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# Can Tight and Centralized Financial Regulation Prevent Financial Crises? Czech Government Bond Seignorage in the Historical Perspective

Tomáš Otáhal, Václav Rybáček

**MENDELU Working Papers in Business and Economics**
Research Centre
Faculty of Business and Economics
Mendel University in Brno
Zemědělská 1, 613 00 Brno
Czech Republic
http://vyzc.pef.mendelu.cz/en
+420 545 132 605

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**Abstract**

Tomáš Otáhal, Václav Rybáček: **Can Tight and Centralized Financial Regulation Prevent Financial Crises? Czech Government Bond Seignorage in the Historical Perspective**

Can tight and centralized financial regulation prevent financial crises? Governments usually respond to financial crises with tightening and centralizing financial regulation. In this paper, we explore the historical parallels between the governmental responses to the financial crises at the end of the 19th and the beginning of the 20th century in the USA and the recent response of the European Union. Our rent-seeking model with endogenous rent derived from the historical narrative predicts that tight and centralized financial regulation might increase the risk of inflationary monetary policy. To illustrate our findings on an empirical example, we calculated the Czech government bond seignorage that represents the rent extracted through inflationary monetary policy.

**Keywords**

Federal Reserve System, financial crises, financial regulation, interest groups, rent-seeking, US monetary history

**JEL**: G01, G18, G28, N11, N21, N41

**Contacts**

Ing. Tomáš Otáhal, Department of Economics, FBE MENDELU in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: tomas.otahal@mendelu.cz.

Ing. Václav Rybáček, Ph.D., University of Economics Prague, nám. W. Churchilla 4, 130 67, Prague 3, Czech Republic, e-mail: vaclav.rybacek@centrum.cz.

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**Introduction**

Every financial crisis induces governmental responses. Governments promising that disastrous financial crises will not happen again are keen to implement various controlling mechanisms to regulate the financial and banking systems. The recent financial crisis culminating in the autumn of 2008 is not an exception.

The European Commission as a response to the financial crisis proposed to set up new controlling bodies. These bodies should be responsible for **(i)** gathering information on all macroprudential risks in the EU; **(ii)** legally binding mediation between national supervisors; **(iii)** the adoption of binding supervisory standards; **(iv)** the adoption of binding technical decisions applicable to individual institutions; **(v)** supervision and coordination of supervisory bodies; **(vi)** licensing and supervision of specific EU institutions (e. g. Credit Rating Agencies and post-trading infrastructure); **(vii)** binding cooperation with the European Systemic Risk Council to ensure adequate and prudent supervision; and **(viii)** strong coordinating role in crisis situations (EU Commission 2008). These proposals should prevent the next financial crises via tight and centralized regulations. But, why should such regulations work?

Traditional arguments for regulation of the financial and banking systems put emphasis on market failure. However, the proponents of financial and banking system regulation do not explicitly argue that tight and centralized regulation prevents financial crises. Some even argue that tight and centralized regulations might cause the governments to become corrupt (Stiglitz, Jaramillo-Vallejo and Park 1993, 13).

In this paper, we follow this argumentation. Using the theoretical apparatus of Virginia Public Choice applied to central bank decision-making,[1] we describe the behavior of the central bank after financial crises, when the government responds with tightening and centralizing the financial regulation. We provide a historical insight into the behavior of the government at the end of the 19$^{th}$ and the beginning of the 20$^{th}$ century in the USA. This historical period in the financial history of the USA is very interesting, because it explains the behavior of the government before the establishment of the central bank (FED). We hypothesize that there might be some parallels between the behavior of the executive bodies of the European Union and the US Federal Government.

In the first section, we describe a general concept which explains the functioning of the financial institutions under the gold and silver standard and under the fiat money standard when the central bank decision-making is dependent on government. We also explore the case of fiat money standard when central the bank decision-making is independent of the government. While in the case of the gold and

[1] For pioneering study see Toma (1982).

silver standard governments gains zero seignorage, in the case of central bank decision-making dependent on government, the government gains substantial seignorage. These cases, however, do not correspond with the modern central bank decision-making when the central bank is independent of the government. In this case, the government preferentially maximizes the bond seignorage.

