have been collected and reported according to the new monetary statistics indicators system. The financial institutions include the People's Bank of China as well as other institutions such as the Industrial and Commercial Bank of China, the Agricultural Bank of China, the China Construction Bank, the State Development Bank, the Export and Import Bank of China, the Agricultural Development Bank of China, Bank of Communications, CITIC Industrial Bank, Everbright Bank of China, Hua-Xia Bank, Guangdong Development Bank, Shenzhen Development Bank, China Merchants Bank, Shanghai Pudong Development Bank, Fujian Industrial Bank, China Minsheng Banking Corporation, Yantai Savings Bank, Benbu Housing and Savings Bank, City

United Commercial Banks, Urban Credit Housing and Cooperatives, Rural Credit Cooperatives, finance companies, trust and investment companies, leasing companies and the Postal Savings Bureau. Analyzing the balance sheet of financial institutions data would consist of the combined financial institutions listed above.

§2.1.2. The Balance Sheet of Monetary Authority

The Asset part of the balance sheet of financial institutions are: foreign assets (FA) converted at domestic currency, claims on government (CG), claims on deposit money banks (CDMB), claims on specific depository institutions (CSDI), claims on other financial institutions (COFI), claims on non-financial institutions (CNFI), and Other assets (OA).

Asset = FA+CG+CDMB+CSDI+COFI+CNFI+OA

The Liability side of the balance sheet of financial institutions is as follows, Reserve money (RM), Currency in circulation (CC), Deposit of financial institutions (DFI), Deposits of non-financial institutions (DNFI), Bond (B), Foreign liabilities (FL), Deposits of government (DG), Own capital (K), Other liabilities (OL).

Liability = RM+CC+DFI+DNFI+B+FL+DG+K+OL

The Balance Sheet of Monetary Authority in Table 2.1 includes the PBOC, state deposit banks, and other banking institutions. On the liability side, reserve money is the main component, of which currency accounts for about 35 percent in year 2002-2003, bond

issuance is 2.9 percent in year 2002 and increased to almost 5 percent in year 2003, deposit of government is about 7 percent in year 2002 and 2003.

On the asset side, the table shows that foreign assets is the major component, of which foreign exchange reserves account for 43 percent in year 2002 and 48 percent in year 2003. Gold is less than 1 percent over the sample periods, claims on the government is about 5 percent in year 2002-2003, claims on deposit money banks is about 18 percent in year 2002-2003, claims on other financial institutions is 14 percent in year 2002 and 11 percent in year 2003.

§2.1.3. Credits Funds of Financial Institutions

In Table 2.2, reviewing data from year 1999 to 2003, financial institutions channeled most of the funds (about 90 percent) from various deposits, about 30 percent is from enterprises deposits, almost half is from household savings deposits, rural deposits falls below 3 percent on average.

Issuing bonds is very limited to those financial institutions. In year 1999, the amount of financial bonds issued is RMB 3,900 million, less than 1 percent of total funds. In year 2002, the figure remains at just RMB 9,000 million. At the end of year 2003, data shows that financial bonds amounted to a high of RMB 222,627 million, a significant 24-fold increase.

Currency issuance is pretty stable as a source of funds and remains at about 10 percent on average over sample periods.

The funds served as a basis to make loans to various sectors, short-term loans to the industrial sector, commercial sector, construction sector, agricultural sector, and other sectors

accounting for 52 percent of loans in year 1999 – this proportion has gradually declined to 37 percent in year 2003.

Portfolio investment was 10 percent in year 1999, 15 percent in year 2002, and 13 percent in year 2003.

Position of foreign exchange purchase: Financial institutions invested enormously on foreign exchange reserves, the proportion was at 12 percent in year 1999, 11 percent in year 2001, and 15 percent in year 2003.

Asset with international financial institutions was relatively insignificant at below 1 percent over sample periods.

On average we notice that 16.5 percent of funds are from currency, the majority of credit funds are "private investment", and the percentage of total loans has gradually declined to 75% in 1996 from 90.1% in 1990. On the other hand, if we treat "Foreign Exchange Purchases" and "Asset with International Financial Institutions" together as Foreign Assets, then the accumulation of foreign assets has increased to 16 percent of total funds in 1996 from 5.1 percent in 1990. This figure is a three fold increase with one sixth of funds invested in foreign assets. Those banking institutions allocated more of their funds for the accumulation of foreign assets.

Table 2.1: Balance Sheet of Monetary Authority

Items	1999.12	2000.12	2001.12	2002.12	as % of total asset	2003.12	as % of total asset
Foreign assets	14458.50	15582.80	19860.40	23,242.85	45.48%	31141.85	50.23%
Foreign exchange	14061.40	14814.52	18850.19	22,107.39	43.26%	29841.80	48.13%
Monetary gold	12.0	12.00	256.00	337.24	0.66%	337.24	0.54%
Other foreign assets	385.1	756.28	754.21	798.22	1.56%	962.81	1.55%
Claims on government	1,582.8	1,582.80	2821.33	2,863.79	5.60%	2901.02	4.68%
Of which: Central government				2,863.79	5.60%	2901.02	4.68%
Claims on deposit money banks	15,373.9	13519.19	11311.60	9,982.56	19.53%	10619.47	17.13%
Claims on specific depository-				2,305.08	4.51%	1363.34	2.20%
institutions							
Claims on other financial institutions	3,833.1	8,600.37	8547.31	7,240.27	14.17%	7255.95	11.70%
Claims on non-financial institutions	101.5	110.20		206.74	0.40%	206.25	0.33%
Other assets				5,266.29	10.30%	8516.19	13.73%
Total Assets				51,107.58	100.00%	62004.06	100.00%
Items	**1999.12**	**2000.12**	**2001.12**	**2002.12**	**as % of total liability**	**2003.12**	**as % of total liability**
Reserve money	33620.00	36491.48	39851.73	45138.18	88.32%	52841.36	85.22%
Currency issue	15069.80	15938.31	16868.71	18589.1	36.37%	21240.48	34.26%
Deposit of financial institutions	14728.5	16019.03	17089.13	19138.35	37.45%	22558.04	36.38%
Deposit money banks				18939.54	37.06%	22274.41	35.92%
Special depository institutions				193.01	0.38%	280.31	0.45%
Other financial institutions				5.8	0.01%	3.32	0.01%
Deposits of non-financial institutions	3821.8	4534.14	5893.89	7410.73	14.50%	9042.84	14.58%
Demand deposits				41.64	0.08%	58.41	0.09%
Saving deposits				7369.09	14.42%	8984.43	14.49%
Bond issue	118.9			1487.5	2.91%	3031.55	4.89%
Foreign liabilities				423.06	0.83%	482.58	0.78%
Deposits of government	1785.5	3100.38	2850.49	3085.43	6.04%	4954.71	7.99%
Of which: Central government				1301.85	2.55%	2624.37	4.23%
Own capital	366.8	356.75	355.21	219.75	0.43%	219.75	0.35%
Other liabilities	-541.4	-553.25	-516.79	753.66	1.47%	474.11	0.76%
Total Liabilities				51107.58	100.00%	62004.06	100.00%

Note: Unit: 100 million yuan.

Table(2.2) Sources and Uses of Credits Funds of Financial Institutions
(Funds Sources)

Year:	1999	as% of total funds	2000	as% of total funds	2001	as% of total funds
	123230.6	100.0%	133325.3	100.0%	153539.7	100.0%
1: Total Deposits	108778.9	88.3%	123804.3	92.9%	143617.1	93.5%
Deposits by Enterprises	37182.4	30.2%	44093.73	33.1%	51546.6	33.6%
Fiscal Deposits	2128.4	1.7%	3508	2.6%	3369.7	2.2%
Deposits by Government						
and Organization	1814.5	1.5%	2224.2	1.7%	2852.8	1.9%
Household Savings Deposits	59621.8	48.4%	64332.38	48.3%	73762.4	48.0%
Demand Deposits	14666.7	11.9%	18190.72	13.6%	22327.5	14.5%
Time Deposits	44955.1	36.5%	46141.66	34.6%	51434.8	33.5%
Rural Deposits	2126.3	1.7%	2642.8	2.0%	3083.2	2.0%
Trust Deposits	3072.2	2.5%	2873.6	2.2%	2689.7	1.8%
Other deposits	2833.7	2.3%	4129.3	3.1%	6312.5	4.1%
2: Financial Bond	39.5	0.0%	30.1	0.0%	51.3	0.0%
3: Currency in Circulation	13455.5	10.9%	14652.6	11.0%	15688.8	10.2%
4:Liabilities to International Financial-						
Institutions	371.9	0.3%	n.a	n.a	n.a	n.a
5:Other Items	584.8	0.5%	-5161.87	-3.9%	-5817.5	-3.8%

Note: Unit: RMB100 Million

Table(2.2) Sources and Uses of Credits Funds of Financial Institutions
(continued)

Year:	2002	as% of total funds	2003	as% of total funds
	184024.52	100.0%	225313.26	100.0%
1: Total Deposits	170917.4	92.9%	208055.59	92.3%
Deposits by Enterprises	60028.5	32.6%	72487.05	32.2%
Fiscal Deposits	3481.9	1.9%	5126.94	2.3%
Deposits by Government,-				
and Organization	5184.4	2.8%	6727.65	0.0%
Household Savings Deposits	86910.6	47.2%	103617.65	46.0%
Demand Deposits	28121.7	15.3%	35118.98	15.6%
Time Deposits	58788.9	31.9%	68498.67	30.4%
Rural Deposits	3764.2	2.0%	4898.33	2.2%
Trust Deposits	2414.3	1.3%	2458.10	1.1%
Other deposits	9133.1	5.0%	12739.87	5.7%
2: Financial Bond	90.3	0.0%	2226.27	1.0%
3: Currency in Circulation	17278	9.4%	19745.99	8.8%
4:Liabilities to International Financial-				
Institutions	423	0.2%	482.57	0.2%
5:Other Items	-4684.3	-2.5%	-5197.17	-2.3%

Note: Unit: RMB100 Million

Table(2.2) Sources and Uses of Credits Funds of Financial Institutions
(Funds Uses)

Year:	1999	as% of total funds	2000	as% of total funds	2001	as% of total funds
	123230.6	100.0%	133325.3	100.0%	153539.7	100.0%
1: Total Loans:	93734.3	76.1%	99371	74.5%	112314.7	73.2%
Short-term Loans	63887.6	51.8%	65748	49.3%	67327.2	43.9%
Loans to Industrial sector	17948.9	14.6%	17019.3	12.8%	18636.6	12.1%
Loans to Commercial sector	19890.9	16.1%	17868.5	13.4%	18563.4	12.1%
Loans to Construction sector	1476.9	1.2%	1617	1.2%	2099.5	1.4%
Loans to Agricultural sector	4792.4	3.9%	4888.9	3.7%	5711.4	3.7%
Other short-term loans	19778.6	16.1%	24354.2	18.3%	22316	14.5%
Medium-long-term loans	23968.3	19.4%	27931.1	20.9%	39238	25.6%
Trust loans	2504.6	2.0%	2709.7	2.0%	2497.5	1.6%
Other loans	3373.8	2.7%	3282.1	2.5%	3251.8	2.1%
2: Portfolio Investment	12505.8	10.1%	19651	14.7%	23112.6	15.1%
3: Position for Bullion & Silver purchase	12	0.0%	12	0.0%	256	0.2%
4: Position for foreign exchange purchase	14792.4	12.0%	14291.1	10.7%	17856.4	11.6%
5: Advances to Treasury	1582.1	1.3%	1582.6	1.2%	1582	1.4%
6: Assets with International financial-						
Institutions	604.1	0.5%	595.7	0.4%	n.a.	n.a.

