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Pecking order theory for government finance*

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Abstract

In this article we argue that asymmetric information can explain why seignorage is an inferior choice to debt for governments. We also argue that the Ricardian equivalence for governments is very similar to what the Modigliani-Miller proposition is for corporations. Our model is based on Bolton and Huang (2018) in that money for governments is similar to what equity is for corporations. In contrast to their model, our model considers rational economic agents.

Keywords: government finance, pecking order, capital structure, money, Ricardian Equivalence, Modigliani-Miller Proposition, asymmetric information

JEL Classifications: D25, D82, D86, E40, E51, E52, E63, G32

1 Introduction

Over the last 30 years, the theory of optimal financing for the government has become more and more influenced by microeconomic theory. For example, the sovereign debt theory uses the reputation model or incomplete contract approach whereby the legal enforcement of debt is too costly, inefficient or even impossible at all, and therefore the debtor must be self-interested in debt reimbursement.¹ However, other microeconomic foundations developed

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¹See Cole and Kehoe (1998), Cole, Dow and English (1995), Diamond (1989), and Eaton and Gersovitz (1983) among others.

within the financial theory on the corporate level and in particular capital structure theory seem to not be used often at the governmental level.² We mentioned the latter because recently Bolton et al (2018) called the problem of government financing the capital structure of a nation. They also mentioned the similarity between money for government and equity for corporations and encouraged further research in this direction. In this paper we continue this line of research. We argue that seigniorage is an inferior choice to government debt and discuss the similarities and differences between this result and the pecking-order theory on a corporate level. We also discuss future possible developments of this line of research and possible applications of other capital structure theories for government finance starting with a comparison between the Ricardian equivalence for governments and the Modigliani-Miller proposition for corporations.

The three main sources of corporate financing are: internal funds, equity and debt. There are many similarities between these sources of financing and the three main sources of financing for government expenditures: taxes, seigniorage and debt. Both government debt and corporate debt represent claims made by an investor (debtholder) to an issuer (borrower) consisting of principal and interest. The inability to repay debt usually leads to the issuer's default or bankruptcy. Both corporate internal funds and taxes collected by the government depend on the efficiency of the firm in the first case and that of the government in the second case. Bolton et al (2018) mentioned that there are many similarities between shares issued by corporations and money printed by governments. For example both money and corporate shares are residual claims whereas debt is not. Also note that the amount of outstanding shares as well as money in circulation depends on the issuer's decision (corporation for shares and government for money). Finally, the real value of shares depends on a firm's success and the real value of money depends on the efficiency of the economy.

In this article we develop an asymmetric information-based theory of government finance. In contrast to Bolton et al (2018) our model considers rational agents. We consider a country where the government considers a public investment project and looks for funds to finance this project. The potential sources of financing are printing money and borrowing externally. Raising taxes and using internal debt are not considered.³ When economic agents

²See Wedig, Hassan and Morrissey (1996) for similar ideas regarding the comparison of private and state enterprises financing.

³In corporate finance literature most articles related to capital structure make an usual

and the government possess the same information about the quality of the project and its potential benefits and costs, the Ricardian equivalence result emerges (analogous to the Modigliani-Miller proposition on corporate level): the government is indifferent between printing money and borrowing. Next we consider a situation when the government has more information about the economy than potential providers of funds. In these conditions the buyers of government bonds or loan providers can be concerned about the quality of available information and require a higher interest rate on bonds/loans. Similarly, economic agents will react to seigniorage differently than in a situation when information is symmetric. They will have to think strategically about the level of GDP (gross domestic product), inflation etc. Our model predicts that issuing money is more sensitive to information asymmetry than borrowing and so debt is preferred to seigniorage. This can be confirmed in practice. For most countries seigniorage is only between 0 and 2% of GDP and less than 10% of government expenditures (see, for example, Click (1998), Haslaq (1998), Aisen and Jose Vega (2005)). While external debt is usually between 10-30% of GDP.⁴ Also, our model predicts that the level of GDP in countries that use seigniorage should be lower than in countries that prefer debt. Or, alternatively, there is a negative correlation between the level of seigniorage and the level of GDP. Elbahnasawy and Ellis (2015) find, for example, that seigniorage and GDP growth are negatively correlated. On the corporate level, the signalling theory of capital structure predicts that high-quality corporations should signal their quality by issuing debt which is similar to the results in our paper.

Myers and Majluf (1984) set forth the pecking order theory. The key element of the pecking order theory is asymmetric information between a

assumption that internal funds are not available. The capital structure problem then becomes a debt-equity choice problem. The reason being that financing with internal funds is usually driven by different considerations than financing with external funds. The latter is affected, for example, by asymmetric information between a firm and investors. Similarly, for the government a debt-seigniorage choice is not an unusual problem (see, for example, Obstfeld (1997)). Often it is assumed that raising taxes, and more generally tax policy, is driven by very different considerations than seigniorage or debt. One can assume, for example, that raising taxes has large political disutility for the government (see, for example, Schleifer and Vishny (1994)). Similar to Bolton et al (2018) we do not consider taxes or internal debt (the latter is because in their paper internal debt is similar to money creation). We further discuss this assumption in Section 5.

⁴See <https://tradingeconomics.com/australia/indicators>
and <http://databank.worldbank.org/data/embed-int/Table-1-SDDS-new/id/4f2f0c86>

firm's insiders and outsiders. Equity is dominated by internal funds in this model. Low-quality firms use equity as much as internal funds but high-quality firms prefer internal funds. Similarly debt dominates equity. Hence a "pecking order" emerges: internal funds, debt, and equity (Myers and Majluf, 1984). Analogously to pecking order on a corporate level we argue that issuing debt is preferred to printing money. Also since taxes are not subject to asymmetric information they should be preferred to debt. Analogously, on corporate level, internal funds do not depend on asymmetric information problems so they are a preferred choice under asymmetric information.

Bolton et al (2018) analyzes funding of investments via foreign-currency denominated debt or domestic currency claims. They show that a nation's optimal funding structure can be characterized as the solution to a trade-off between inflation costs and expected default costs. It also brings new insights into such issues as the costs and benefits of foreign exchange reserves and the optimal currency composition of sovereign debt. In contrast to Bolton et al (2018) in our paper the economic agents are rational. Also in our paper information between the government and economic agents is asymmetric. They mentioned the importance of asymmetric information but did not model it explicitly.