We go further and derive a rent-seeking model with endogenous rent (Lambsdorff 2002) explained in a historical narrative in accordance with the theoretical concept above. We assume that additional liquidity provided by central banks represents rent. Our rent-seeking model predicts that when the central bank is independent of the government, the government tends to tighten and centralize financial regulation to provide protected private banks with additional government bonds $\Delta B$. Generally, this is the interest-bearing debt held by non-government public *D* to encourage private banks to exchange these bonds for additional liquidity provided by the central bank. Since bond prices set by law are usually higher than the true price of bonds in the market, this process might increase the risk of inflationary monetary policy.

In the second section, we discuss government rent gained by the regulation of the banking industry and, at the same time, by emission of fiat money. For this type of government rent to be positive, specific conditions must be fulfilled. Thus, first we define under which circumstances this rent is gained in the form of "bond seigniorage". As a next step, we use indicators of the Czech economy to estimate the amount of bond seignorage.

The last section summarizes our findings.

## 1. A simple model of inflation and regulation

In this section, we develop a model of tightening and centralizing financial regulation as a governmental response to financial crises.[2] Firstly, let us assume that the main goal of the government is to maximize non-interest-bearing debt held by public. Non-interest-bearing debt held by non-government public is the revenue generated from printing fiat money by the central bank. Then let us assume that the second goal of the government is to maximize the interest bearing debt held by public. The interest-bearing debt held by non-government public is the revenue generated from selling government bonds by the government. In an institutional environment where the central bank is independent from the governmental decision-making it is realistic to assume that the government would rather maximizes the revenue generated from selling government bonds than the revenue from printing fiat money by the central bank.

[2] We build on White (1999, chap. 8).

Secondly, let us assume that the goal of the central bank is to maximize its own power (Toma 1982, White 1999, chap. 8). Naturally, the central bank might seek additional goals. For instance, it could create a political business cycle. Nevertheless, in the case of tightening and centralizing financial regulation, the other goals of central banks are of minor importance.

### 1.1. Government as a maximizer of non-interest-bearing debt and interest-bearing debt held by public

To explain our model in detail, first let us assume that an economy without a central bank operates under the gold and silver standard. As a result, seignorage is the difference between the face value of coins minted and their actual bullion content minus the cost of minting. The money supply therefore, could be expressed by the following equation:

$$M = PQ + C + S,$$

where *M* is the nominal value assigned to the batch of coins, *P* is the nominal price paid by the mint per ounce of precious metal, *Q* is the number of ounces of precious metal embodied in the batch of coins, *C* are the average costs of operating the mint (called "brassage"), *S* is the nominal seignorage.

Now, let us assume that providing gold and silver money is a perfectly competitive industry. Assuming this, perfect competition would enforce the price conditions equal to marginal cost, $M = PQ + C$, implying $S = 0$.

Under perfect competition, seignorage is reduced to zero. The nonexistence of barriers to entry ensures that the profit in the form of seignorage will be eliminated because new mints could be operating with lower costs. Not even the government could earn seignorage, unless it restricts potential competitors by creation of barriers to entry. [3]

Nevertheless, to be more realistic, let us now suppose that an economy with a central bank operates under the fiat money standard. Then the bullion content of base money is zero $Q = 0$, and the production costs are almost zero. Even though the production of fiat money is not cost-free, it would be useful to assume that $C = 0$. Then the equation describing money supply under the fiat money standard could be rewritten as $M = S$. Under the fiat money standard the government seignorage per year is simply equal to the change in stock of base money per year. The relationship is as follows:

[3] Kirzner (1973) argues that the perfect competition model is unrealistic in its assumptions. According to Kirzner (1973) sufficient conditions ensuring free competition is no barriers to entry. For this reason we might abandon the assumption of perfectly competitive market and assume competition as a dynamic process without barriers to entry. For recent explanation see Otáhal (2008b).

$S = \Delta H$,

where $\Delta H$ indicates the change in $H$, the stock of "high-powered" money or base money in existence. Real seignorage is

$$s = \frac{\Delta H}{P},$$

where $P$ is the price index used as a deflator.

Forder (2003) argues that politically, the independence of the central bank at the beginning of the 20th century in the USA was understood as the independence from bankers' interests. An independent central bank should have been obligated to provide "easy money" to every citizen. Throughout the 20th century this kind of independence was transformed into the independence of the central bank from the governmental interests. This is why we need to assume that the government does not just maximize the non-interest-bearing debt held by public. With increasing independence of central banks from the governmental interests such source of revenue would be limited.