Note: Unit: RMB 100 Million.

Table(2.2) Sources and Uses of Credits Funds of Financial Institutions
(continued)

Year:	2002	as% of total funds	2003	as% of total funds
	184024.5	100.0%	226895.26	100.0%
1: Total Loans:	131293.9	71.3%	158996.23	70.1%
Short-term Loans	74247.9	40.3%	83661.15	36.9%
Loans to Industrial sector	20190.4	11.0%	22756.00	10.0%
Loans to Commercial sector	17973.1	9.8%	17994.41	7.9%
Loans to Construction sector	2747.9	1.5%	3002.14	1.3%
Loans to Agricultural sector	6884.58	3.7%	8411.35	3.7%
Other short-term loans	26451.7	14.4%	31497.25	13.9%
Medium-long-term loans	48642	26.4%	63401.40	27.9%
Trust loans	2170.3	1.2%	2281.32	1.0%
Other loans	6233.6	3.4%	9652.36	4.3%
2: Portfolio Investment	26789.7	14.6%	30259.47	13.3%
3: Position for Bullion & Silver purchase	337.24	0.2%	337.24	0.1%
4: Position for foreign exchange purchase	23223.3	12.6%	34846.92	15.4%
5: Advances to Treasury	1582	0.9%	1582	0.7%
6: Assets with International financial-				
Institutions	798.2	0.4%	873.40	0.4%

Note: Unit: RMB 100 Million.

§2.1.4. Accounting Framework

First of all, seigniorage revenues of the central bank result mainly from two sources: Monetary seigniorage and Interest revenues on all invested assets.

1. Monetary seigniorage (S^M): is the change in base money stock (M) deflated by the output (Y).

$S^M = (M_t - M_{t-1})/Y_t$ (in discrete time period)

$S^M = \Delta M_t / Y_t$ (in continuous time period)

In China, when the broad money (M_2) is used as monetary base. The monetary seigniorage (S^M) is being estimated as follows:

Average (1953-1998)	56.95
Average (1953-1977)	3.93
Average (1978-1998)	120.06

Note: unit: RMB billion

As data revealed in the previous section, on average, monetary seigniorage is about 2.5 percent of GDP when M_0 is used as money base and 10.77 percent of GDP when M_2 is used as money base in China over year 1986-1999.

2. Interest revenues on all non-government assets: In a simplified model, we assume that central bank only holds two types of assets, one is private (domestic) asset (A^p), and the other is foreign asset (A^F).

Total interest revenues (IR) are equal to: $IR = (i^p * A_{t-1}^p + i^F * A_{t-1}^F)/ Y_t$

where (i^p) and (i^F) are interest rate on private asset and on foreign asset.

3. The realized gains (RG) of the central banks from asset trading:

The return on the asset trading of central banks is also part of the revenue of the central bank. .

To add these items above altogether, total sources of seigniorage (S^T) collected by the central bank are as follows:

$S^T = (M_t - M_{t-1})/Y_t + (i^p * A_{t-1}^p + i^F * A_{t-1}^F)/ Y_t + RG/ Y_t$

$S^T = S^M + IR + RG$

Data Description

In the following section, we intend to assess the magnitude of sources of seigniorage based on the equation above, due to the unavailability of data, we ignore the realized gain of asset trading. Money stocks consist of currency in circulation and total deposits. Foreign assets consist of two items, foreign assets and foreign exchange.

In order to simplify our estimation, we make a rough assumption that the average rate of return on all foreign assets is 5 percentage points.

In Table 2.3, the percentage of total seigniorage income to GDP has risen from 14.2% in year 1999, 23.4% in year 2001 to 36.5% in year 2003. Reviewing the data below, we find that the rapid increase of total deposit is the main contributor to the sources of seigniorage, the rate of growth of deposits is 13% in year 2000, 16% in year 2001, 19 % in year 2002 and

21% in year 2003, deposits received from the public continue to accumulate at an increasing rate.

Table 2.3. Sources of Seigniorage

Item	Year	1999	2000	2001	2002	2003
1	Deposits	108,778	123,804	143,617	170,917	208,055
2	Currency in Circulation	13,455	14,652	15,688	17,278	19,745
3	Money stock:(1+2)	122,233	138,456	159,305	188,195	227,800
4	Change in money stock	10,193	16,223	20,849	28,890	39,605
5	Monetary seigniorage as percentage of GDP	12.4%	18.1%	21.4%	27.6%	33.9%
6	Foreign assets	14,458	15,582	19,860	23,242	31,141
7	Foreign exchange	14,061	14,814	18,850	22,107	29,841
8	Total foreign assets (6+7)	28,519	30,396	38,710	45,349	60,982
9	Rate of return(5%) on foreign assets	1,425.95	1,519.8	1,935.5	2,267.45	3,049.1
10	Return on foreign assets- as percentage of GDP	1.7%	1.7%	2.0%	2.2%	2.6%
11	Total sources of seigniorage- as percentage of GDP (5+10)	14.2%	19.8%	23.4%	29.7%	36.5%

Note: unit: RMB 100 million.

§2.2. The Allocations of Seigniorage

In terms of the allocation of seigniorage revenue in China, the People's Bank of China is still under direct government administration. The priority function of the People's Bank of China is to finance fiscal deficit of the government sectors.

In the following section, we explore the issue of how seigniorage revenues are allocated? Thurston (1998) pointed out that after state banks acquired seigniorage revenues from the People's Bank of China, they used those incomes and other resources in order to accumulate claims on non-bank loans.

Seigniorage is also likely to be used to subsidize the prices of agriculture products, to subsidize state-owned enterprises.

Another feature is that an increasing amount of money is invested in foreign assets, including foreign reserves.

1. Fiscal seigniorage: The government can finance its own debt expenditures through three channels.
   1.1. Net borrowing from central bank (A^G).
   1.2. Coinage (R^{coin}).
   1.3. Appropriated profit (R^G) from central bank minus interest payment to central bank ($i^G * A^G$).

As we review the data in Table 2.2, the funds advanced to treasury department are pretty stable, the financial institutions appropriated around RMB 158,200 million to treasury department during year 1999-2003, about one percent of total funds has been appropriated to the treasury department annually.

Government sector

A major part of seigniorage revenues that central bank accrued are to finance budget deficit (G-T) and interest payment on debt (B).

$(G-T+ i^{B}*B)/Y$

In this section, we examine the balance account of the government. The figures in Table 2.3 and Table 2.4 revealed that the central government issued a total of RMB 566 billion of domestic debts in year 2002, about 12 percent is used to pay back the interest expenditures on domestic and foreign debts. Interest payment to the PBOC counts just at a small fraction of less than 1 percent.

The percentage of total government debts to GDP has been around 2.5 percent during 1989 to 1996, and gradually moved up to 5 percent of GDP in 2002. The government seemed to put more weights on debts tools to fill its fiscal gaps over time. Due to the limited access to international financial markets, foreign borrowing is still not widely available, falling less than 1 percent over sample periods.

Table 2.4. Government Debts Issuance

Year	Total Debts	as % of GDP	Domestic Debts	as % of GDP	Foreign Borrowing	as % of GDP
1989	407.97	2.41%	56.07	0.33%	144.06	0.85%
1990	375.45	2.02%	93.46	0.50%	178.21	0.96%
1991	461.4	2.13%	199.3	0.92%	180.13	0.83%
1992	669.68	2.51%	395.64	1.49%	208.91	0.78%
1993	739.22	2.13%	314.78	0.91%	357.9	1.03%
1994	1,175.25	2.51%	1,028.57	2.20%	146.68	0.31%
1995	1,549.76	2.65%	1,510.86	2.58%	38.9	0.07%
1996	1,967.28	2.90%	1,847.77	2.72%	119.51	0.18%
1997	2,476.82	3.33%	2,412.03	3.24%	64.79	0.09%
1998	3,310.93	4.23%	3,228.77	4.12%	82.16	0.10%
1999	3,715.03	4.53%	3,702.13	4.51%	n.a.	n.a
2000	4,180.1	4.67%	4,153.59	4.64%	23.1	0.03%
2001	4,604	4.73%	4,483.53	4.61%	120.47	0.12%
2002	5,679	5.42%	5,660	5.40%	n.a.	n.a.

Note: unit: RMB 100 million

Table 2.5. Government Payment for the Principal and Interest of Debt

Year	Payment for the Principal and Interest of Domestic Debts	Payment for the Principal and Interest of Foreign Debts	Payment of the Interest of loans from PBOC
1996	1,266	61	28
1997	1,820	71	27
1998	2,246	77	30
1999	1,792	91	27
2000	1,552	28	n.a
2001	1,923	84	n.a
2002	2,468	95	n.a

Note: unit: RMB 100 million

Subsidies to Loss-making Enterprises (SD)

One of the missions of the government is to support the state-owned enterprises which run heavy losses. The government extracts financial capital from financial institutions to support those enterprises either through control of the lending rate setting or direct transfer of credit funds. Although, the official figure does not look very significant, it varies around 0.3 % of GDP during year 1999-2002. It solely reflects the fact that the hidden transfer from the government unit to the enterprises units could hardly be estimated. Yet, there is reason to believe that this figure amounts to a large portion of seigniorage allocations. We will discuss this issue later.

Thus, Fiscal seigniorage (S^G) is as follows:

$$S^G = (1/Y)*(A^G+R^{coin}+(R^G - i^G *A^G)+ (G-T+ i^B*B+SD)) \quad (1)$$

The data revealed that fiscal seigniorage ranges from 4.3% of output in year 1999, to 4.9% of output in year 2000, to 4.7% of output in year 2002.

2. Central bank has to cover the cost of maintaining operations (C^{op}) and the cost of coinage (C^{coin}).

$$S^C = (1/Y)*(C^{op} + C^{coin}) \quad (2)$$

In this part, the figure of operation costs is not available in the official report.