The rest of the article is organized as follows. Section 2 presents the basic model and demonstrates the analogy between the Modigliani-Miller proposition and the Ricardian equivalence. Section 3 analyses the model extension with asymmetric information and demonstrates that seigniorage is an inferior choice to debt. Section 4 describes the model's implications and analyzes how consistent they are with empirical evidence. Section 5 discusses the model's robustness and its possible extensions. Section 6 provides a discussion about the similarities between money for governments and equity for corporations. Section 7 discusses possible applications of other capital structure theories on a governmental level and Section 8 concludes.

2 Basic Model

2.1 Preliminaries: Corporate Debt and Equity.

Consider a firm that looks for financing for an investment B , which produces a cash-flow \tilde{R} . Denote the initial number of shares outstanding by N . In order to finance the project the firm may issue equity (let ΔN be the number

of shares issued) or debt (D).

Definition 1. A financial contract is debt (with face value D') if the contract holder's earnings are given by

$$W_D = \min \left\{ \tilde{R}, D' \right\} \quad (1)$$

In this definition $D' = D(1+r)$, where r is the interest rate. (1) means that if the firm's profit is sufficiently high (greater than the face value of debt) the nominal debt is paid back in total; if not, the debtholders have the right to all the profit.

Definition 2. Shares are securities with the following earnings:

$$W_S = \frac{\tilde{R}_n}{N'} \quad (2)$$

where R_n means the firm's net profit (after repayment of debt if necessary) and $N' = N + \Delta N$ means the total number of shares after the issue.

Note that:

$$\min(R, D') + \max(0, R - D') = R \quad (3)$$

(1) and (3) imply that (2) is equivalent to the following:

$$W_S = \frac{\max \left\{ \tilde{R} - D', 0 \right\}}{N + \Delta N} \quad (4)$$

This equation means that the shareholders are residual claimants, i. e. if the firm's profit is sufficiently high the shareholders will divide the net profit according to the number of their shares; if not, they have nothing.

2.2 Government Finance vs. Corporate Capital Structure.

Suppose that a government considers a public project and denote the total expenditures for this project as G in real units.⁵ The country's GDP after

⁵For a non-US country real units can represent US dollars, for example. Or one can assume that the project requires G units of some specific assets etc. The key here is a separation between money and assets. To convert the nominal value of money to its real value one should use the conversion ratio. If real units represent US dollars, one can use US/home currency exchange rate. For more discussion about real and nominal values see, for example, Wolla (2013).

the project completion ($t = 1$) is \tilde{Y} (stochastic) (we suppose that there is 1 product in the economy and denote by p it's price at $t = 1$). The expected value of GDP is equal to θ , i.e. $\theta = \bar{Y}$ and let $\theta \in [\theta_{min}, \theta_{max}]$. θ becomes known to the government at $t = 0$ but not to the investors or consumers. To finance the project the government can borrow (the total debt in real units will be referred to as D), or it can issue money. Let ΔM be the nominal quantity of money issued (we also assume that initially the quantity of money in the economy is M_0 and government's debt is 0) and let e denote the real value of 1 unit of money in period 0. The government budget constraint is then:

$$D + \Delta M e = G \tag{5}$$

For simplicity we assume that the economic agents are risk-neutral. Note that ΔM can be positive or negative as well. The former situation can be interpreted as a seigniorage. In this case the government prints ΔM units of nominal money in order to purchase the total amount of real units equal to $e\Delta M$ (it can be for instance, an additional amount of labor). When ΔM is negative, debt is higher than investments and the surplus represents what is available for the current consumption of real goods. In this case $e\Delta M$ represents the net consumption in the first period. After Y is realized, the government pays back the debt D' . The sequence of events is present in Figure 1.

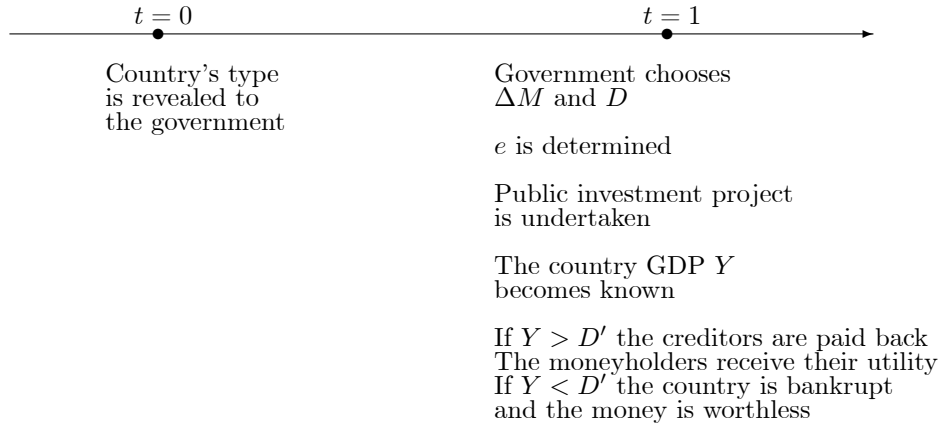


Figure 1. The sequence of events.

If $\tilde{Y} > D'$ the debt is repaid in total. If $\tilde{Y} < D'$, debtholders receive Y . Hence the debtholder's payoff is equal to

$$\widetilde{W}_D = \min \left\{ \tilde{Y}, D' \right\} \quad (6)$$

which is equivalent to (1). The real consumption in period 1 is

$$\widetilde{C}_1 = \max \left\{ \tilde{Y} - D', 0 \right\} \quad (7)$$

To purchase period 1 consumption the consumers use their nominal money stock ($M_0 + \Delta M$). The cash-in-advance constraint is⁶:

$$M_0 + \Delta M \geq pC_1 \quad (8)$$

where p is the price level. Since money is worthless after period 1 the constraint (8) is binded in equilibrium. Since the consumers are risk-neutral, the real value (in real consumptions units) of one unit of money in period 1 (W_M) is equal to $\frac{1}{p}$ and equ. (7) and (8) imply that this equals

$$W_M = \frac{1}{p} = \frac{C_1}{M_0 + \Delta M}$$

Or:

$$\widetilde{W}_M = \frac{\max \left\{ \tilde{Y} - D', 0 \right\}}{M_0 + \Delta M} \quad (9)$$

which is equivalent to (4).