Let us therefore suppose that an economy with a central bank operates under the fiat money standard and the central bank is independent from the governmental decision making. Within this assumption, the government rather maximizes the revenue generated from selling government bonds than the revenue from printing fiat money by the central bank. Under the fiat money standard when the central bank is independent from the governmental decision-making, revenues generated from selling government bonds is simply equal to the change in stock of government bonds per year. The relationship is as follows:

$D = \Delta B$,

where $\Delta B$ indicates the change in *D*, the stock of government bonds.

Change of real interest-bearing debt held by public is

$$b = \frac{\Delta B}{P},$$

where $P$ is the price index used as a deflator.

Previous assumptions allow us to describe the government budget constraint under the fiat money standard as follows:

$G = T + \Delta B + \Delta H$,

where $G$ is the government spending including debt service, $T$ is the tax revenue, $\Delta B$ is the change in the interest-bearing debt held by non-government public, and $\Delta H$ is the change in non-interest-bearing debt held by public, which is the nominal seignorage. Definition of nominal seigniorage $\Delta H$, however, can be further extended with bond seignorage, which is government revenue generated from printing fiat money by the central bank when the central bank is independent from the governmental decision-making (Section 2).

### 1.2. Tight and centralized financial regulation with exogenous money supply

To explain our rent-seeking model, let us assume that the government, in order to maximize the interest-bearing debt held by non-government public *D,* obligates private banks to hold government bonds *B*. We can demonstrate this issue on the historical example of the so-called "wild cat banking" of the end of the 19th century in the USA.[4] Government bonds served as a collateral for the distribution of private banks' currencies. When the market value of bonds fell, the banks obligated to hold overpriced bonds faced the problem of insufficient liquidity (Kvasnička 2008, 34-35, Rybáček and Šíma 2010). This process brought the government to provide additional liquidity through distribution of additional government bonds $\Delta B$ to private banks to satisfy the money demand.

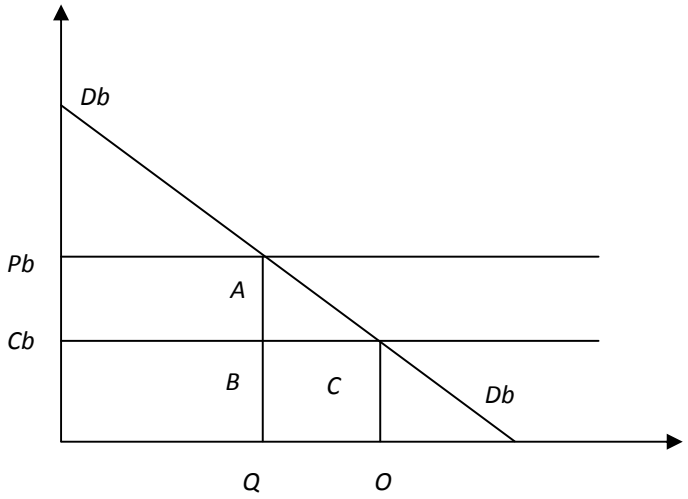
Through financial regulation the government protected private banks from competition and created rents encouraging private banks to rent-seeking. Stigler (1971) generally argues that: "…every industry or occupation that has enough political power to utilize the State will seek to control entry. In addition, the regulatory policy will often be so fashioned as to retreat the rate of growth of new firms." (Stigler 1971, 5)[5] In banking and financial sector, rents were represented by additional liquidity, which private banks obligated to hold government bonds *B* as a collateral, were allowed to create and distribute.[6] Simply, private banks were protected against competition in exchange for holding overpriced government bonds as a collateral, which allowed them to create and distribute additional liquidity.

[4] This period started in 1837 when *Free Banking Act* was passed on national level.

[5] Stigler (1971) assumes that the political control of citizens is very limited. Similar argument was presented by Olson (1965).

[6] Today private banks are obligated to hold governmental bonds by Capital adequacy ratio (CAR) regulations. CAR regulations classify governmental bonds as less risky financial instruments thus it indirectly incites banks to hold governmental bonds even though the true quality of governmental bonds might be different.