3. Financial Investment: Central bank could invest in its portfolio of non-government assets (both in domestic asset (A^P) and foreign asset (A^F).

$$S^I = (1/Y)*(A^P + A^F) \quad (3)$$

The data in Table 2.2 show that portfolio investment has increased from RMB 1,250,580 million in year 1999, RMB 1,965,100 million in year 2000, to RMB 3,025,947 million in year 2003. a significant increase of 141 percent from year 1999 to 2003. The purchase of foreign exchange has gone up from RMB 1,479,240 million in year 1999, RMB 1,785,640 million in year 2001, to RMB 3,484,692 million in year 2003. An increase of 135 percent from year 1999 to 2003. Asset with International financial institutions is reported at about 0.4 percentage of total funds during year 1999-2003. It is evident that a significant portion of funds have increasingly invested on foreign assets.

Financial Institutions appropriated the funds to the Treasury department on a regular basis. This figure amounts to almost 1.6 percentage of GDP during year 1999-2003. Financial institutions continue to invest in various financial assets, this figure has increased from 7.07 percent of GDP in year 1999, 7.42 percent of GDP in year 2003, to 12.35 percent of GDP in year 2003.

Our estimation result is presented in the following table. The balance account can be set up as follows.

$$S^M + IR + RG = S^G + S^C + S^I$$

Table 2.6. Allocation of Seigniorage

Item	Year	1999	2000	2001	2002	2003
1	Advances to Treasury from financial institutions	1,582	1,582	1,582	1,582	1,582
	as % of GDP	1.9%	1.8%	1.6%	1.5%	1.4%
2	Government deficit	1,743	2,491	2,516	3,149	
	as % of GDP	2.1%	2.8%	2.6%	3.0%	
3	Subsidies to Loss-making-enterprises	290	278	300	259	
	as % of GDP	0.3%	0.3%	0.3%	0.2%	
4	Fiscal seigniorage(=1+2+3)	3,325	4,073	4,098	4,731	
	as % of GDP	4.3%	4.9%	4.5%	4.7%	
5	Portfolio Investment	12,505	19,651	23,112	26,789	30,259
6	Foreign Exchange Purchases	14,792	14,291	17,856	23,223	34,846
7	Asset with International-					
	Financial Institutions	604	597	597	798	873
8	Total Financial Investment-					
	(=5+6+7)	27,901	34,539	41,565	50,810	65,978
9	Change in Financial-Investment	5,800	6,638	7,027	9,245	15,168
	as % of GDP	7.07%	7.42%	7.22%	8.82%	12.35%

Note: unit: RMB 100 million.
Data: end of each year.

Horchreiter (1996) pointed out that seigniorage can be distributed in the following ways:

1. Interest rate subsidy or refund on government liabilities with central bank.
2. Transfer of central bank pre-tax profits.

3. Central bank dividend payments.

4. Central bank tax payments.

5. Transfer of central bank residual (post-tax and post-dividend) profits.

6. Central bank can keep seigniorage for its own purposes. To offset the cost of running the central bank (operating costs), to invest, or to accumulate its own (domestic and foreign) capital.

Hochreiter observed that in Romania seigniorage acts as a subsidy to the financial sector. The central bank distributed a subsidy of about 10% of GDP to domestic banks.

Christine(1995) mentioned that in China, there is no clear distinction between the People's Bank of China and government, the PBOC has to accommodate the fiscal financing of local governments in the following ways

1. Accommodate whatever portion of the government's budget deficit upon request.

2. Ensure sufficient credit to enable fulfillment of the investment plans drawn up by the state.

3. Extends loans to bankrupt key enterprises to ensure continued supply of their output, and extend loans to other bankrupt large enterprises to ensure full employment, keeping the inflation rate low.

As the People's Bank of China plays a passive role, there are two direct flaws confronting PBOC.

1. The council that sets the annual credit plans has representatives from almost every ministry and economic agency and this wide range of departments makes it difficult to reach consensus on monetary policy. The result is that monetary policy is reactive rather anticipatory.

2. The People's Bank of China has branches in most major provinces. Those regional branches are under dual leadership: a branch is supervised by its head office and by the local government. The staff of a branch can be very dependent on the local government due to the great interest of local governments in promoting local development. Bank branches are reluctant to implement a tight credit squeeze when they are ordered to do so by the head office. As a result of these two factors, the independence of the PBOC has been greatly reduced as it has to take into account the fiscal needs of those local governments.

Chapter 3

Seigniorage Revenue transfers to the Government sectors

The People's Bank of China is under the direct control of the central government, seigniorage revenue collected by the People's Bank of China is most likely to fill the budget deficit. In this part, we explore the process of financial reform of China, to help understand the uses of seigniorage revenues.

In China, reform of the banking system began in 1979 through the establishment of a system of lending with interest payment requirements. In the early 1980s, The People's Bank of China was the only "one bank" with all deposits and loans approved by and collected for. Under such a system there can be no multiple expansion of deposits.

1. In 1983, the national central banking system was formed. The People's Bank of China and the specialized banks were separated to take on different functions. The management and control of multiple expansion of deposits became an important issue.

2. In 1985, the minimum reserve requirement system on deposits was created, all special banks have to maintain a minimum reserve at the People's Bank of China. For instance, in 1985 the minimum reserve requirement was 10%. In 1988 it was 13%. Insurance companies also have to deposit 20% of cash capital at the People's Bank of China. The rural credit co-operatives should maintain their minimum reserves at the Agriculture Bank of China and their minimum reserve requirements were between 15% and 30%. From 1986 on, this minimum reserve requirement has transformed the system from central administrative control to towards market economic management.

3. Double-track interest rate system: In 1986, Wenzhou was named a banking trial city in which the special banks and the credit co-operatives were to use a double-track interest rate system. The People's Bank of China determined interest rates for certain projects or types of credit with banks (special banks and those credit co-operatives), granting the banks complete liberty to set rates by themselves. In some provinces market interest rates were reaching 50% annually.

4. In 1994, the Budget Law was passed: it prohibited the government from borrowing from the People's Bank of China. It was the first time that a strict rule was made cutting the channel between the People's Bank of China and the government. As a result most enterprises could not be directly financed by the People's Bank of China and most borrowers turned to state banks for financing. Supporting the loss-making state enterprises caused a heavy burden for state banks and a bad-debt problem to exist in the banking system.

5. In 1995, The Central Bank Law was passed, which forces the Ministry of Finance to substantially increase its sale of bonds to finance the government's budget deficit and to reduce the reliance on currency issuance. The government introduced indexing on government bonds to finance its financial deficit.

6. Open market operation as a tool of the monetary policy instrument was established first in April 1996. By the end of December, the People's Bank of China conducted 51 repo transactions of short-term treasury bills, with transaction volume totaling 4.3 billion yuan. In the first stage, 17 large commercial banks as primary dealers were selected as the makers in the market, which created a market-based monetary policy transmission mechanism. The trading price was formed through competitive bidding between the commercial banks. Transactions were conducted in the form of re-purchase and the People's Bank of China

formulated the "Agreement on government Bonds Repurchase" and signed the document with market makers to standardize repo transactions.

Monetary Policies during 1988–1993

In the fourth quarter of 1988, in order to ease the threat of inflation, the banking system introduced a value guarantee deposit program which is an indexing scheme that linked the return of deposits to the inflation rate. The return of three-year time deposits was 17% in the fourth quarter in 1988, increasing to 26.78% in the third quarter of 1989. By the end of 1989, time deposits increased rapidly to 514 billion yuan, which was 134 billion higher than in 1988. This tightening program eased inflation successfully by reducing loans to state-owned enterprises. As a result, thousands of township and village enterprises went bankrupt.

In order to mitigate the shortage of loans, in 1990, The People's Bank of China provided massive amount of loans to the state-owned enterprises. The immediate consequence was high volume of bad debts of SOE's totaling 200 billion yuan. The government ordered the banking system to continue providing new loans to those enterprises in financial trouble.

After Mr. Deng Xiaoping's trip to southern China in 1992, the economy started to heat up. Thousands of new non-bank financial institutions were formed which were out of the control of the central government.

In 1993, an austerity program was implemented by Mr.Zhu Rongji. The main parts of the program are as follows:

1. Separating the state-owned banks from their affiliated trust and investment firms.
2. All specialized banks must call back all outside credit–plan loans.

3. Restricting inter-regional lending and requiring this lending to be approved and supervised by the central bank.

This program caused severe impact: First, it hurt the efficient firms more than those loss-making firms. Efficient firms were able to return money to banks by postponing new projects. Loss making firms had no money to pay back regardless of this austerity program. Second, the difference between official and market rates (underground) increased. The official rate estimated by Gang (1993) was in the range of 10-16%, whereas the market rates (underground) were said to be in the range of 20–35%.

§3.1. Credit Control

The government extends substantial credits to enterprises. Those credit funds are referred to as "policy loans". Credit rationing has been adopted as an intermediate control target by the People's Bank of China in China. Under the Annual Credit Plan, credit is divided into national credit and regional credit. The central bank is able to control the growth of different industries and products by controlling the credit target. The State council has ultimate power in deciding the rationing of credit and therefore a "differentiated" interest rates structure exists. Normally, it means a higher interest rate for poorly operated enterprises and a discounted rate for good enterprises or state-owned enterprises (Huang, 1994). The distribution of loanable funds has low efficiency. Good enterprises usually face fund shortages while loss-making enterprises still receive credit support. The outcome is that a corruption problem is common in every economic unit. Thurston (1998) argued that a great deal of seigniorage generated revenues was distributed to state banks, which utilized the proceeds to subsidize those state enterprises. A

large fraction of bank loans are not true loans because the interest rates of loans are set far below the market rate. This reflects the fact that substantial proceeds are transferred to the borrowers of those loans. The hidden seigniorage revenue transfer hardly appears in the government account even though it should be considered a component of government expenditure.

In Table 1.3, we examine the interest rate structures, the real interest rate is actually negative in years 1988, 1989, 1993, 1994, and 1995 due to the high fluctuation of the inflation rate. Clearly, money market interest rates fail to reflect the opportunity cost of borrowing and lending because of credit rationing.

§3.2. Financing Government Expenditure

Economic reform has been in effect and commenced in 1978. As we observe in Table 3.1, besides a minor fiscal surplus of 57 million RMB in 1985, rapid economic reform forced the government to run a budget deficit in almost every year. In the years 1981-1985, the total deficit was RMB 8.04 billion. In 1986-1990, this figure increases to RMB 58.5 billion. In 1991-1995, this figure has vaulted to RMB 194.5 billion, almost 24 times higher than that of 1981-1985.

The World Bank (1995) estimated the consolidated budget deficit at 6.4% of GNP in 1988 and 8.9% in 1993. Those estimates are bigger than what the official reports revealed. In Table 3.1, the budget deficit stands at around 1 percent of GDP before year 1997. Starting from year 1998, it steadily increases to 2.78 percent in 2000 and 3.01 percent of GDP in year 2002.