Money to governments is similar to what equity is to corporations, and the seigniorage-sovereign debt choice can be analyzed as the equity-debt choice on a corporate level. We can also see why in this economy people keep money. This is because in the case when real GDP (in real units) is high then prices are low and money holders can fully benefit from this deflation as compared to the debtholders' earnings, which are limited in real units by D' .

⁶Recall that ΔM can be negative (technically it can not be less than $-M_0$). This is analogous to a stock repurchase on a corporate level. This happens in cases when external debt is too high and there is a current surplus in real units. Consumers decrease their period 1 consumptions (equals to $\frac{\Delta M}{p}$ in absolute value) and increase their period 0 consumptions ($C_0 = -e\Delta M$).

2.3 Symmetric Information.

In this section we analyze a perfect market case, i.e. we assume that economic agents have the same information as the government about the project. Suppose that the government's objective is maximizing the expected real net consumption:

$$\overline{C}_n = C_0 + \overline{C}_1 = \overline{C}_1 - e\Delta M \quad (10)$$

where \overline{C}_1 is expected period 1 consumption and $e\Delta M$ is the cost of seigniorage.⁷ In this case financing policy does not matter and the Ricardian equivalence holds. It means that, no matter the policy, the expected real net consumption equals

$$\overline{C}_n = \overline{Y} - G \quad (11)$$

To see this, consider the following scenarios:

1. *Debt financing.* ($\Delta M = 0$). The equilibrium creditors' payoff should cover the cost of their investments. It implies

$$G = \overline{W}_D = E \left[\min(\tilde{Y}, D') \right], \quad (12)$$

$$\overline{C}_1 = E \left[\max(0, \tilde{Y} - D') \right] \quad (13)$$

(12) represents the risk-neutral equilibrium valuation formula (see (6)). The expected earnings of debtholders (\overline{W}_D) must be equal to G (initial cost). (13) is just an application of (7). Given the identity (3) they imply (11).

2. *Seigniorage.* ($D = 0$). The equilibrium relations are now

$$G = \Delta M e \quad (14)$$

$$e = \overline{W}_M = \frac{\overline{Y}}{M + \Delta M} \quad (15)$$

(14) represents the government's budget constraint. (15) means that the real money value in period 0 must be equal to the expected real money value in

⁷Recall that if ΔM is negative $-e\Delta M$ represents the net current period consumption. Note that traditional macroeconomic literature (like Barro and Gordon (1983a,b), Backus and Driffill (1985) or Bernheim and Bagwell (1988)), often assumes the ad-hoc objective functions, or assumes the exogenously known law of changing GDP as a function of future inflation, or a multi-period setting with overlapping generations. An advantage of our model and in general an advantage of using a microeconomic approach to government finance is that it does not have many of the ad-hoc assumptions described above.

the period 1 (seigniorage equilibrium condition). These equations also imply (11).

Proposition 1. *The value of money does not depend on the government's financial policy. Regardless of the policy chosen by the government, the real value of money (e) equals*

$$e = \frac{\bar{Y} - G}{M_0} \quad (16)$$

Proof. For the case of seigniorage it follows from (14) and (15). For the case of debt financing it follows from (11), (13) and (9) given that $\bar{C}_n = \bar{C}_1$ in this case.

This is merely the Modigliani-Miller theorem (meaning that in a perfect market, share price is irrelevant to financial policy) applied to the government (see Wallace (1981) and Barro (1974) for examples of alternative views of government policy irrelevance).

3 Financing Under Asymmetric Information.

If the information shared by the government and investors is symmetric then seigniorage and debt lead to the same result. What if information is asymmetric?

Consider the following situation. Suppose that θ is known by the government but not by the investors and the consumers. We use the money-inutility approach⁸ and the government's objective function is $U = C_n + ae$, where a is a known parameter, $a > 0$. U depends on total net consumption C_n and the value of money at $t = 0$, which reflects the expected level of inflation (recall that e depends on both the level of GDP and quantity of money in the economy (see (15))). Suppose for simplicity that $Y \geq G$ in any state of nature, meaning that the project can be financed by risk-free debt.⁹

Proposition 2. *If information between the government and economic agents is asymmetric, debt dominates seigniorage, i.e. no country uses seigniorage except the one with the lowest GDP.*

Proof. If the project is financed by this risk-free debt, (11) and (16) imply

⁸See, among others, Blanchard and Fischer (1989). This approach is typical in modern macroeconomics.

⁹On a corporate level, the result holds even if debt is risky (Noe and Nachman (1994)).

that the value of the government's objective function equals

$$\theta - G + ae = \theta - G + a \frac{\theta - G}{M_0} \quad (17)$$

The last term equals $a \frac{\theta - G}{M_0}$ because if financing is debt, the amount of money in the economy equals M_0 . If the country of type θ uses seigniorage it equals

$$V_e = \theta - G + ae \quad (18)$$

Comparing (17) and (18) we get that the government issues money if and only if $e \geq \frac{\theta - G}{M_0}$. In equilibrium (risk-neutral valuation) it must be that

$$\begin{aligned} e &= E\left[\frac{1}{p}\right] \Leftrightarrow \\ e &= E\left[\frac{\theta}{\Delta M + M_0}\right] \end{aligned}$$

Since in the case of seigniorage $e\Delta M = G$ we can rewrite this as

$$e = \frac{E[\theta] - G}{M_0} \quad (19)$$

where the expectation is taken under the condition that type θ issues money. It will be the case if

$$e \geq \frac{\theta - G}{M_0} \quad (20)$$

The only solution to equations (19) and (20) is $e = \frac{\theta_{min} - G}{M_0}$.

In equilibrium no government would finance its project with seigniorage (except for the generic case of the country on the lower bound θ_{min}) because the real value of money at time 0 is $\frac{\theta_{min} - G}{M_0}$.

4 The Model Implications.

1. *Debt dominates seigniorage.* Our model predicts that in an environment with asymmetric information about GDP, debt dominates seigniorage. This result is consistent with empirical evidence. As was mentioned previously, for most countries seigniorage is only between 0 and 2% of GDP and less than 10% of government expenditures while external debt is usually between 10-30% of GDP.