**Graph 1: Rent-seeking**




Source: Tullock (1967)

Graph 1 presents the classical rent-seeking diagram. Let us assume that in a competitive market, a certain amount of government bonds *B can be distributed* at price *Cb* for which there is a demand shown by *Db*. Quantity *O* would thus be distributed at the price of *Cb*. Let us suppose, however, that it is possible for the government to set the financial regulation so that it protects certain private banks against competition. Then the government is allowed to distribute a different amount of government bonds *B* at price *Pb* for which there is constant demand shown by *Db.* This process might bring the government to encourage provision of additional liquidity through the distribution of additional government bonds $\Delta B$. Additional government bonds $\Delta B$, which generally is the interest-bearing debt held by non-government public *D* is represented by rectangle *PbCbBA.* Within this rent-seeking diagram, governmental financial regulation restricts competition and raises the price of the interest-bearing debt held by non-government public. This allows private banks to create and distribute additional liquidity.

This kind of behavior of the state and private banks was recorded in human history at the end of the 19$^{th}$ and the beginning of the 20$^{th}$ century in the USA. During the period called “wild cat banking” at the end of the 19$^{th}$ century in the USA, banks were allowed to issue money, especially in exchange for government bonds. Due to government bond estimation, banks were able to reach additional profit (rent). Competition was restricted, even if very softly, while the banks had a strong incentive to purchase government bonds because this was an extremely easy way to issue money. Bond prices set by law were usually higher than the true price of bonds in the market. As a result, banks were legally permitted to issue money that was not covered from the very beginning. Because of this regulatory arrangement,

governments and banks were in the privileged position of institutions reaching additional funds to the detriment of the society.

This situation was very advantageous for the government. To issue money backed by government bonds gave rise to stable demand for government debt. As already mentioned, an important feature of this period was the mechanism of the bond pricing. Once the price of bonds dictated by law was higher than their true market price, rent-seeking conditions were created. It was favorable to buy bonds the market price of which fell under the regulated nominal value of bonds, as was the case of Michigan (Rockoff 1972). The net profit of banks was the difference between the nominal and market prices of bonds.

Specific regulatory procedures could differ state by state during this period, resulting in different banking techniques to reach profit due to the perverse incentives created by regulation. For example, banks in Illinois were allowed to issue paper money amounting to only 80 % of Illinois´ government bonds value. Regardless of the measures taken to avoid "wild-cat" behavior, "free" banks could reach additional profit because of the high volatility of bond prices. Once the price had fallen rapidly, difference between the "legislated price" and market price created a clear incentive to purchase bonds and to issue money covered by the "legislative price" of bonds.

These mechanisms motivating banks to purchase government bonds was naturally very welcomed by the government, because the resulting rise in supply of money diminished the real value of dollar and government bonds at the same time. In other words, the government reached bond seignorage.[7] It is worth mentioning that regulators were also under the pressure of interest groups, such as the steel or railway industries. Inflation of fiat money was seen by these interest groups as welcomed profit of exporters due to the impact of inflation on the exchange rate or beneficial for highly indebted industries such as the railway construction industry.

Otáhal (2011) explicitly argues that throughout the period of the end of the 19$^{th}$ and the beginning of the 20$^{th}$ century in the USA, the federal government tried to control rent-distribution through money supply control and banking sector regulation. It had systematically tried to tighten and centralize financial regulation to provide certain private banks and investment companies with privileges to use securities and bonds with regulated nominal value as a collateral for distribution of federal government currency. Striking example is the period of the Civil War. "In 1863 and 1864 two laws were passed, the *National Currency Act* and the *National Banking Act*. These acts started off a period in the US monetary history referred to as the N*ational Banking Era*. By these acts the federal government empowered itself by chartering banks operating on the national level. The reason for central regulation was simple. The

[7] This issue is discussed below.

federal government wanted to enlarge the national debt, so it created a system of national banks distributing federal currency, fiat money, United States Notes, also referred to as *greenbacks*. This ensured the distribution of the national debt in the form of federal bonds." (Otáhal 2011, 8-9) Otáhal builds a rent-seeking model with endogenous rent that predicts that the described state and private bank behavior led to centrally-controlled financial regulation by the federal government and to the establishment of Federal Reserve System at the beginning of the 20th century. The Federal Reserve System fully controlled the fiat money supply throughout the entire banking sector and the financial regulation. A similar model describes our logic below.

### 1.3. Tight and centralized financial regulation with endogenous money supply

The concept above derived from a historical example has made an assumption that rent is given exogenously. However, in an economy with a central bank, which operates under the fiat money standard, money supply is given endogenously. In the perspective of the discussed historical concept it means that additional liquidity is distributed by the central bank to the private banks in exchange for government bonds and the private banks then supply credit to satisfy the existing money demand.