Thus, the People's Bank of China's obligation to finance a persistent government deficit was the major source of inflationary pressure. After economic reform, the rapid increase in the People's Bank of China's lending to the financial system was also a source for inflationary surges.

In Table 3.2, the data revealed that the government expenditures could be used on the following items: 1. Private investment, 2. Price subsidies, 3. Subsidies to loss-making state-owned enterprises, 4. Expenditure for development & social security, 5. Expenditure for national defense, and 6.Foreign investment.

Table 3.1. Total Budgetary Revenue and Expenditure

Year	Total revenue	as % of GDP	Total expenditure	as % of GDP	Balance	as % of GDP
1978	1,132.26	31.24%	1,122.09	30.96%	10.17	0.28%
1980	1,159.93	25.67%	1,228.83	27.20%	-68.9	-1.53%
1985	2,004.82	22.36%	2,004.25	22.36%	0.57	0.01%
1989	2,664.9	15.76%	2,823.78	16.70%	-158.88	-0.94%
1990	2,937.1	15.84%	3,083.59	16.63%	-146.49	-0.79%
1991	3,149.48	14.57%	3,386.62	15.67%	-237.14	-1.10%
1992	3,483.37	13.08%	3,742.2	14.05%	-258.83	-0.97%
1993	4,348.95	12.56%	4,642.3	13.40%	-293.35	-0.85%
1994	5,218.1	11.16%	5,792.62	12.39%	-574.52	-1.23%
1995	6,242.2	10.67%	6,823.72	11.67%	-581.52	-0.99%
1996	7,407.99	10.91%	7,937.55	11.69%	-529.56	-0.78%
1997	8,651.14	11.62%	9,233.56	12.40%	-582.42	-0.78%
1998	9,875.95	12.61%	10,798.18	13.78%	-922.23	-1.18%
1999	11,444.08	13.94%	13,187.67	16.07%	-1,743.59	-2.12%
2000	13,395.23	14.97%	15,886.5	17.76%	-2,491.27	-2.78%
2001	16,386.04	16.84%	18,902.58	19.42%	-2,516.54	-2.59%
2002	18,903.64	18.04%	22,053.15	21.04%	-3,149.51	-3.01%

Note: unit: RMB100 million

Table 3.2. Government Revenues and Expenditures

	Revenues		Expenditure				
Year	Taxes	Subsidies to Loss-making Enterprises	Economic Construction	Social,Cultural & Education	National Defense	Government Administration	Others
1978	519.28	n.a.	718.98	146.96	167.84	52.9	35.41
1980	517.70	n.a.	715.46	199.01	193.84	75.53	44.99
1985	2,040.79	-507.02	1,127.55	408.43	191.53	171.06	105.68
1989	2,727.4	-598.88	1,291.19	668.44	251.47	386.26	226.42
1990	2,821.86	-578.88	1,368.01	737.61	290.31	414.56	273.1
1991	2,990.17	-510.24	1,428.47	849.65	330.31	414.01	364.18
1992	3,296.91	-444.96	1,612.81	970.12	377.86	463.41	318
1993	4,255.3	-411.29	1,834.79	1,178.27	425.8	634.26	569.18
1994	5,126.88	-366.22	2,393.69	1,501.53	550.71	847.68	499.01
1995	6,038.04	-327.77	2,855.78	1,756.72	636.72	996.54	577.96
1996	6,909.82	-337.4	3,233.78	2,080.56	720.06	1,185.28	717.87
1997	8,234.04	-368.49	3,647.33	2,469.38	812.57	1,358.85	945.43
1998	9,262.8	-333.49	4,179.51	2,930.78	934.7	1,600.27	1,152.92
1999	10,682.58	-290.03	5,061.46	3,638.74	1,076.4	2,020.6	1,390.47
2000	12,581.51	-278.78	5,748.36	4,384.51	1,207.54	2,768.22	1,777.87
2001	15,301.38	-300.04	6,472.56	5,213.23	1,442.04	3,512.49	2,262.26
2002	17,636.45	-259.6	6,673.7	5,924.58	1,707.78	4,101.32	3,645.77

Note: unit: RMB: 100 million

The government revenue is mainly from taxes collections, accounting for 92% in 1996. “Subsidies to Loss-making Enterprises” is treated on the revenue side, yet the figures are negative equating it with those items on the “Total Current Expenditures” side. In 1996, 1.8

percent of income is to support those loss-making enterprises. This official figure is problematic and will be discussed in detail later. Subsidies to Loss-making Enterprises has been declining from a high of RMB 59.8 billion in year 1989 to RMB 26 billion in year 2002.

When we turn to the expenditure side, the government allocated almost 70 percent of income to "Economic construction", "National Defense" and "Social, Cultural, and Education" and "Government Administration". One significant item is "price subsidies" to support the price of agriculture products with the government using 7.5 percent of income on this item. This issue will be addressed in a later section.

Price Subsidy

In China, a unique feature is the price subsidy. The government grants fiscal subsidies for those main agriculture products during the production stage. This amounts to 294.6 RMB in 1987 and 364.9 billion in 1995. In local governments price subsidies are the largest component of local budgets, on average absorbing over 25 percent of total local expenditures during 1986-1990 (Christine, 1995).

Price reform was initiated in 1985 with the main reform programs consisting of these following steps (Du, 1992):

1. Readjust the purchasing and selling prices of grains and the purchasing price of cotton in rural areas.

2. Properly raise the short-distance freight charges of railway transportation so as to favor the restructuring of transportation.

3. Properly widen the price differences between commodities of different qualities and in different localities in order to promote the rapid increase of production for good quality products and the rational circulation of commodities.

4. Adopt a two-tier system for important means of production such as raw and semi-finished material.

Before the reform, in a system with centrally planned prices, there was a shortage of commodities because aggregate demand exceeded aggregate supply by far. Thus, there was potential inflation. The easing of supply shortages relied mainly on the rationing and coupon system. The government sought to adjust the structure of the agriculture sector and raise the income level of peasants. Government decided to increase the prices of agriculture products more than industrial products. As a result, by 1983, the data shows that the purchase price for agriculture products had increased by 48% over that of 1978, with an annual average increase of 8.1%. Retail food prices increased in cities as well. To compensate for the increasing price pressure the government adopted a "visible subsidy" program (Gang, 1994) by giving each urban employee and college student a 5 yuan (that is, 0.65 USD) a month subsidy.

The direct consequences of the subsidy programs are as follows:

1. Costs of industrial products were also increased due to higher labor costs.

2. The central bank had to issue more money to accommodate the needs of the public sector and the increasing demand for money.

Price subsidy was to adjust relative prices between the industrial and agriculture sectors. This is analogous to income redistribution between urban and rural sectors. However, it was not feasible to make the urban wage worse off. In order to enforce the price subsidy, the

government had to run a large deficit. Printing money was the easiest way to collect revenues to finance the deficit. The rapid increase in the money supply was the direct reason for the inflation.

Table 3.3. Budgetary Expenditure for Price Subsidies

Year	Subsidies on price increase in grain,cotton and edible oil	Subsidies on curbing Price increase	Subsidies on increase in meal price	Other price subsidies	Total
1996	311.39	53.38	27.46	61.68	453.91
1997	413.67	43.20	28.25	66.84	551.96
1998	565.04	28.10	26.09	92.89	712.12
1999	492.29	14.25	20.55	170.55	697.64
2000	758.74	17.71	19.39	246.44	1,042.28
2001	605.44	16.74	4.55	114.78	741.51
2002	535.24	5.32	1.60	102.91	645.05

Note: unit:100 million

§3.3. The Administration Cost of Government

The government is the largest employer of last resort in China. The cost of government administration could stem from the following:

1. The rapid rise of urban wages: Average wage in the state sector rose from 644 billion in 1978 to 2,140 billion in 1990. This is equivalent to a 10.5 percent average growth rate annually. For example, State enterprises in Shenyang and Chongqing gave wage increases to their workers even though half of them were running losses.

2. Economic reform imposed new demands for administration services through the creation of 47,000 new finance offices at the township level. For example, the creation of a new layer of financial management and tax collection at the township level to handle the greatly expanded work load created by de-collectivization and the diversification of the rural economy. With de-collectivization in the agriculture sector, government no longer collected taxes from 6 million production teams and instead tax revenues were collected from nearly 200 million farm households (Zhang, 1990).

3. The government has been slow to cut or transfer personnel from departments that are obviated by the reform process. The inability or unwillingness to lay off unneeded workers is attributable to the expectations that pervade the whole state sector of lifelong employment.

4. With the rapid aging of the population in China, the number of retired workers and staff has increased and the pension fund payable by state-owned enterprises has increased tremendously. The pension problem has been a fiscal burden to the government.

Chapter 4

Subsidies to Loss-making state owned enterprises

One of the missions of state banks is designed to support state-owned enterprises, it will be crucial to know some facts about those enterprises, to enhance our understanding of why the People's Bank of China and the state banks have to financially support those enterprises.

The Non-Performing-Loans (NPL) at the state-owned commercial banks can be classified into three categories (Henry Liu).

1. Loans to traditional old-line industrial enterprises.

2. Loans to enterprises established during the mid-1980s in lieu of a founding equity.

3. Loans contracted during the overheated period in the early 1990s.

The bad loans in China are mainly born out of the planned economy, which had the commercial banks conduct government assigned projects. According to one study conducted by the International Monetary Fund (IMF, 1997), state enterprises absorb almost two-thirds of bank credit. The World Bank estimated that 49% of large and medium-size state enterprises suffered losses. It is estimated that the proportion of loss-incurring state owned enterprises grew from 10 percent of the total in 1985 to 47 percent in 1997(Cho, 1997).

Beginning in 1983, The People's Bank of China adopted the policy of "Subsidy to Loan" (Zhang, 2003)[1]. The purpose of the "Subsidy to Loan" program was to convert financial support for enterprise losses and investment needs into loans that were applied to banks by the

[1] See Aug,15, 2003. Washington China Review.

state enterprise. This policy was enacted to establish the looming liability of the state enterprise. But, it turned out as a failed policy, Zhang mentioned that the state bank only audits reports that have been submitted, the government has a significant influence on the bank loan process, and government officials and businesses have tried to secure loans without a guarantee. Many state enterprises especially the comprehensive ones are poorly managed. According to regulation they are not permitted to obtain loans. However, by providing workers with housing, schools, jobs, pension, and medical benefits, the state enterprises play a critical role in the government. If the state enterprises were forced into bankruptcy, social problems would begin to arise. As a result, the governments demand banks to approve loans for the state enterprises

In 1997, facing the heavy losses of state-owned enterprises, the government aimed at reducing the fiscal burden. At the 15th Party Congress, an initiative proposed for the sale of most of China's state enterprises targeted 2000-3000 enterprises for bankruptcy, merger, or acquisition. This act hopes to reduce the heavy debt burden that the government has incurred. As most enterprises run losses and are less likely to pay back the loans, the government is forced to continue extending credit to those enterprises. Those loss-making enterprises have placed a heavy burden on the financial sector.