2. *Seigniorage reduces the real value of money.* As follows from the model, if a country increases M , e goes down. After the market learns that the government has a valuable investment project (but before the financing decision is made), the true value of money is $\frac{\theta-G}{M_0}$. However after the seigniorage is announced, the value of money is $\frac{\theta_{min}-G}{M_0}$. In all cases e decreases except for the case for a country with lowest GDP possible. This result is also consistent with empirical evidence. For example Haslaq (1998) states that a large body of empirical evidence suggests that the rate of money creation is closely correlated with inflation. Hence, faster money creation costs society by eroding the purchasing power of money already in circulation, which is the inflation tax. Good illustrations are well known historical examples of hyperinflation related to large volumes of printed money: european countries at the end of WWI and in 1920s, Argentina in 1980s, etc.

3. *Pecking order of government finance.* Countries with high expected GDP values should use taxes as much as possible for financing and avoid external financing because tax collection is not subject to asymmetric information problems unlike borrowing or printing money. This seems to be consistent with the observation that taxes usually cover about 70-90% of government spending¹⁰ (similarly on the corporate level internal funds cover about 60-70% of investments¹¹), followed by debt and seigniorage.

4. *Countries with higher extents of asymmetric information about GDP should use less seigniorage.* One can measure the extent of asymmetry by the level of transparency of government activities (see Fry et al (2000) and Geraats (2005)).

On the corporate level the classical theory is the pecking-order theory, which implies that first of all corporations use internal funds to finance expenditures, then debt and finally equity (Myers and Majluff (1984)). In contrast to corporate literature, the government's objective function is different from the objective function of a typical corporation. This creates a major difference between our model and, for example, Myers and Majluff (1984). Other implications of the pecking-order theory for corporations¹² include the following. 1) The announcement of issuing stock drives down the stock price (Masulis and Korwar, 1986; Antweiler and Frank, 2006). This is analogous to our result that seigniorage reduces the real value of money.

¹⁰See, for example, Booth (2016).

¹¹See, for example, Brealey and Myers (2016).

¹²See, for example, Miglo (2011).

2) A Negative correlation between debt and profitability (see Titman and Wessles, 1988). Good-quality firms tend to use internal funds for financing as much as possible. Because low-quality firms do not generate as much profits and retained earnings as high-quality firms, they use external sources, usually debt, more frequently. Although our model does not include taxes, the implication of a similar point for the government is quite intuitive. Since the collection of taxes depends only on actual (past) performance of firms in the economy and it is not subject to asymmetric information regarding the quality of future projects, countries with a high level of GDP should primarily use taxes to finance their projects and not external financing (debt) to avoid adverse selection problems. Countries with a low level of GDP do not have enough revenues from taxes so they will use debt. Empirically, some research finds a negative correlation between external debt and the rate of GDP growth (see, for example, Shkolnyk and Koilo (2018)). However most research finds a non-linear relationship between external debt and GDP growth. Note that some recent versions of asymmetric information-based theories of capital structure also provides different suggestions for the relationship between debt and profitability (see, for example, Ebaid (2009) and Finnerty (2013)). 3) The Pecking order theory predicts that a higher extent of asymmetric information reduces the incentive to issue equity. This is analogous to our predictions that higher extent of asymmetric information reduces the incentives for seignorage. Note that on a corporate level the empirical evidence is ambiguous. D’Mello and Ferris (2000) and Bharath, Pasquariello, and Wu (2008) support the prediction that the pecking order theory is more likely to hold when the extent of asymmetric information is large. Choe, Masulis, and Nanda (1993) find that equity issues are more frequent when the economy is doing well and information asymmetry is low. Yet, Frank and Goyal (2003) find the greatest support for the pecking order theory among large firms that are expected to face the least severe adverse selection problems because they receive better coverage by equity analysts.

5 Model Extensions and Robustness.

Indexed debt. Our model’s results hold if instead of external debt we analyzed the indexed debt (see, for example, Sargent (1989) regarding the theory of indexed debt). The indexation is assumed to follow the inflation rate which in turn follows the real value of money. In this case the indexed debt is

similar to external debt.

Internal debt. This logic does not work when internal debt is also possible. External debt differs from internal debt in that the latter is paid (and paid back) in nominal units (in nominal currency). We follow Bolton et al (2018), which does not consider internal debt. In their model internal debt is analogous to printing money. In some of our model's variations (when slightly changing the government objective function, for example) one can show (available upon demand) that internal debt is equivalent to issuing warrants on a corporate level. Warrants are typically not a part of the traditional debt-equity choice models since it involves other consideration like the control rights of shareholders (see Kalay and Zender (1997)) which may be affected when corporations issue warrants instead of traditional equity. This aspect of capital structure choice is considered less important compared to other issues and so warrants are rarely included as part of major discussions related to the pecking order theory or other capital structure theories for corporations. Including warrants in traditional debt-equity choice models sometimes produces interesting results, such as Green (1984), but the main results of POT about the dominance of debt over equity is generally unaffected. By analogy, including internal debt will not have significant implications regarding the main results of our model. In this paper we suppose that only external or indexed debt is possible. The interpretation is that internal debt is theoretically limited by the amount nominal money while sovereign debt and money issues are not limited.

Two periods. An interesting extension is a two-period model. For example, one can assume that in each period the government has an investment project. If one country has a higher expected GDP in each period than another country then the result of the basic model holds (proofs are available upon demand): debt dominates seigniorage. However, if one considers different scenarios, for example, when one country (can be called growing country or developing country) has a lower GDP in period 1 and a higher GDP in period 2 than another country (can be called stagnating country), one can show that a separating equilibrium can exist where the developing country type will tend to issue debt while the stagnating one will issue money. This can produce so far nontested hypotheses about the link about government financing policy and the country's GDP profile over time (for a similar analysis on corporate level see Miglo (2007) and Miglo (2012)).

6 Money for Government As Equity For Corporations: a Discussion.

In the introduction we began a discussion about the similarities between the sources of finance for the government and the corporation. Below we consider some differences between money and corporate shares. We argue that while formal differences between them do exist, they are less obvious if considered on a more abstract level.

1. *Money does not provide any dividends while shares do.*

Only 20% (Fama and French (2001)) of corporations pay dividends, although these dividends are not the most important part of equity revenue (capital gain is the most important part). The real value of money is equivalent to the share's price and the change in the real value of money is equivalent to capital gain. The government can distribute some "dividends" to people living in a country (moneyholders). As an example note lotteries or pension funds. On the corporate level, the amount of dividends is proportional to the number of shares. There exist some exceptions however. First, the company may issue different types of shares which will grant larger dividends to some shareholders. Secondly, informal differences exist when major shareholders or those who have control enjoy extra benefits, perks etc. at the expenses of minor shareholders (see, for example, Grossman and Hart, 1980; Burkart, Gromb and Panunzi, 1997, 1998; Shleifer and Vishny, 1997). The government "dividends" also depend to some extent on the amount of money. For example, one needs to buy tickets in order to participate in a lottery. The amount of government funded pension funds depends on the amount earned by individuals.