To explain our rent-seeking model with endogenous rent, let us assume that the probability $p_i$ that the banks get additional government bonds is proportional to the investment of banks into rent-seeking $x_i$. Since financial regulation allows all banks to exchange government bonds for additional liquidity provided by the central bank and since all probabilities must add up to one, a single bank's probability of getting additional government bonds, which allow the bank to get additional liquidity from the central bank, decreases with the investments undertaken by its competitors. In case of $n$ banks, this results in

$$p_i = \frac{x_i}{\sum_j x_j} \qquad i, j = 1,...,n$$

with $x_i$ being the expenses for rent-seeking of bank $i$. The resulting equilibrium can be determined once the following assumptions are introduced: banks are risk-neutral, they act symmetrically, they are unable to influence the rent-seeking investments of other competitors $x_j$.

Assuming that the government increases the interest-bearing debt held by non-government public *D* by additional government bonds $\Delta B$, banks maximize their profit $E(\bar{r}p_i\Delta B - x_i)$ from getting additional

liquidity from the central bank in exchange for additional government bonds $\Delta B$.[8] Maximization of the profit of the banks looks as follows:

$$\frac{d(\bar{r}p_i\Delta B - x_i)}{dx_i} = \frac{d(\bar{r}\Delta B x_i / \sum x_j - x_i)}{dx_i} = \frac{\bar{r}\Delta B}{\sum x_j} - \frac{\bar{r}\Delta B x_x}{(\sum x_j)^2} - 1 = 0 \text{ (1).}$$

Assuming that banks are symmetrical, $x_i = x_j = x$, the Cournot-Nash-equilibrium could be followed by optimal levels of rent-seeking.

$$\frac{\bar{r}\Delta B}{nx} - \frac{\bar{r}\Delta B x}{n^2 x^2} = 1 \Leftrightarrow n\bar{r}\Delta B - \bar{r}\Delta B = n^2 x \Leftrightarrow x = \frac{n-1}{n^2}\bar{r}\Delta B .$$

Total expenses $R$ for rent-seeking then could be summed up as follows:

$$R = nx = \frac{n-1}{n}\bar{r}\Delta B \text{ (2).}$$

The last equation implies the following. If banks face a problem with liquidity and the central bank provides additional liquidity in exchange for additional government bonds $\Delta B$, banks will spend more resources on rent-seeking *R* when the number of banks $n$ is larger. The government thus must provide additional government bonds to larger number of banks $n$.

Now, let us assume that $\Delta B$ is positively dependent on the total rent-seeking expenses: $\Delta B = \Delta B(R)$, with $\Delta B' > 0$ (Lambsdorff 2002). The larger the size of the additional government bonds $\Delta B$ that banks seek to obtain additional liquidity provided by central bank, the larger bank's total expenses for rent-seeking *R* required to induce the government to provide them with additional government bonds $\Delta B$. This equation might be introduced into the model above. Since $\Delta B = \Delta B(\sum x_j)$, equation 1 can be rewritten:

$$\frac{d\left(\frac{\bar{r}\Delta B(\sum x_j)x_i}{\sum x_j} - x_i\right)}{dx_i} = \frac{\bar{r}\Delta B' x_i}{\sum x_j} = \frac{\bar{r}\Delta B}{\sum x_j} - \frac{\bar{r}\Delta B x_x}{(\sum x_j)^2} - 1 = 0 \text{ (1').}$$

Assuming that banks are symmetrical, $x_i = x_j = x$, the Cournot-Nash-equilibrium could be followed by optimal levels of rent-seeking.

[8] Private bank maximizes $E(\bar{r}p_i\Delta B - x_i)$ where $\bar{r}$ is a constant, $\bar{r} > 0$, which represents the ratio of difference between interest received from government and interest paid to central bank.

$$\frac{\bar{r}\Delta B' x}{nx} + \frac{\bar{r}\Delta R}{nx} - \frac{\bar{r}\Delta B x}{n^2 x^2} = 1 \Leftrightarrow n\bar{r}\Delta B - \bar{r}\Delta B = nx\left(n - \Delta R'\right) \Leftrightarrow x = \frac{n-1}{n\left(n - \bar{r}\Delta B'\right)}\bar{r}\Delta B .$$