In response to this situation, the Ministry of Finance sets a limit on the amount of bad loans that state-owned commercial banks are allowed to write off. This limit was RMB 30 billion in 1997. The limit for 1998 was RMB 50 billion with RMB 40 billion marked for debt forgiveness for bad loans arising from state owned enterprises restructuring (primarily mergers and bankruptcy). The limit would rise to RMB 60 billion in 1999 and to RMB 70 billion in

2000. This will decrease the tax burden of banks and help reduce non-performing assets (Cho, 1997).

In Table 4.1, we can see that fiscal subsidies to loss-making state-owned enterprises are 25 percent of budget expenditures in 1985, almost a quarter of resources of government used to aid those enterprises. Those figures decline gradually to 18% in 1988 and 12% in 1992. After 1993, those figures dropped to the single digits. The drop partially reflects the reduction of direct support from the central and local government. Most state-owned enterprises' losses are no longer covered by grants from the state budget, but by budget deficits from the sale of bonds rather than simply borrowing from the central bank. Zhou (1994) came to the conclusion that those state-owned enterprises would have to write off RMB 1,215 billion yuan in loans to state banks in order to reduce indebtedness to a level at which interest on their debt could be paid. That RMB 1,215 billion figure is several times the financial losses.

Table 4.1. Budgetary Revenue

Year	Taxes Revenues	Subsidies to Loss-making enterprises
1985	n.a	507.00
1990	n.a.	579.00
1996	6,909.82	337.40
1997	8,234.04	368.49
1998	9,262.80	333.49
1999	10,682.58	290.03
2000	12,581.51	278.78
2001	15,301.38	300.04
2002	17,636.45	259.60

Note: unit: 100 million.

According to the People's Bank of China report, the four largest banks had outstanding non-performing loan amounting to RMB 1.99 trillion yuan by the end of year 2003. This represents a non-performing loan ratio of 21.4 percent.

As Dai Xianglong[1] , governor of the People's Bank of China said in 2002, 25.37 percent of the loans at the four biggest state-owned commercial banks were non-performing, moreover, some analysts argued as much as 40 percent of the estimated $US 600 billion in outstanding loans are generating no payments of interest or principal (Jonathan Sprague, 1997). The People's Bank of China is requiring commercial banks to reduce their bad-loan ratios by 2 to 3 percentage points each year until 2005, however, it is an on-going challenging project.

[1] See China Daily. April 26, 2002.

China is in the World Trade Organization now and its banking industry have to lower its rate of non-performing loans, to get rid of historical financial burdens and to raise its capital adequacy (The country's commercial bank law stipulates that commercial banks' capital adequacy ratio should be 8 percent, the minimum required by the Basel agreement.) to international standards because more and more foreign financial institutions have begun to enter the Chinese market.

The Government planned to manage and purchase those bad debts from the state banks by creating financial asset management companies in 1999. The government set up four asset management companies to take over nearly 1.4 trillion yuan in bad loans from the Big Four banks: 1. China Construction Bank, 2. Bank of China, 3. the Industrial and Commercial Bank of China, and 4. the Agriculture Bank of China. When these companies take over a loan, those enterprises in question pay dividends to the financial asset management companies instead of paying interest to the bank. Those asset management companies try to recover the principal through either an initial public offering or by transferring ownership.

As Dai (2000) mentioned that the total bad loans of state banks amounted to RMB 3,500 billion, that is 40% of GDP in year 2000. The four asset management companies bought $US169 billion worth of non-performing loans from the big four banks at face value. By the end of 2000, Asset Management Companies had disposed of 90 billion yuan in bad loans, about 6 percent of the NPLs taken over from the banks (Henry C. Liu)[1].

At a key meeting of the Communist Party in October 2003, an agreement was reached to continuously inject fresh capital into the country’s banks, especially those four state-owned banks, set-up to take over bank’s non-performing loans, thus, those loans would be taken off

their balance sheets and transferred to the four special asset management companies. However, the asset management companies have so far worked slowly in selling off the bad debts and are unlikely to receive another big transfer soon. The bailout project would follow a RMB 270 billion capital injection in 1997 and RMB 1.4 trillion of non-performing loans off banks' balance sheets into four asset management companies in 1999, which have tried to divest the bad debt at heavy discounts.

Next, how those four asset management companies finance the sources: as Gao (2001) explicitly stated that in year 2000 the People's Bank of China provided financing of RMB 174.5 billion to the four asset management companies.

The absence of commercial borrowing from other financial institutions makes the People's Bank of China as the sole supporter. First of all, in a report by Ma[2] (2002), he estimated that Bank of China received cash payments of RMB 107 billion from Orient Asset Management Corp for its Non Performing Loans transfer in year 2000. Secondly, Huarong Asset Management Corp explicitly recognizes that the People's Bank of China provided it with RMB 95 billion worth of financing in year 2001. Therefore, a rough estimation is that financing to these two asset management companies alone is at least RMB 202 billion yuan. This number represents the lower-bound estimate of the People's Bank of China credit to the four companies, funding 14% of those Policy-based Non-Performing Loans transfers.

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[1] See, Asia Times, June,1, 2002

[2] See Bank of International Settlement, 2002,Working paper, no.115.

Table 4.2. Policy-based Non-Performing Loans transfers during 1999-2000

Asset management corp.	Matched bank	Assets transferred (RMB billions)	Share of bank loans Outstanding (% at end-1998)
Orient Asset Management	Bank of China	267.4	20.4%
Great Wall Asset Management	Agriculture Bank of China	345.8	24.6%
Cinda Asset Management	China Construction Bank	373.0	21.7%
Huarong Asset Management	Industrial and Commercial Bank of China	407.7	17.9%
Total		1,393.9	20.7%

Note: source: Zhu (2001).

For example in 1999, the China Construction Bank (CCB) transferred RMB 250 billion yuan worth of non-performing assets over to China Cinda Asset Management Corp. It still had RMB 267.8 billion yuan worth of non-performing assets at the end of year 1998. Non-performing loans in 1999 accounted for 39 percent of the bank's loan portfolio.

In the meantime, these banks seek to cooperate with foreign banks to write off those loans, for instance, in May 2002 the CCB and Morgan Stanley signed a Letter of Intent on NPL cooperation in a bid to accelerate the handling of non-performing loans and seek new approaches to handling non-performing loans. The two parties have agreed to the pilot project beginning in five branches in east China which involves RMB 4.3 billion yuan of principal and interest book balance. On June 5, 2003, the investment bank Goldman Sachs and China's largest state-owned commercial bank agreed to set up a joint venture to handle part of the Industrial and Commercial Bank of China's non-performing assets. A key element was the establishment of a joint venture to deal with between RMB 8 billion and RMB 10 billion yuan of non-performing assets.

For instance, Bank of China is one of four state-owned banks trying to reduce RMB 400 billion of bad loans created by five decades of lending to unprofitable state enterprises. It had loans and overdrafts of RMB 1.74 trillion yuan at the end of 2002. The bank's bad-loan ratio stood at about 22.49 percent of total lending at the end of year 2002.

In year 2003, the Industrial and Commercial Bank of China reported that non-performing loans represented 26.4 percent of total loans at the end of September 2002. Bad loans fell by RMB 36 billion yuan in the first nine months to 21.56 percent of total loans. In the first half year, the bank wrote off RMB 21.4 billion yuan of bad credit.

As the People's Bank of China's vice finance minister Lou Jiwei said in 2003, the administration authority will involve possibly using some of China's nearly RMB 400 billion dollars in foreign exchange as a source of funds while the state may also issue debt or issue currency. In order to help alleviate the burden, in January 2004, the Chinese government announced a complex transfer of $U.S. 45 billion from the country's soaring foreign exchange

reserves to two (the Bank of China and the China Construction Bank) of the four big state-owned banks. It was said that the Bank of China[1] received a $U.S. 20 billion government bailout to help it write off bad loans, to help state-owned banks to mitigate the existing and potential financial risks to a great extent.

Bremner (2005)[2] also reports that the People's Bank of China will divert $15 billion from its $600 billion foreign exchange stocks to Industrial & Commercial Bank of China to help write off bad loans.

Privatizing Banks

When those banks faced with heavy non-paid loans, limited policies could be implemented to reduce its burdens. the government transferred the experience of western countries to privatize some banks, the goal of privatizing those banks is to separate weak clients from banks and privatizing banks to foreign owners as a credible commitment to no further government bailouts.

State banking system functioned as a funding agency for national development programs. China's banking system expanded rapidly from 1985 to 1993, as the number of branches of state banks rose from 60,785 to 143,796. During the same period total deposits increased from RMB 427.3 billion to RMB 2.3 trillion yuan, while total loans increased from RMB 590.5 billion yuan to RMB 2.6 trillion. In an attempt to regulate the banking system, a new commercial-bank law was adopted on July 1, 1995, aimed at commercializing the country's

[1] See the report by Tian Ying (Dec, 26, 2003), The International Heralb Tribune.
[2] See the report by Brian Bremner (May, 2005), Business Week.

banks by the year 2000. The law imposed requirements such as capital-adequacy ratios in line with international banking practice.

In 1994, in a plan to transform those specialized banks to commercial banks, the State Council established three policy banks, 1. the State Development Bank of China, 2. the Import-Export Bank of China, and 3. the Agriculture Development Bank of China. The goal was for the banks to offer financing for policy-oriented projects in the state's development plan and to create a commercial banking system in China. Presumably, they were to be responsible for their own profits and losses. Yet, as the funding of these policy banks comes from existing financial institutions, mainly from the specialized banks, they do not take deposits from the public, funds are from state budgetary appropriations, the sale of financial bonds to other banks and non-bank financial institutions, loans from international organizations, and borrowing from the People's Bank of China. The State Development Bank and the Import-Export Bank sold bonds totaling of RMB 77.5 billion in 1994 and received RMB 9.86 billion from the state budgetary capital as well.

In one study by Lardy[1], the loans made by the People's Bank of China to the specialized banks grew from RMB 268 billion in year 1986 to RMB 961 billion in year 1993, decreasing to RMB 680 billion in year 1995. The specialized banks are dependent on funds from People's Bank of China, for instance, the Bank of China used funds from the People's Bank of China to finance 53 percent of its total loans in year 1991. The Agriculture Bank made 38 percent of its loans using funds received from the People's Bank of China. As a result, the state and

[1] See ch.3, China' Unfinished Economic Revolution.

People's Bank of China granted large sums to subsidize the specialized banks by financing state projects at below market interest rates.

Table 4.3. Borrowing and Lending of the Specialized Banks

Year	Borrowing from PBOC	Total lending
1986	268.2	811.1
1987	275.6	976.5
1988	336.1	1,024.6
1989	416.3	1,206.4
1990	508.2	1,476.0
1991	590.5	1,759.5
1992	670.9	2,108.2
1993	961.2	2,587
1994	697.2	3,282.8
1995	680.2	3,908

Note: unit: RMB billions
Data quoted from Lardy (ch.3).