2. *Money provides no votes.*

Firstly, note the free-rider problem (see, for example, Grossman and Hart, 1980) - whereby the right to vote does not play a large role in the life of an enterprise. Secondly, money often provides power.¹³ Even though each individual has one vote, in reality money plays a large role during the electoral process or other issues related to government decision-making and control. Other things being equal, those who are able to accumulate larger amounts of money or find support from those with large amounts of money have an

¹³See, for example, Coleman (1986) for a detailed analysis of this idea. Note that personal wealth is probably a more precise parameter of power than money and the same could be true on a corporate level.

advantage.

3. *Corporations maximize profits while governments do not.*

Modern corporations are different than the smaller corporations that existed in the 19th century, when the decision making process was carried out by one person: generally the actual owner and manager. Now there are the managers who, while often partial owners, are separate from shareholders and act as the shareholders' agents. The same is true at the level of the government (managers), who maximize the wealth of the total population, who are in fact the moneyholders (shareholders). In the end the efficiency of government affects the economy efficiency, which in turn affects the government's ability to pay its debts as well as the real value of money and the amount of taxes. Note that the government can reduce tax rates (which will ultimately reduce the amount of collected taxes) during an improving economy. In the corporate case high efficiency ultimately leads to a larger amount of internal funds. The point however is that the government's major concern is not the amount of taxes it receives but rather the GDP or similar measures of the efficiency of the economy, whose increase should lead to higher taxes if tax rates remain unchanged. To see an analogy of a tax reduction on the corporate level imagine a multinational corporation that establishes a policy with its branches abroad regarding the percent of profit that a branch has to send to the head office. If one day they decide to reduce this percent the amount of cash available to the head office can decrease even if the corporation has been working more efficiently.

4. *In cases of insolvency, it is possible for a government to print money while this is impossible for corporations.*

First, in cases of insolvency, we know that corporations can and often do cover their debts by issuing new equity. Second this thesis means that it is impossible for a government to declare bankruptcy. But this is not true (Germany in the 1920s, Russia in 1917, 1998, Argentine etc.) Often the reason for this is that should a government prints money to cover bankruptcy, then the resulting costs of inflation become too high.

The goal of the next section is to provide further intuitions about possible applications of the traditional capital structure theory (debt-equity choice) on government financial policy.

7 Major Theories of Capital Structure and Their Possible Applications for Government Finance

1. *Trade-off theory.* In contrast to dividends, interest paid on debt reduces the firm's taxable income. Debt also increases the probability of bankruptcy. Trade-off theory suggests that capital structure reflects a trade-off between the tax benefits of debt and the expected costs of bankruptcy (Kraus and Litzenberger, 1973). There are two types of bankruptcy costs: direct costs (lawyer fees, the cost of bulk asset sales, court fees, etc.) and indirect costs (costs associated with: losing customers who might have been already worried about the company prior to the bankruptcy; higher interest rates required by bankers; reputation loss etc.). Can the concept of expected bankruptcy costs be applied to government finance? Expected bankruptcy costs depend on the probability of bankruptcy and the magnitude of bankruptcy costs. Similar to the corporation, the probability of government default increases with the amount of debt. With regard to the magnitude of bankruptcy costs note that that on a corporate level they depend on such factors as the tangibility of a firm's assets, the industry in which a firm is operating (Branch, 2002) etc. What about governments? Since most external loans are not easily enforceable, direct costs of bankruptcy may represent cost associated with the actual settlement of bankruptcy procedures which, unlike the cases on the corporate level, may include political conflicts and perhaps even wars. Goldmann (2012) argues, for example, that excessive sovereign debt leads to a higher risk of unrest and civil war. An example of politically motivated costs are Russian bonds issued before the Revolution of 1917, which could not be paid because the socialist government refused to pay for the debts of czarist Russia until 1995 (Oosterlinck, 2006). The concept of bankruptcy cost leads to the following possible implications for the government. Countries with tangible assets (government invested in industries with tangible assets) should borrow more. In general safer countries, countries with more political stability etc should borrow more. This is consistent with, for example, Aisen and Vega (1998). Also countries with high military power like, for example, Russia (who have presumably high direct bankruptcy costs from the lenders' point of view) should borrow less.

We disagree with Bolton et al (2017) that the trade-off theory of capital structure cannot be applied on a governmental level. Although there is no

direct implication of the tax idea for the government since governments do not pay taxes and government debt does not have any tax advantages. Indirectly, it may be related to the marginal costs and benefits of taxes in other forms. The decrease in the purchasing power of money after a money issue can be seen as an inflation tax (see, among others, Kiguel and Nuemyer (1989), Poterba and Rotemberg (1990)). In this case the optimal government budget policy would be determined by a trade-off between the inflation tax and the bankruptcy costs discussed above. This is analogous to the trade-off theory of capital structure at the corporate level. Alternatively, one can assume that the marginal costs of raising taxes is lower in countries with high debt and thus these countries should use debt less.

2. *Signalling*. In the pecking order model, good quality firms have to use internal funds to avoid adverse selection problems and losing value. These firms cannot signal their quality by changing their capital structure. Signalling theory discusses models in which capital structure serves as a signal of private information (Leland and Pyle (1977), Ross, 1977). Usually, the prediction of these models is that the market reaction on equity issues (or leverage-decreasing transactions) is negative and the market reaction on debt issues (more generally, on leverage-increasing transactions such as issuing convertible debt, repurchasing shares, and debt for equity swaps) is positive although the former has mixed evidence. An analogy on a governmental level is that the seignorage is a negative signal of a country's quality. Further research is required.