Total expenses $R$ for rent-seeking then could be summed up as follows

$$R = nx = \frac{n-1}{n - \bar{r}\Delta B'}\bar{r}\Delta B \quad (2').$$

The last equation implies the following. If $\Delta B$ is larger (smaller) than 1, *R* is larger (smaller) than $\Delta B$ and an increase in the number of banks *n* will decrease (increase) the total expenses for rent-seeking. Under the gold and silver standard, banks' seignorage *S* dissipates through competition. As seignorage *S* attracts new entries into the market, the increasing money production drives down the nominal seignorage *s* and reduces banks' profits. But assuming the economy with a central bank that operates under the fiat money standard, as soon as additional government bonds $\Delta B$, which allow banks to get additional liquidity provided by the central bank, are seen to depend on rent-seeking expenses, the additional liquidity distribution might lead to a decrease of number of rent-seeking banks *n* protected by financial regulation. Economically, this relates to the fact that the positive impact of rent-seeking expenses *R* on the additional government bonds $\Delta B$ might be felt more when a few protected banks exist. If there is too many banks competing for additional government bonds $\Delta B$, they might rather increase their market share instead of devoting more resources to rent-seeking in order to get additional liquidity provided by the central bank.

This implication of our rent-seeking model with endogenous rent means that if the government maximizes the interest-bearing debt held by non-government public *D,* it will protect a few banks with financial regulation to induce them to exchange additional government bonds $\Delta B$ for additional liquidity provided by the central bank. A situation with a few protected banks competing for additional government bonds $\Delta B$ might be optimal, because a few protected banks are rather encouraged to rent-seeking than to increasing their market share. This situation, however, raises the price of the interest-bearing debt held by non-government public *D* above its q market clearing price and thus it brings a risk of inflationary monetary policy.

## 2. Czech government bond seignorage in the period from 2002 to 2010

As mentioned in the discussion of the wild cat banking period, emission of fiat money can help the government to reach additional profit in the form of seigniorage. This type of government rent is called "bond seignorage". This rent does not extend budget constraints of the government, but it is one of the ways in which government debt can be amortized. The task of estimating this type of revenues is not unambiguously answered. Hu (2004) defines bond seignorage as a situation in which agents are willing to

accept lower rate of return from government bonds than that from other financial instruments. It is evident that an important feature of bond seignorage defined in this way is the voluntarism of the entire process.

A more common definition of bond seignorage is growth of (nominal or real) GDP exceeding (nominal or real) rate of interest paid on government bonds (Frait 2000). If GDP rise surpasses the rate of interest, the relative value (debt to GDP) of debt decreases. On the contrary, interest rate exceeding GDP rise provokes the relative value of debt to rise (the so-called "snowball effect"). The following analysis is based on the given definition of bond seignorage, because of the need to include the component of coercion (inflation tax). This constraint results from the fact that GDP, from long-term perspective, is very closely connected with the rise in the amount of money. In other words, a rise in nominal GDP is not conceivable without a rise in money supply (inflation).

Thus, inflation generated by central banking systems enables the real debt to fall. Naturally, this situation is favorable to highly-indebted institutions, such as the government. On the other hand, there is a rate of interest paid on government bonds which usually does not reflect inflation in its full range, because inflation is currently defined as the change in consumer price index *CPI*. Thus, if the interest rate on government bonds *r* exceeds the rise in GDP *g*, a situation called as "bond seignorage" occurs. Nominal values are used to get around the unpleasant problem of price index choice.

To quantify bond seignorage, let us start with the very well-known equation of exchange proposed by Irving Fischer (1911):

$$MV = PQ,$$

where *M* is money supply, *V* represents velocity of money supply, *P* is the average price and *Q* is the quantity of goods and services. Change in GDP can be identified with the change in *PQ* on the right side of the equation of exchange. For our purposes, we can assume velocity of money to be constant in the course of time. Thus:

$$m = g,$$

whereas "*m*" represents the change in money supply $\Delta M$ and "*g*" the change in nominal value of GDP $\Delta GDP$. In fact, government or its agency (central bank), does not have the total money supply under control. But money supply forms a pyramidal system standing on "high-powered money" or the "monetary base". The relationship between monetary base *MB* and money supply *M* is defined by the use of money multiplier *MP*:

$$MBMP = M.$$

So, we can substitute the change in money supply in the following way:

$$mbMP = g,$$

where *mb* denotes the change in monetary base $\Delta MB$. To define bond seignorage, one step remains. As described before, a rise in GDP *g* should be higher than the interest rate paid on government bonds. Thus, we can state that bond seignorage is defined as follows:

$$mbMP > r.$$

So, if the change in monetary base multiplied by the appropriate money multiplier surpasses the interest rate on government bonds, we can speak about bond seigniorage. On the other hand, if r exceeds *mbMP*, for example if default risk is rising, then we speak about the so-called snowball effect mentioned above.