In November 2000, China announced that it was planning to set up a number of private banks prior to the country's entry into the World Trade Organization. Some of those commercial banks already operated had been formed by private entrepreneurs to pool their funds and to borrow additional money to begin operations. A number of private banks also operate in China. The private commercial banks mostly concentrate on the small and medium enterprises and high-tech companies.

Data description

In this section, a number of banks (Bank of Communications, China Merchants Bank, Huaxia Bank, CITIC Industrial Bank, China Everbright Bank, Shenzhen Development Bank, and Industrial Bank.) in China are selected for observation, we examine the asset structure of those selected financial institutions to help understand how those funds are used in those selected financial institutions.

Apparently, in Table 4.4, the data revealed the fact that the People's Bank of China transferred a significant amount of funds to those banks, varying from a low of 9.5 percent of total funds at China Merchants Bank to 23.8 percent of total funds at Huaxia Bank.

Those financial institutions has mainly used those funds received from the People's Bank of China and the public to investment in various assets (bonds, stocks, and equity), varying from 14.5 percent of total assets at Industrial Bank to 23 percent of total assets at China Merchants Bank.

The numbers of bad loans are believed to be under-valued, varying from just 0.2 percentage of total assets at Industrial Bank to 12 percentage of total assets at Bank of Communications.

Table 4.4. Assets Structure of Selected Chinese Banks

	OC-Bank	M-Bank	HX-Bank	CTI-Bank	E-Bank	SD-Bank	I-Bank
Due from central bank	**76,383.97**	**40,313.77**	**42,368.21**	**41,993.37**	**32,460.24**	**15,815.92**	**26,235.34**
Due from central bank and accounts with/total assets	**10.0%**	**10.8%**	**23.8%**	**12.5%**	**9.9%**	**9.5%**	**13.7%**
Overdue loans	**59,229.25**	**1,266.01**	**4,808.64**	**20,356.92**	**23,798.9**	**196.98**	**211.67**
Doubtful loans		**8,114.92**				**9,188.59**	
Bad loans		**463.26**					
Sum of all bad loans (overdue+doubtful+bad)	**59,229.25**	**9,844.19**	**4,808.64**	**20,356.92**	**23,798.9**	**9,385.57**	**211.67**
Sum of all bad loans / total assets	**12.1%**	**3.7%**	**3.8%**	**9.2%**	**10.7%**	**7.7%**	**0.2%**
Long-term investment	**92,146.22**			**32,319.83**	**41,453.38**		
Long-term bonds investments		**60,240.49**	**24,375.95**			**18,187.47**	**23,472.39**
Long-term stocks investments		**91.08**				**153.49**	
Long-term equity investments							**57**
Sum of investments (long-term bonds+stocks+equity)	**92,146.22**	**60,331.57**	**24,375.95**	**32,319.83**	**41,453.38**	**18,340.96**	**23,529.39**
Sum of investments / total assets	**18.8%**	**22.9%**	**19.3%**	**14.5%**	**18.7%**	**15.0%**	**17.0%**

Note: unit: RMB Million

1: OC- Bank: Bank of Communications. 2: M-Bank: China Merchants Bank Co., Ltd.
3: HX-Bank: Huaxia Bank Co., Ltd. 4: CTI-Bank: CITIC Industrial Bank
5: E-Bank: China Everbright Bank Co., Ltd. 6: SD-Bank: Shenzhen Development Bank Co., Ltd.
7: I-Bank: Industrial Bank Co., Ltd.

Chapter 5

The Demand for Money

§5.1. The Demand for Money

In 1994, The People's Bank of China started to adopt money supply as key indicators for macro-control. In 1996, open market operation of securities was established, The change of money base have an immediate impact on demand for money function, further affecting the ability of generating seigniorage revenue.

In this section, we explore the demand for money function, in the early work, Chow (1987) estimated the model in which demand for real money balance depends only on national income (Y), using annual data for the period 1952 to 1983. The elasticity of real money balance to output is larger than one (1.16). The OLS regression result was as follows:

$$\ln(M_t/P_t) = \underset{(0.492)}{-3.927} + \underset{(0.067)}{1.16}*\ln(Y_t)$$

where $R^2 = 0.90$, standard error (s) = 0.19, Durbin-Watson (D.W.) = 0.78

Replicating this model, we adopt the data from the first quarter of 1982 to the fourth quarter of 2000, when the currency (M_0) is treated as money base, The elasticity of real money balance to output is 2.15.

The OLS regression output is as follows.

$$\ln(M_t/P_t) = \underset{(0.27)}{-11.77} + \underset{(0.02)}{2.15}*\ln(Y_t)$$

where $R^2 = 0.98$, standard error (s) = 0.13, Durbin-Watson (D.W.) = 0.77

We compare the two equations listed above, as the data interval shifts from year 1952-1983 to year 1982-2000, the elasticity of real money balance to output rises from 1.16 to 2.15. The real money balance is getting more sensitive to output, reflecting the high demand of money holdings to the pubic as the income level increases. Indeed, the high demand of money in China provides an ideal environment for the government to generate seigniorage revenue at low cost.

In the next part, we adopt Cagan demand for money function. The Cagan's money function retains a well-established relationship to capture the connection between money demand and rate of inflation, especially, in a country with high inflation. the model is specified by means of the specific to general approach.

A parsimonious Cagan-type demand for money function can be set up as follows:

$$M_t/P_t = \alpha * e^{(-\beta*\pi+\varepsilon)} \qquad (1)$$

where α is a constant, β measures the elasticity of real money balance to inflation rate, and ε is a random error term.

The amount of seigniorage revenue is equal to the product of the level of real money base and inflation rate.

$$S = (M_t/P_t)* \pi = \alpha * e^{(-\beta*\pi+\varepsilon)}* \pi \qquad (2)$$

The maximization condition could be attained at the point where

$dS/d\pi = 0$ and $\pi = 1/\beta$ (3)

Next, linearization of eq(1) yields the following demand function.

$\ln (M_t/P_t) = \ln(\alpha) - \beta * \pi_t + \varepsilon_t$ (4)

The elasticity of the demand for real balances with respect to inflation rate is (ϕ).

$\phi = d\ln(M/P)/d\ln(\pi) = -\beta*\pi$ $>= < 0$ as $\beta < = > o$

To generalize the demand for money function, we experiment with various variables included in the Cagan demand function, which would be specified as follows:

1. The structure shift between the agriculture sector and urban sector is important phenomena in determining the demand for money by the public in China. We add the ratio of agriculture (AG) population to total population and urban (U) population to total population as explanatory variables.

2. Interest rate (i) would be considered as an alternative variable to inflation rate, we also add it to the model.

3. The degree of openness of the economy can be measured by taking into account the ratio of trade (export plus import) volume (EI) to GDP in the equation.

We estimate a series of demand for money function listed as follows:

$\ln(M_t/P_t) = \ln(\alpha) + \beta_1 * i_t + \varepsilon_t$

$\ln(M_t/P_t) = \ln(\alpha) + \beta_2 * \pi_t + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_3 * \pi_{t-1} + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_4*\ln(M_{t-1}/P_{t-1}) + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_5*\ln(AG_t) + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_6*\ln(U_t) + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_6*\ln(U_t) + \beta_7*\ln(EI_t) + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_5*\ln(AG_t) + \beta_7*\ln(EI_t) + \varepsilon_t$

$\ln(M_t/P_t) = c + \alpha*\ln(Y_t) + \beta_2 * \pi_t + \beta_5*\ln(AG_t) + \beta_6*\ln(U_t) + \beta_7*\ln(EI_t) + \varepsilon_t$

Data Description

Data cover the period between 1986 and 1999, the stock of money (M) can be determined in the following figures (M_0, M_1, and M_2). According to the official definition in China:

1. M_0 = Currency in circulation.
2. M_1 = M_0 +Demand deposits by enterprises + rural deposits + deposits by governments agencies.
3. M_2 = M_1+ time deposits by enterprises + self mobilized capital construction deposits +personal deposits +other deposits.

All money bases (M_0, M_1, and M_2) are deflated by GDP and take logs.

π_t: is the rate of inflation measured by the percentage change in consumer price index. .

Empirical Results

The regression outputs are presented in Table 5.1, Table 5.2, and Table 5.3.

1. National income (Y): National income is positively related to demand for real money balances. The elasticity of real money balances with respect to income varies between 0.62 and 2.57.

2. Interest rate (i): In eq(a.1, b.1, and c.1), as interest rate increases, real money balances will drop by 0.13 to 0.32 percentage point, t-value reveals that these coefficients are all very significant.

3. Inflation rate (π_t): In eq(a.2, and c.2). higher inflation level lowers the demand for real money balances. These coefficients move from 0.13 to 0.18 percentage point.

4. Inflation rate at lagged period (π_{t-1}): Most of the coefficients on lagged inflation rate are negative, except for eq(a.7) and eq(b.9). In that case, urban percentage of population as an explanatory is incorporated into the model. In both cases, the coefficients are 0.06 and 0.07.

5. Urban percentage of population (U): These coefficients (U) are all positive, when the dependent variable is real money balance of M_2. these coefficients became negative in eq(c.7) and eq(c.10) of Table 5.3. all t-statistics are not significant in these cases.

6. Agriculture percentage of population (AG): The t-statistics shows none of the coefficients are significant.

7. The ratio of total trade volume to gross output [EI = (export+import)/GDP], Taking into account the total trade volume in the equation, one finding is that the elasticity of real money demand with respect to income has gone up, it is 0.92 in eq(c.8) and 1.78 in eq(c.9), then these figures move up to 2.78 in eq(c.10) and 2.9 in eq(c.11).