3. *Security Design, Informed Investors, and Information Production*. Investors such as banks can sometimes obtain information on a firm's quality and produce analytical information. Fulghieri and Lukin (2001) show that good firms want to partition their securities so that some claims are informationally sensitive. If the cost of becoming informed is low and the degree of asymmetric information is high, firms may prefer a higher information sensitive security to promote information production by "specialized" outside investors. This explains the negative correlation between debt and firm value because firms with low profitability do not need to issue equity, which is sensitive to a firm's value. Usually this theory predicts that younger firms or firms with good growth opportunities or more risky projects are more likely to be equity financed. These firms can be especially interested in information production by outside investors. On a governmental level, this idea may be related to extracting information from banks or foreign investors in terms of their private knowledge of a country's prospectives. So developing countries

or countries with growing GDP should print more money.

4. *Market timing.* The decision to issue equity depends on stock market performance (Lucas and McDonald, 1990; Korajczyk, Lucas, and McDonald, 1992). This idea did not become a major capital structure theory, called “market timing”, until Baker and Wurgler (2002). Usually this theory predicts that when the economy is bad or the stock market is not doing well or a firm’s stock is not doing well, firms will not issue equity. When the economy is booming, equity issues are large. Empirical work by Choe et al. (1993), Bayless and Chaplinsky (1996), and Baker and Wurgler (2002) suggests a positive relationship between equity issues and the business cycle.

Applying similar ideas on a government level leads to the following. Countries maybe interested in using more external financing when their earnings (GDPs etc.) are high. On the debt side, a country maybe intersted in issuing debt when interest rates are low and bonds values are high. Recent political and economic events illustrate the following. One of the key points of Trudeau’s campaign in the 2015 Canadian election was often mentioning the fact that Canada’s debt/GDP ratio is low compared to other developed countries and secondly that current interest rates are low and thus the Government should use it to borrow and finance investments in infrastructure.¹⁴ The second example is Donald Trump’s 2016 US presidential campaign. Speaking of large government debt, Trump suggested that an increase in interest rates will reduce the value of debt. which can be used to renegotiate and purhapse repurchase debt.¹⁵ Market timing theory and the bankruptcy costs idea discussed previously (recognizing that high debt is detrimental to the economy and the country, i.e. rating agencies reduced the US credit rating based on an increasing bankruptcy probability) can be relevant to this argument. It is also related to the flexibility theory, which we will discuss later (recognizing that a very large amount of government debt reduces government flexibility in terms of available choices and that reducing debt (even using non-traditional [from classical politician’s point of view] measures) maybe beneficial).

Similarly since asymmetric information should be reduced after an information release, this should be a good time to conduct equity issues. As time passes, managers receive new information and the degree of asymmetry increases. Thus, the magnitude of the price decline associated with a

¹⁴<http://www.theglobeandmail.com/news/politics/what-the-liberals-economic-plan-would-mean-for-canada/article26838610/>

¹⁵<http://www.npr.org/2016/05/09/477350889/donald-trumps-messy-ideas-for-handling-the-national-debt-explained>

stock issue announcement should be positively related to the time between the last information release and the issue. Korajczyk, Lucas, and McDonald (1991) find that equity issues tend to cluster early within a quarter, which is consistent with the release of quarterly earnings announcements, and that issues trail off near the end of the quarter. Also, few firms issue equity before releasing their annual report and larger firms, which suffer less from asymmetric information, tend to issue equity later. One interpretation is that overvalued firms always issue equity. Undervalued firms may wait until the cost of misvaluation is low enough to be outweighed by the benefits from new projects. Similarly if the arrival of growth opportunities is independent of price history, then overvalued firms will experience average performance before the issue. Undervalued firms will have above-average performance as they wait for the price to improve before they issue equity. Thus, on average, positive abnormal returns precede equity issues. The evidence confirms this prediction (Korajczyk, Lucas, and McDonald, 1990; Loughran and Ritter, 1995). On a government level, countries should use seigniorage when the currency is overvalued and/or if moneyholders have been enjoying high returns in the near past. Also seigniorage should be conducted closer to GDP announcements, when there is good news about GDP etc.

Ritter and Welch (2002) provide evidence that stock returns of companies issuing new shares underperform in the long run compared to that of non-issuing firms. This new issue puzzle suggests that investors purchasing shares of initial public offerings (IPOs) or seasoned equity offerings are irrational because they have lower returns compared to investments in shares of non-issuing firms. Eckbo, Masulis, and Norli (2007) and Carter, Dark and Sapp (2009) note, however, that one needs to estimate the risk of those firms to provide a correct interpretation of long-term underperformance of newly issued stocks. Miglo (2007) suggests a rational model explanation. An analogy on a government level would be that countries using seigniorage underperform in the long run compared to other countries.

5. *Agency-based theories of capital structure.* Agency problems that affect capital structure can arise from either shareholders-manager relationships or shareholders-creditors relationships. In the former case, shareholders are the principal and they do not have direct control over the manager's actions (agent). In the latter case creditors (principal) cannot control the actions of the shareholders (firm's owners) responsible for major decisions. Agency costs arise because managers do not necessarily act in the best interests of the shareholders who also may not act in the best interests of creditors. There

are two major types of conflicts between shareholders and creditors: asset substitution and debt overhang.

5.1. Asset substitution

If an investment yields large returns, equity holders capture most of the gains. If, however, the investment fails, debt holders bear the consequences. As a result, equity holders may benefit from investing in high risk projects, even if the projects are value-decreasing. Jensen and Meckling (1976) call this the “asset substitution effect”. Debt holders can correctly anticipate equity holders’ future behavior. This leads to a decrease in the value of debt and reduces the incentive to issue debt.

The implication of this idea on a government level means the following. Suppose that the government has a lot of debt to pay. The government has no revenue available and therefore the risk that the country will have to issue a lot of money in order to be able to pay for its debt is very high. This would lead to high inflation, a decrease in the real value of money etc. In these conditions, the government that predicts that the likelihood of such a scenario is very high can be engaged in high risk projects. High risk means that with some small probability the GDP of the country will be very high and the government will be able to pay back its debt without causing hyperinflation etc. Note that on a government level the definition of a project can have a different meaning than on a corporate level. It may include things like wars. If it is the case then one should observe a positive correlation between the level of debt and the likelihood of initiating a war. As was mentioned previously, Goldmann (2012) argues, for example, that excessive sovereign debt leads to a higher risk of unrest and civil war. Further research is required. If this mechanics takes place indeed then the implications of it from the optimal financing point of view is that if a country has a lot of risky choices (from an investor’s point of view) then this country should use less debt. Otherwise countries with high debt would invest in very risky projects.