Now, let us try to calculate the bond seigniorage for the Czech government. The last problem remaining to solve is the quantification of the money multiplier as a link between monetary base and money supply. The standard formula has been used (Holub 1997):

$$MP = (currency + deposits) \big/ (currency + reserves).$$

Variables needed for *MP* calculation can be found in monetary statistics, this information is summarized in the following table:

**Table 1**

| *in mil. CZK* | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** |
|---|---|---|---|---|---|---|---|---|---|
| Currency | 197808 | 221362 | 236775 | 263787 | 295263 | 324065 | 365548 | 353557 | 357510 |
| Demand deposits | 589868 | 681420 | 725574 | 823526 | 944542 | 1114586 | 1179720 | 1308705 | 1553721 |
| Deposits with maturity | 651180 | 666433 | 675339 | 671352 | 674903 | 709820 | 615930 | 593792 | 563195 |
| Time deposits | 194311 | 185552 | 198833 | 224147 | 265597 | 315515 | 458048 | 482728 | 358114 |
| Reserves | 28,5 | 29,4 | 31,2 | 33,4 | 36,7 | 42,3 | 47,2 | 49,8 | 50,6 |
| Other liquidity | -0,1 | -1,7 | -5,9 | -11,9 | -2,7 | -17,3 | -9,9 | -6,7 | -10,9 |

Source: www.cnb.cz, ARAD

Thus, the money multiplier and the change in monetary base (currency + reserves + other liquidity) can be calculated.

**Table 2**

| *in mil. CZK* | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** |
|---|---|---|---|---|---|---|---|---|
| MP | 4,85 | 4,69 | 4,39 | 4,18 | 4,16 | 3,94 | 4,04 | 3,58 |
| m | 1,12 | 1,07 | 1,11 | 1,12 | 1,10 | 1,13 | 0,97 | 1,01 |
| MP * m | 5,43 | 5,02 | 4,90 | 4,68 | 4,57 | 4,44 | 3,91 | 3,62 |

In the period from 2003 to 2010, the money multiplier has fallen from 4,85 to 3,58. At the same time, the monetary base was rising in all years except 2009; in this year the demand for currency declined. Last row in the table shows rates at which money supply was rising and pushing prices higher, independently of the consumer or producer prices.

The interest rate paid on government debt plays a key role in these calculations. As mentioned before, if the government´s interest rate on its debt is less than the rate at which the "nominal" economy (in our case represented by *MPm*) is rising, then the relative value of this debt is decreasing. So, we can take two additional inputs into consideration – the interest rate on government debt for convergence purpose and the nominal value of government debt.

**Table 3**

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|
| MP * m | 5,43 | 5,02 | 4,90 | 4,68 | 4,57 | 4,44 | 3,91 | 3,62 |
| r | 4,82 | 4,14 | 3,61 | 3,77 | 4,68 | 4,3 | 3,98 | 3,89 |
| MP*m – r | 0,61 | 0,88 | 1,29 | 0,91 | -0,11 | 0,14 | -0,07 | -0,27 |
| Debt* | 768,3 | 847,8 | 885,4 | 948,3 | 1023,8 | 1104,9 | 1280,4 | 1413,5 |
| Bond seigniorage* | 4,65 | 7,44 | 11,38 | 8,67 | -1,13 | 1,57 | -0,87 | -3,86 |

*billions of crowns

For clarification, bond seignorage is calculated as the difference between the rise in money supply *MPm* and the interest rate *r* multiplied by the nominal value of the government debt. The results of our estimation are shown in the last row of the table. From 2003 to 2006, the Czech government reached significant extra money resulting from the fact that nominal economy was rising more rapidly than the interest rate paid on its debt. In the monitored period, the total amount of bond seignorage was 27,85 billions of CZK. In 2010, we can identify a significant negative bond seignorage. The primary reason is a significant decline in the money multiplier due to decreasing amount of deposits.