Table 5.1. Money Demand Function (Money base=Mo)

Dependant	**Mo/P**										
Explanatory	**(a.1)**	**(a.2)**	**(a.3)**	**(a.4)**	**(a.5)**	**(a.6)**	**(a.7)**	**(a.8)**	**(a.9)**	**(a.10)**	**(a.11)**
Y:	**2.42**		**1.42**	**1.57**	**1.35**	**0.81**	**1.13**	**0.62**	**1.48**	**2.44**	**2.57**
	(4.57)		**(8.95)**	**(-1.22)**	**(5.01)**	**(0.86)**	**(4.61)**	**(-2.96)**	**(0.50)**	**(1.10)**	**(0.93)**
i	**-0.32**										
	(-2.47)										
π_t		**-0.03**	**-0.13**		**-0.13**	**-0.14**		**-0.13**			
		(-0.02)	**(-7.81)**		**(-6.22)**	**(-7.60)**		**(-7.64)**			
π_{t-1}				**-0.06**			**0.06**		**-0.06**	**-0.06**	**-0.07**
				(-1.22)			**(-1.22)**		**(-1.16)**	**(-1.49)**	**(-1.50)**
(Mo_{t-1}/P_{t-1})					**0.04**						
					(0.21)						
U						**6.23**	**4.41**			**0.47**	
						(0.65)	**(2.46)**			**(0.02)**	
AG								**-22.16**	**-2.56**		**2.32**
								(-0.70)	**(-0.03)**		**(-0.03)**
EI										**-3.43**	**-3.44**
										(-1.66)	**(-1.67)**
R-squared	**0.74**	**0.01**	**0.93**	**0.59**	**0.93**	**0.94**	**0.58**	**0.94**	**0.59**	**0.69**	**0.68**
D.W.	**1.90**	**0.02**	**1.91**	**1.27**	**1.93**	**2.05**	**1.24**	**2.05**	**1.26**	**1.72**	**1.73**

Note: Y: log(national income). i: (interest rate).
π_t: (inflation rate). U: log(urban percentage of population).
Ag: log(agriculture percentage of population).
M: log(high powered money (Currency+Deposit))
EI: log((export+import)/GDP) t-value: in parentheses.

Table 5.2. Money Demand Function (Money base= M_1)

Dependent	**M_1/P**										
Explanatory	**(b.1)**	**(b.2)**	**(b.3)**	**(b.4)**	**(b.5)**	**(b.6)**	**(b.7)**	**(b.8)**	**(b.9)**	**(b.10)**	**(b.11)**
Y:	**0.61**		**0.81**	**0.45**	**0.01**	**2.35**	**1.86**	**2.92**	**2.48**	**5.65**	**6.39**
	(3.77)		**(3.91)**	**(1.83)**	**(0.01)**	**(1.11)**	**(1.16)**	**(1.18)**	**(1.33)**	**(2.49)**	**(2.60)**
i	**-0.11**										
	(-2.41)										
π_t		**-0.07**	**-0.08**		**0.06**	**-0.02**		**-0.02**			
		(-1.73)	**(-2.03)**		**(1.11)**	**(-0.61)**		**(-0.59)**			
π_{t-1}				**0.05**			**0.07**		**0.07**	**-0.03**	
				(0.19)			**(2.37)**		**(2.44)**	**(-0.91)**	
(M_{1t-1}/P_{t-1})					**0.74**						**-0.02**
					(3.16)						**(-0.89)**
U						**-12.90**	**-12.57**			**-26.60**	
						(-0.64)	**(-0.82)**			**(-1.49)**	
AG								**51.14**	**51.50**		**90.76**
								(0.78)	**(1.05)**		**(1.67)**
EI										**-5.19**	**-5.21**
										(-2.19)	**(-2.30)**
R-squared:	**0.37**	**0.23**	**0.34**	**0.21**	**0.56**	**0.44**	**0.67**	**0.45**	**0.69**	**0.69**	**0.71**
D.W.	**0.91**	**0.42**	**1.14**	**0.78**	**1.79**	**1.41**	**1.06**	**1.45**	**1.05**	**2.14**	**2.27**

Note: Y: log(national income). i: (interest rate).
π_t: (inflation rate). U: log(urban percentage of population).
Ag: log(agriculture percentage of population).
M: log(high powered money (Currency+Deposit))
EI: log((export+import)/GDP) t-value: in parentheses.

Table 5.3. Money Demand Function (Money base= M_2)

Dependant	**M2/P**										
Explanatory	**(c.1)**	**(c.2)**	**(c.3)**	**(c.4)**	**(c.5)**	**(c.6)**	**(c.7)**	**(c.8)**	**(c.9)**	**(c.10)**	**(c.11)**
Y:	**0.98**		**1.29**	**1.97**	**1.06**	**1.14**	**2.04**	**0.92**	**1.78**	**2.78**	**2.9**
	(6.69)		**(11.06)**	**(6.03)**	**(6.99)**	**(1.26)**	**(0.86)**	**(0.84)**	**(0.61)**	**(1.26)**	**(1.06)**
i	**-0.13**										
	(-2.62)										
π_t		**-1.08**	**-0.18**		**-0.15**	**-0.13**		**-0.14**			
		(-0.55)	**(-6.7)**		**(-6.37)**	**(-7.99)**		**(-8.07)**			
π_{t-1}				**-0.09**			**-0.06**		**-0.06**	**-0.07**	**-0.06**
				(-2.30)			**(-1.18)**		**(-1.20)**	**(-1.55)**	**(-1.55)**
(M_{2t-1}/P_{t-1})					**0.22**						
					(1.82)						
U						**4.83**	**-2.85**			**-0.93**	
						(0.53)	**(-0.12)**			**(-0.04)**	
AG								**-19.15**	**0.59**		**5.56**
								(-0.64)	**(0.01)**		**(0.07)**
EI										**-3.48**	**-3.49**
										(-1.70)	**(-1.71)**
R-squared:	**0.59**	**0.4**	**0.79**	**0.55**	**0.86**	**0.94**	**0.64**	**0.95**	**0.64**	**0.74**	**0.73**
D.W.	**0.96**	**0.2**	**0.93**	**1.19**	**1.41**	**2.09**	**1.32**	**2.1**	**1.31**	**1.79**	**1.80**

Note: Y: log(national income). i: (interest rate).

π_t: (inflation rate). U: log(urban percentage of population).

Ag: log(agriculture percentage of population).

M: log(high powered money (Currency +Deposit))

EI: log((export+import)/GDP) t-value: in parentheses.

In this section, we focus on the parsimonious Cagan demand for money function with use of different money bases (M_0, M_1,and M_2) which are retrieved from column(a2) of Table 5.1, column(b2) of Table 5.2, and column(c2) of Table 5.3. This Cagan function posses a property that the output (Y) does enter into this function, it is specified as follows.

$\ln(M_t/P_t) = -1.24 - 0.03*\pi_t$ when M_0 is money base

$\ln(M_t/P_t) = 0.12 - 0.07*\pi_t$ when M_1 is money base

$\ln(M_t/P_t) = 0.77- 1.08*\pi_t$ when M_2 is money base

Solving for the above equations, we present estimation results of the seigniorage revenue based on the above three equations. The seigniorage revenue (S) is deflated by GDP. The estimation outputs are displayed in Table 5.4.

$S/GDP = ((M/P)* \pi)/GDP$

Table 5.4. Seigniorage revenue derived from demand for money function

Inflation rate	Seigniorage /GDP	Seigniorage /GDP	Seigniorage /GDP
π_t	(Money base: M_0)	(Money base: M_1)	(Money base: M_2)
1.00%	0.3%	1.1%	2.1%
2.00%	0.6%	2.2%	4.2%
4.00%	1.2%	4.5%	8.3%
6.00%	1.7%	6.7%	12.1%
8.00%	2.3%	8.9%	15.8%
10.00%	2.9%	11.1%	19.4%
12.00%	3.5%	13.3%	22.8%
14.00%	4.0%	15.4%	26.0%
16.00%	4.6%	17.6%	29.1%
18.00%	5.2%	19.7%	32.0%
20.00%	5.8%	21.8%	34.8%
25.00%	7.2%	27.0%	41.2%
30.00%	8.6%	32.1%	46.9%
40.00%	11.4%	42.1%	56.1%
50.00%	14.3%	51.8%	62.9%
75.00%	21.2%	74.4%	72.1%
100.00%	28.1%	95.1%	73.3%
150.00%	41.5%	131.1%	64.1%
200.00%	54.5%	160.5%	49.8%
300.00%	79.3%	203.1%	25.4%
500.00%	124.5%	241.0%	4.9%

§5.2. Maximun seigniorage

In the monetary economics literature, the rising prices level reduces the real value of the public's money holdings. In order to make up the decline in cash balances, the public demand more money balances, the price rise eventually will result in an increase in monetary seigniorage. we have estimated the money demand function above, in the next section, we explore the issue of when the senigniorage revenues will be maximized under some certain inflation levels.

In this part, we first adopt the perfect-foresight Cagan model[1] in which the output (Y) does not enter into this function. The supply of money (M) is in log, the general price level (P) is in log as well.

$(M_t - P_t) = -\varepsilon * (P_{t+1} - P_t)$

Exponentiating the equation above yields:

$M_t/P_t = (P_{t+1}/P_t)^{-\varepsilon}$

Let the growth rate of money be (g_m) equals the growth rate of price:

$1 + g_m = M_{t+1}/M_t = P_{t+1}/P_t = 1+\pi$

In discrete time case, seigniorage (S) can be defined as the following:

$S = (M_t - M_{t-1}) / P_t = ((M_t - M_{t-1}) / M_t) * (M_t / P_t)$

$S = (1 - (1/(1+g_m))) * (1+g_m)^{-\varepsilon} = (g_m/(1+g_m)) * (1+g_m)^{-\varepsilon}$ (1)

[1] For a complete discussion of the model, see ch.8, Foundations of International Macroeconomics.

The first order condition yields.

$$dS/dg_m = (1+ g_m)^{-\varepsilon} * (1/(1+ g_m)^2) + (g_m / (1+ g_m)^{-\varepsilon} * (1+ g_m)^{-\varepsilon -1} = 0$$

$$\pi = g_m = 1/ \varepsilon \quad (2)$$

In eq(1), Maximum seigniorage can then be written as:

$$S = ((1/\varepsilon)/(1+1/\varepsilon))*)(1+1/\varepsilon)^{-\varepsilon} = (1/(1+\varepsilon))*((\varepsilon+1)/ \varepsilon)^{-\varepsilon} \quad (3)$$

In eq(2), The rate of money growth is equal to the reciprocal of the semi-elasticity of real money balances with respect to inflation.

According to the money demand functions which are estimated above in Table 5.1- 5.3, we calculate the maximum seigniorage given the different level of the growth rate of money. We observe that semi-elasticity of real money balances with respect to inflation (ε) are between 0.02 and o.18. According to eq(3), if (ε) is 0.02, maximum seigniorage will be 33.1 percent, if (ε) is 0.18, maximum seigniorage will be only 5.2 percent.

Table 5.5. Seigniorage Revenue

	Growth rate of Money	Seigniorage (% GDP)
ε		S
0.01	1.00	0.497
0.02	0.50	0.331
0.03	0.33	0.248
0.04	0.25	0.198
0.05	0.20	0.165
0.06	0.17	0.142
0.07	0.14	0.124
0.08	0.13	0.110
0.09	0.11	0.099
0.10	0.10	0.090
0.11	0.09	0.083
0.12	0.08	0.076
0.13	0.08	0.071
0.14	0.07	0.066
0.15	0.07	0.062
0.16	0.06	0.058
0.17	0.06	0.055
0.18	0.06	0.052
0.20	0.05	0.047
0.25	0.04	0.038
0.30	0.03	0.032
0.40	0.03	0.024
0.50	0.02	0.019
0.75	0.01	0.013
1.00	0.01	0.010

Note: ε: Semi-elasticity of real money balances with respect to rate of inflation.
M: nominal money base.