5. 2. Debt overhang

The asset substitution problem occurs when firms invest in projects with negative NPV, while the debt overhang problem occurs when firms do not invest in projects with positive NPV. Equityholders may underinvest, which is, pass up profitable investments because the firm’s existing debt captures most of the project’s benefits (Myers, 1977). If a firm has issued senior debt, the equityholders may pass up positive NPV investments. An intuitive explanation of debt overhang problem is provided below. Recall that the NPV

of a project is sometimes different for shareholders and creditors. Since the board of directors usually acts in the interest of the shareholders, a firm will choose projects with the highest earnings for shareholders. The problem is that projects with positive NPVs (for the firm as a whole) sometimes have low payoffs to the shareholders and junior creditors. In the real world, debt typically has covenants preventing issues of new debt of the same or higher seniority as the existing debt. Although one would think that the existing creditors would be willing to renegotiate these terms since the investment makes everyone better off, it usually does not happen. Financially distressed firms represent a good practical implication of the debt overhang problem. It is very difficult for firms to obtain new funds when the firm is in financial distress and the existing debtholders have a high risk of losing money. These firms have to cut capital expenditures and R&D. It is also found that firms that are financially constrained may have a harder time responding to competition because firms with higher leverage cannot respond to competitors' price changes. This is because any price decrease is in fact an investment because the firm loses funds in the short term. Evidence of this can be found in studies in the supermarket and trucking industries. Higher debt increases the likelihood of debt overhang. Debt overhang may exist in the form of passing up positive NPV projects or paying excessive dividends to shareholders. The main implication of the debt overhang idea is that firms with need for flexibility should borrow less.

On a government level, a high level of debt may lead to passing up good investment projects. So countries that need flexibility the most (for example, countries with high levels of public investments) should avoid using debt. Empirical evidence seems to be consistent with this logic. For example, Xu, Kim and Moussawi (2016) mentioned that rising interest costs would force reductions in government programs.

Debt overhang has several other implications on a corporate level. The firm can, for example, ask existing (incumbent) creditors for an additional financing. Or lenders can commit to additional financing when the first loan is granted. This can also help resolve a debt overhang problem. This idea can work well for governments because it is harder for them than for corporations to enforce debt payments. So debt renegotiations are more likely to occur on a government level.

Note however that the process of debt renegotiations has its own problems. On the corporate level these negotiations are costly and sometimes not feasible. The reason for this is because creditors are often dispersed, making

it hard for all of them to negotiate and creating conflicts of interest among themselves. One other problem that occurs is that creditors have doubts that their funds will be used for a “good” project. However, if the number of initial debtholders is large, then the free-rider problem can appear: it is in the interest of the initial debtholders to put up the money collectively, but it is not in the interest of any one of them to do it alone because the new debt has a negative NPV (face value of debt is below the cost of investment). So the shareholders may find it hard to convince the creditors to invest in the new project. The implication of this point on a corporate level is that the cost of negotiation, the ability of parties involved to renegotiate, their powers etc. should affect the outcome of the initial debt agreements. In particular, if the lenders feel that the borrower has a lot of power and it will be hard to enforce the debt then the cost of debt should increase. Applying similar logic on a government level leads to the point that the cost of debt should be higher for countries with high negotiation power. An example are some arguments used by president-candidate D. Trump in his 2016 campaign. He argued that US debt should be renegotiated and it can be done efficiently and he is the best person for this because he has a lot of experience and skills in debt renegotiating. Another implication on a government level is that in order to facilitate coordination between multiple creditors to the same country and reduce the risk of the free-rider problem etc, such institutions as creditors clubs (Paris) have been created to make sure that creditors have similar opinions.

A special case of the debt overhang problem arises when firms are primarily interested in short-term earnings for shareholders instead of investing in more profitable long-term projects. This may take place when firm has long-term risky debt and investing in long-term project would create value for long-term creditors and not for shareholders. Long-term does not necessarily mean long-term in an absolute sense (like any debt with maturity more than 3 years) but rather with regard to alternative policy decisions available to the firm. Similarly the shareholders may prefer to invest in a less profitable shorter term project than in a more profitable long-term projects if the firm has issued long-term debt and investing in long-term projects is more beneficial to creditors. A popular topic for financial journalists since the late 1980s has been the perceived short-sightedness of American businesses. This problem occurs when firms invest in projects that are profitable in the short term compared to the long term, because of the maturity of the high amounts of debt within the corporation. Applying similar logic on a gov-

ernment level leads to the point that countries with high debt may prefer shorter-term investments than is optimal (see, for example, Leeper, Walker and Yang (2010)).

The following are some of the ways to mitigate the debt overhang problem. 1. Dividend covenants, which is a restriction where dividends are not allowed to be paid until the claim is paid to debtholders. These covenants limit the ability of shareholders to pay high dividends and force them to invest in positive NPV projects. 2. Banks and privately placed debt can eliminate the free-rider problem and cheating by shareholders/managers since banks or private lenders have more incentive and skills to monitor borrowers. In highly leveraged firms, there is more of an incentive for managers to cheat. This happened at Enron, and led the company to bankruptcy in 2001. 3. “Debtor-in-possession” (DIP) financing rule in US Chapter 11 bankruptcy. Project financing creates a direct link between financing received and the performance of the project where these funds have been invested unlike regular corporate debt where the probability of paying this debt back depends also on the firm’s overall performance. 4. Most commercial mortgages contain covenants that protect the lenders from the kind of behavior associated with underinvestment in building maintenance. Often it eliminates the incentive to cut maintenance by restricting the payout to the partners (dividend covenants). 5. Use of short-term debt to mitigate debt overhang if the debt maturity is before the decisions about new projects are made.

Can one use similar logic on a government level in order to prevent a debt overhang problem? For example, dividend covenants or other debt covenants are equivalent to some conditions that are often a part of external debt contracts, eg no seigniorage condition until debt is paid or requirements to follow market reform (asset covenant) etc. Examples represent EBRD or World Bank loans to Eastern European countries in early 1990s.

5.3. Shareholders-manager conflict.

Theories of capital structure based on an entrepreneur’s moral hazard problem with regard to her choice of effort, have also suggested explanations for the link between firm performance and the debt-equity choice. Jensen and Meckling (1976) underline the idea that an equity issue decreases the manager’s stake in the company and reduces the incentive to undertake value maximizing projects. This results in the after issue underperformance of the firm. Does this point work for governments? If yes then it means that printing money can increase the risk of the incumbent government losing power if the money is accumulated by a few rich people who influence the

government etc. This may reduce the incentive for the incumbent government to work in the interest of the country and not in their own interest. We do not know any empirical evidence confirming or rejecting this idea. or excessive usage of money in an inefficient way (similar to high dividends on a corporate level): politicians spending money on their own projects.