It must be noticed, that governments can reach bond seignorage even if debts are usually indexed by inflation rate. The reason is that inflation is currently expressed as consumer price inflation. But GDP is not affected only by consumer inflation, but also by prices of producers. Real inflation may also be undervalued in official statistics due to the share of goods or the substitution procedure that allows substituting more expensive goods by cheaper ones. Because of indexation, the most preferred situation is when rising prices are not displayed in official statistics.

**Conclusions**

In this paper, we used the theoretical apparatus of Virginia Public Choice applied to the central bank decision-making to describe the behavior of central banks after financial crises, when governments responds by tightening and centralizing the financial regulation. We assumed that additional liquidity provided by central banks represents rent.

We provided the historical insight into the behavior of the US government at the end of the 19$^{th}$ and the beginning of the 20$^{th}$ century and derived a rent-seeking model with endogenous rent to explain how the process of tightening and centralization of financial regulation might increase the risk of inflationary monetary policy. To support our theoretical model by an empirical example we quantified the bond seignorage (rent) gained by the Czech government during the period 2002-2010; this government rent amounts to 27,85 billions of CZK.

Nevertheless, we do not necessary claim that every financial regulation increases the risk of inflationary monetary policy. We found it very important to provide lessons from the period in the financial history of the USA when FED had not yet been established and the US Federal Government wanted to consolidate its power (Otáhal 2009). Naturally, the historical circumstances of the European Union and those of the USA between the 19$^{th}$ and 20$^{th}$ were different. However, the interesting part of this narrative is that the US Federal Government had been systematically tightening and centralizing the financial regulation till the FED was established. The effect of this process on the frequency and depth of financial crises in the USA, however, needs to be further explored.

**References**


EU Commission (2008): Brief Summary of the De Larosiere Report. Available at: (http://ec.europa.eu/commission_barroso/president/pdf/statement_20090225.pdf [1.9.2009]

Frait, J. (2001): Měnová politika, neutralita a superneutralita peněz. *Bankovnictví,* 2001, str. 19.

Fisher, I. (1911): *Purchasing Power of Money.* New York, Macmillan, 1911.

Holub, T. (1997): Peněžní multiplikátor a měnový vývoj v ČR. *Finance a úvěr,* Vol. 47(3), s. 129-142.

Forder, J. (2003): Independence and the founding of the Federal Reserve. *Scottish Journal of Political Economy,* 50(3): 297–310.

Hu, Y.: Government Bond Seigniorage, Money Seigniorage and Their Responses to Monetary Policy Shocks. University of Honk-Kong, March 2004

Kirzner, I.M. (1973): *Competition and Entrepreneurship.* London and Chicago: The University of Chicago Press, 1973.

Kvasnička, M. (2008): Stabilita a efektivnost amerického "Svobodného bankovnictví". *Národohospodářský obzor,* Vol. 6(3-4): 22-41.

Lambsdorff, J.G. (2002): Corruption and rent-seeking. *Public Choice,* 113(1-2): 97–125.

Olson, M. (1965): *The Logic of Collective Action.* Harvard University Press, Cambridge (MA), 1965.

Otáhal, T. (2011). Rent-Seeking Origins of Central Banks: The Case of the Federal Reserve System. *MENDELU Working Papers in Business and Economics* 8/2011. Mendel University in Brno.

Otáhal, T (2009): Souvislosti vzniku Federálního reservního systému: Přehled ekonomických zájmů. *Ekonomický časopis,* 57(8) 2009: 788-803.

Rockoff, H. (1972): American Free Banking before the Civil War: A Re-examination. *Journal of Economic History*, Vol. 32(1):417-420.

Rybáček, V. and Šíma, J. (2010): Bankovnictví divokých koček, minulost či přítomnost. *Ekonomický časopis,* 58(9): 958-966

Stigler, G. J. (1971): The Theory of Economic Regulation. *Bell Journal of Economics and Management Science*, Vol. 2(1): 3-21

Stiglitz, J.E., Jaramillo-Vallejo, J., and Yung Chal Park (1993): The role of the state in financial markets. *World Bank Research Observer, Annual Conference on Development Economics Supplement,* (1993): 19-61.

Toma, M. (1982): Inflationary Bias of the Federal Reserve System: A Bureaucratic Perspective. *Journal of Monetary Economics,* 10(2): 163-190.

White, L.H. (1999): *The Theory of Monetary Institutions.* Blackwell Publishers, 1999.