Maximum revenue of seigniorage can be collected by inflating at (1/ε). Friedman (1971) modified this model to incorporate income growth (y: per capita real income growth), and population growth (n). Revenue maximizing inflation rate is = [(1/ε)-(n+ η y)], where (η) is income elasticity of money demand. The higher the growth rate of population and of real per capita income, and the higher the income elasticity of demand, the lower the rate of inflation.

We also consider the case when output (Y) is added to the perfect-foresight Cagan model, the demand for real money balance could be reset as follows:

$$\ln(M_t/P_t) = c + \varepsilon * \pi_t + \beta * \ln(Y_t) \quad (4)$$

$$\ln(M_t) - \ln(P_t) = c + \varepsilon * \pi_t + \beta * \ln(Y_t) \quad (5)$$

In exchange equation: MV = PY. The growth rate of nominal variable is as follows:

$$g_m + g_v = \pi + g_y$$

$$g_m - \pi = g_y - g_v$$

where (g_m) is the growth rate of money, (g_v) is the growth rate of velocity, (π) is the growth rate of price, and (g_y) is the growth rate of output.

In eq (5), we then can reset the demand for money function as follows.

$$\ln(M_t) - \ln(P_t) = c + \varepsilon * \pi + \beta \ln(Y_t)$$

$$g_m - \pi = \beta * g_y \quad (6)$$

When β =1, the equation above can be reset as the following.

$g_m = \pi + g_y$

Apparently, data in Table 5.1- Table 5.3 show that the coefficient (β) is not equal to zero, from the demand for money function, β is 1.42 in column (a.3) of Table 5.1, 0.81 in column (b.3) of Table 5.2, and 1.29 in column (c.3) of Table 5.3. The function could be set as follows.

$\ln(M_t/P_t) = -0.3 - 0.13*\pi_t + 1.42*\ln(Y_t)$ when M_0 is money base (7)

$\ln(M_t/P_t) = 0.6 - 0.08*\pi_t + 0.81*\ln(Y_t)$ when M_1 is money base (8)

$\ln(M_t/P_t) = 0.3 - 0.18*\pi_t + 1.29*\ln(Y_t)$ when M_2 is money base (9)

When β is not equal to one, we can reset the eq (6) as follows.

$g_m = \pi + \beta * g_y$ (10)

$g_m = \pi + 1.42* g_y$ when M_0 is money base

$g_m = \pi + 0.81* g_y$ when M_1 is money base

$g_m = \pi + 1.29* g_y$ when M_2 is money base

Seigniorage revenue could be measured as the following.

$S= g_m * (M_t/P_t) = g_m *(e^{c+\varepsilon\pi+\beta \ln(Y)})$ (11)

$S = (\pi + 1.42* g_y)*(e^{c+\varepsilon\pi+\beta \ln(Y)})$ when M_0 is money base

$S = (\pi +0.81* g_y)*(e^{c+\varepsilon\pi+\beta \ln(Y)})$ when M_1 is money base

$S = (\pi + 1.29* g_y) *(e^{c+\varepsilon\pi+\beta \ln(Y)})$ when M_2 is money base

Maximum seigniorage revenue could be deduced by the following.

$$S = g_m * (M_t/P_t) = g_m *(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) = (\pi + \beta * g_y)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) \quad (12)$$

The first order condition yields.

$$dS/d\pi = (1+ \varepsilon * \pi + \varepsilon * \beta * g_y)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) = 0$$

Maximum seigniorage revenue could be achieved at the point where inflation rate is:

$$\pi = (-1- \varepsilon * \beta * g_y) / \varepsilon$$

In our estimation above, ε is -0.13, -0.08, and 1.29 when money base is M_0, M_1, and M_2, respectively. If the growth rate of output (g_y) is 10 percent per year, the inflation rate (π) would be 7.55, 12.4, and 5.38, respectively.

In eq(12), the ratio of maximum seigniorage to output (Y) is as follows:

$$S/Y = (1/Y) *(\pi + 1.42* g_y)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)})$$

$$S/Y = (1/Y)*((-1+0.42* \varepsilon * g_y)/ \varepsilon)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) \quad \text{when } M_0 \text{ is money base} \quad (13)$$

$$S/Y = (1/Y)*(\pi +0.81* g_y)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)})$$

$$S/Y = (1/Y)*((-1+0.19* \varepsilon * g_y)/ \varepsilon)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) \quad \text{when } M_1 \text{ is money base} \quad (14)$$

$$S/Y = (1/Y)*(\pi + 1.29* g_y) *(e^{c+\varepsilon\,\pi+\beta*\ln(y)})$$

$$S/Y = (1/Y)*((-1+0.29* \varepsilon * g_y)/ \varepsilon)*(e^{c+\varepsilon\,\pi+\beta*\ln(y)}) \quad \text{when } M_2 \text{ is money base} \quad (15)$$

In order to calculate the seigniorage revenue, all data is average value from year 1990 to 2002. Assume that the growth rate of output is (g_y) = (0.05), (0.10), (0.15), and (0.20). The ratio of seigniorage revenue to output is listed in Table 5.6, Table 5.7 and Table 5.8.

In Table 5.6, Table 5.7, and Table 5.8, when the economy achieve an annual growth rate of 10 percent, on average seigniorage revenue to output is 3.04 percent when currency (Mo) is treated as money base, 6.28 percent when money (M_1) is treated as money base, and 20.28 percent when broad money (M_2) is treated as money base.

Comparing these numbers with those figures listed in Table 1.1, and Table 1.2, when money base is just currency in circulation (Mo), in Table 1.1, monetary seigniorage to GDP is 2.46 percent, in Table 1.2, opportunity cost approach yields the smallest number, 1.14 percent, in Table 5.6, 3.04 percent is the largest number when seigniorage revenue is deduced from demand for money function.

Table 5.6. Seigniorage Revenue (Money base = Mo)

	g_y =0.05	g_y =0.10	g_y =0.15	g_y =0.20
Year	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y
1990.4	1.30%	2.31%	3.32%	4.33%
1991.4	1.63%	2.68%	3.72%	4.76%
1992.4	2.23%	3.39%	4.54%	5.70%
1993.4	3.78%	4.98%	6.18%	7.38%
1994.4	4.85%	5.95%	7.06%	8.17%
1995.4	2.95%	3.91%	4.87%	5.83%
1996.4	1.49%	2.41%	3.33%	4.25%
1997.4	1.08%	2.05%	3.02%	3.99%
1998.4	0.63%	1.64%	2.66%	3.68%
1999.4	0.67%	1.84%	3.00%	4.16%
2000.4	1.10%	2.26%	3.42%	4.59%
2001.4	0.78%	1.92%	3.07%	4.21%
2002.4	1.26%	2.43%	3.60%	4.76%
Mean	1.97%	3.04%	4.10%	5.17%
Maximum	4.85%	5.95%	7.06%	8.17%
Minimum	0.63%	1.64%	2.66%	3.68%

Note: sources: Chinese Statistical Yearbook

Table 5.7. Seigniorage Revenue (Money base = M_1)

	g_y =0.05	g_y =0.10	g_y =0.15	g_y =0.20
Year	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y
1990.4	2.27%	3.79%	5.30%	6.82%
1991.4	3.21%	4.83%	6.45%	8.07%
1992.4	4.69%	6.47%	8.26%	10.04%
1993.4	9.05%	10.95%	12.86%	14.76%
1994.4	12.32%	14.10%	15.88%	17.66%
1995.4	7.73%	9.39%	11.05%	12.72%
1996.4	3.55%	5.25%	6.95%	8.65%
1997.4	2.27%	4.16%	6.06%	7.95%
1998.4	0.67%	2.69%	4.70%	6.71%
1999.4	0.59%	2.85%	5.11%	7.37%
2000.4	2.17%	4.57%	6.98%	9.39%
2001.4	1.10%	3.59%	6.08%	8.57%
2002.4	3.13%	5.86%	8.59%	11.32%
Mean	4.41%	6.28%	8.15%	10.01%
Maximum	12.32%	14.10%	15.88%	17.66%
Minimum	0.59%	2.69%	4.70%	6.71%

Note: sources: Chinese Statistical Yearbook

Table 5.8. Seigniorage Revenue (Money base = M_2)

	g_y =0.05	g_y =0.10	g_y =0.15	g_y =0.20
Year	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y	Seigniorage/Y
1990.4	6.97%	12.29%	17.60%	22.92%
1991.4	9.35%	15.13%	20.90%	26.67%
1992.4	12.45%	18.60%	24.75%	30.90%
1993.4	21.81%	28.30%	34.80%	41.29%
1994.4	30.56%	37.03%	43.50%	49.97%
1995.4	22.08%	28.78%	35.48%	42.18%
1996.4	12.16%	19.39%	26.62%	33.85%
1997.4	8.86%	16.74%	24.62%	32.51%
1998.4	5.00%	13.61%	22.21%	30.81%
1999.4	5.04%	14.46%	23.89%	33.31%
2000.4	9.10%	18.81%	28.51%	38.22%
2001.4	6.80%	17.30%	27.79%	38.28%
2002.4	12.39%	23.73%	35.08%	46.43%
Mean	13.03%	20.28%	27.53%	34.79%
Maximum	30.56%	37.03%	43.50%	49.97%
Minimum	5.00%	12.29%	17.60%	22.92%

Note: sources: Chinese Statistical Yearbook

Conclusions

In this paper, we analyze the creation and distribution of seigniorage in China, The conclusion can be summarized as follows:

1. When currency in circulation (M_0) is adopted as money base, monetary seigniorage is 2.45 percent of GDP, and opportunity cost approach show that on average seigniorage revenue is merely 1.14 percent of GDP in China.

2. Rapidly monetary expansion is the major source of seigniorage revenues.

3. Financial repression has kept interest rates fixed over a long period for policy consideration. Thus, monetary seigniorage approach would be more appropriate to reflect the change in the magnitude of seigniorage revenue.

4. Seigniorage is mainly used as a credit extended to state-owned enterprises.

5. Financial repression has kept the interest rate at a low level, failing to reflect the true cost of capital utilization.

6. Financial institutions continue to invest enormously in various (domestic and foreign) financial assets, this figure has gone up from 7.07 percent of GDP in year 1999, to 12.35 percent of GDP in year 2003.

7. Budget Law was passed in 1994, it prohibited the government from borrowing from the People's Bank of China, which have less burden and take less responsibility to fill the gap of budget deficit.

8. Price Subsidies and Subsidies to loss-making enterprises are major two outlays to the government. As economic reform progresses, market mechanisms will alter the situations.

As the financial reform continues, diversified financing channels are more accessible to both public and government sector, like emerging security and equity markets, the government would be able to reduce the reliance on seigniorage revenue.

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