Jensen and Meckling (1976) also point out that when a firm can be financed with risk-free debt, the risk-neutral entrepreneur will choose his effort optimally. Innes (1990) extends the analysis by allowing a large set of possible contracts and shows that risky debt is still optimal. Jensen (1986) argues that debt improves the discipline of an entrenched manager. The evidence confirms that firms use leverage as a disciplinary device for managers. For example, firms reduced their leverage after the Sarbanes-Oxley Act (2004) that required more reliable financial information and hence reduced the extent of agency problems (Bertus, Jahera, and Yost, 2008).

Applying this argument on a government level leads to the following. Governments whose countries' performances depend strongly on their own performances are subject to these kinds of problems. So they should use more debt. One can consider a situation where a government has to choose between different expenditure possibilities (different projects) and it has private benefits which do not necessarily correspond with the common optimality of choice (like a moral hazard at the government level; see also Helsley and Strange (1998) about private government). For example, some government members can be interested in financing some enterprises closer to the areas of their personal interests etc. Applying the debt and discipline idea to governments leads to the point that governments that are subject to a higher degree of moral hazard should benefit from a higher level of debt. Governments that do not have debt are not as efficient as governments that do. Presumably it works until debt becomes unenforceable. If there is too much debt then the debt becomes uncontrollable and is unlikely to have the power to be used as a disciplinary device (similar to debt overhang problem discussed above).

6. *Flexibility theory of capital structure.* Flexibility theory is related to the debt overhang idea and it suggests that if a firm has too much debt or it does not have any credit experience it will be harder for them to obtain loans when necessary. Firms therefore preserve debt capacity or hold back on issuing debt because they want to maintain flexibility. Firms maintain excess debt capacity or larger cash balances than are warranted by current needs, to meet unexpected future requirements. While maintaining this financing flexibility has value to firms, it also has a cost; the excess debt capacity

implies that the firm is giving up some value and has a higher cost of capital. Some predictions of this idea are that other things remaining equal, firms that operate in businesses where projects earn substantially higher returns than their hurdle rates should value flexibility more than those that operate in stable businesses where excess returns are small. Also if flexibility is viewed as an option, its value will increase when there is greater uncertainty about future projects; thus, firms with predictable capital expenditures should value flexibility less. Also the greater the capacity to raise funds, either internally or externally, the less is the value of flexibility. Some implications of this result are as follows. Firms with significant internal operating cash flows should value flexibility less than firms with small or negative operating cash flows. And firms with easy access to financial markets should have a lower value for flexibility than firms without that access.

Applying similar logic to governments leads to the following. Countries that have a lot of efficient public projects available should borrow less. Countries with good debt capacity (good rankings for example) can borrow more.

7. Other theories.

7.1. Life cycle theory of capital structure. Life cycle theory of capital structure argues that besides financial flexibility there are other factors that can explain financing patterns of firms in different stages of their development (Damodaran, 2003). Start-up firms do not have much profit, so the tax advantage of debt is not as important as it is for a mature firm. Start-up firms do not require incentives for managers since there is no large separation between ownership and management like in the case of big public corporations. This leads to the idea that mature firms value debt more compared to start-up firms. To what extent the life cycle theory represents a separate theory of capital structure rather than a combination of arguments from other theories remains an open question. Young countries should have lower debt compared to older countries.

Applying this idea to governments leads to the following. Countries with good credit ratings and low bankruptcy costs should borrow more. Countries with bad credit ratings should print more money.

7.2. Theories of capital structure based on corporate culture and history. Krepes (1990) argues that costly communication inside the firm creates and incentive for corporate culture. Hermalin (2001) argues that corporate culture is an important determinant of corporate governance and corporate finance. One prediction of this theory is that the capital structure policy of a firm that has a parent company can be explained by the capital structure policy of the

parent company because they usually have similar corporate cultures. This prediction finds some support in Cronqvist, Low and Nilsson (2009). Other predictions of this theory are that corporate culture can be more important for capital structure policy in large and/or mature firms.

Applying this idea to governments leads to the following. Countries with a high degree of risk tolerance borrow more-US etc. Countries with a risk averse culture (Germany, Japan) borrow less.

Lemmon, Roberts and Zender (2008) argue that a major determinant of capital structure is debt policy and more specifically debt structure prior to IPO. Firms with low leverage prior to IPO tend to have low leverage subsequently and vice versa. More theoretical papers addressing the impact of corporate culture and firm history on capital structure policy are expected.

Applying this idea to governments leads to the following. Countries with traditionally low debt should have low debt and vice versa.

7.3. Control-based theories of capital structure. Harris and Raviv (1988), Aghion and Bolton (1992) and Hart (1995) argue that firms issue debt as a tool to establish an appropriate control structure. Aghion and Bolton (1988) and Hart (1995) are based on incomplete contracts between firm claimholders. In an environment where complete contracts are impossible to write, the question of ownership is crucial because it establishes the residual decision-maker. Issuing debt establishes an efficient control structure by giving control to debtholders when a firm is in financial distress. Literature based on incomplete contracts has had some success in explaining the life cycle theory of capital structure (Fluck, 1999). More theoretical papers are still expected. Lemmon, Roberts and Zender (2008) mention that this literature can also contribute to the explanation of persistency in observed capital structure policies.

Applying this idea on a government level leads to the following. Countries that care about keeping control of the current government or, more generally, keeping the current regime should avoid seigniorage and use more debt in order to reduce the risk of losing control.

8 Conclusions.

In this article we argue that asymmetric information can explain why seigniorage is an inferior choice to debt for governments. We also argue that the Ricardian equivalence is very similar to the Modigliani-Miller proposition. Our

model is based on Bolton et al (2017) in that money for governments has many similarities with equity for corporations. In contrast to their model, in our model economic agents are rational. We also provided a discussion of potential implications of other capital structure theories developed on a corporate level but applied to government finance. Some empirical evidence seems to suggest that the area of research related to the application of microeconomic foundations, and in particular capital structure theory, on governments is a promising direction for future research.

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