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Why do public bodies need equity and how much do they need?

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Abstract:
Until now, very little research has been published on the optimal capital structure of public organisations. Although there are several empirical studies of local government debt, a good analysis of the optimal capital structure is lacking. Debt theories for national governments and capital structure theories for firms do not apply to individual public institutions. In this paper, an attempt is made to develop a theory of the optimal capital structure for public bodies. Subsequently, a generalised framework to calculate and evaluate the (optimal) capital structure is presented.

Keywords: capital structure, public debt, financial resilience, equity public bodies, financial capacity

1. Introduction

Why do public bodies[1] need equity and how much do they need? Surprisingly, there is very little research published which attempts to answer this question. This is in contrast to the amount of research done regarding equity (or capital structure) of firms. Since Modigliani and Miller published their famous article in 1958, an extensive literature has accumulated on this subject.

The literature about the optimal debt level of central governments or of the public sector as a whole began centuries ago and may be even more extensive. Debt theories for central governments try, although not explicitly, to establish the optimal capital structure of central governments or the public sector as a whole, given the expenditure level.

However, debt theories for central governments and capital structure theories for firms do not apply to individual public bodies. Therefore, new theories need to be developed to evaluate the capital structure or the optimal debt position of individual public bodies. This paper does not

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[1] When referring in this paper to the public sector or public bodies, central governments are not included.

examine the total amount of capital needed, because this question is more related to the question of the optimal size of government and the choice of how to spend (capital versus consumption goods).

This paper is organized as follows: Chapter 2 gives an overview of the literature on the capital structure of non profit institutions. Chapter 3 establishes those capital structure theories for the private sector and the debt theories for central governments do not apply to individual public bodies.

Chapter 4 is divided into three sections. Section 4.1 tries to answer the question of why public bodies need equity by looking at the functions equity fulfills. Besides the financing function, equity has a buffer function. Furthermore, equity can be used to generate income (by reducing interest costs) or to smooth taxes. Section 4.2 discusses the disadvantages of having equity. Section 4.3 tries to determine the optimal capital structure.

In many countries, bankruptcy of a public body is considered undesirable. To avoid bankruptcy, a public body needs to be able to withstand the risks it can incur. Chapter 5 introduces the concept of financial resilience. This concept links risks incurred by public bodies to their capacity to withstand them.

Chapter 6 describes a method of estimating financial resilience. This method not only calculates long-term financial resilience, but also captures the dynamics of financial resilience in time. The model enables public organizations to analyze their present financial resilience. The impact of newly proposed policies or changing risks on the financial resilience can be calculated in the model as well.

2. Literature overview

Studies of the optimal capital structure of public organizations are virtually non-existent. Denison and Hur (2002) claim to develop a theory of the optimal capital structure of local governments. In fact, their theory states that, when no income taxes have to be paid over the interest on local government bonds, low income households prefer local government debt financing and high income households prefer taxes.

A few articles focus on the level of equity a public or non-for-profit organization needs, but do not search for the optimal capital structure. Tuckman and Chang (1991) and Charity Commission

(1997, 2002, 2003) conclude that the level of equity should be sufficient to withstand setbacks. Charity Commission (2003) also mentions other functions equity can have, such as reserves for regular, short term fluctuations, reserves to help plan growth or to grasp opportunities, reserves for specific future projects, reserves for generating income and reserves to exert influence or power over other charities within their area of activity.

Based on the conclusion that a sufficient level of equity is needed, Feenstra and Van Helden (2003) present two models which calculate the minimum level of equity needed to secure the continuity of Dutch academic hospitals. In one of the models they take into account the time an organization needs to adjust itself after a financial setback. Feenstra and Van Helden were not the first to recognize the importance of the time dynamic aspect. According to Lorig (1941) "Most of the expenditures of a municipality are inevitable and must be met. A city could not do without police and fire protection, sanitary and health service, relief, etc. even for a short time." Therefore, he concludes, a city should not only meet its current expenditures and liabilities, but also its future ones. Also, he adds, the current and future resources should be taken into account.

An organization with a weak financial position (financial vulnerable) has a higher chance to go bankrupt and/or faces more problems attracting capital. This endangers the continuity of organization and increases the cost of capital. Several articles suggest measures for financial vulnerability.[2] Financial vulnerability is often captured by a set of indicators. Equity, debt, tax capacity, deficit and the ability to economize are a few of the mentioned indicators. The organizations are generally placed on a scale based on their relative position to other comparable organizations. These articles do not define an absolute measure for the financial vulnerability.

None of these articles discussed the optimal capital structure of public bodies. In this article, an attempt is made to develop such a theory. In the last chapter, a general model to calculate the optimal capital structure is developed, including the relevant factors mentioned in the articles above.

[2] Van Helden (2000) or see Van Peteghem and Christiaens (2005) for an overview.

3. Existing capital structure theories

3.1. Definition capital structure

A balance sheet can be drawn for every organization or individual. On the left hand side, one can place all their assets, on the right hand side how these are financed. The right hand side of the balance sheet can be divided into equity and liabilities. Equity of firms consists of reserves and capital stock. Public organizations, in general, only have reserves. The level of equity can be determined by subtracting liabilities from the total value of the assets. The term "capital structure" is used in this paper for the ratio between liabilities and equity.

Capital structure theories for firms try to establish the optimal capital structure for them, given the expenditure level. Debt theories do the same for central governments. Although most debt theories do not explicitly mention the level of equity or the solvability, they implicitly do so. Given the total amount and type of expenditure, the volume of capital needed is known. The debt theories try to establish an optimal level of debt, which subsequently results in the level of equity needed.[3]

The characteristics of local governments and other public organizations sometimes resemble those of firms and other times those of central governments. In some cases their characteristics are unique. The singularity of public bodies makes the existing capital structure theories inapplicable, as will be shown in the following sections.

3.2. Debt theories

Debt theories are concerned with the influence of the capital structure of central governments on welfare and the distribution of welfare over time. Keynesians argue that government debt has no influence on the welfare over time. Their argument is that the creditors of public debt are the same as the taxpayers.[4] This, to a certain extent, might be the case for central governments. However, it generally is not so for other public bodies. A municipality, for example, does not have a local capital market. Hence, the Keynesian debt theories do not apply to public bodies. Moreover, a large part of the investments by local governments leaks away to neighboring

[3] Some authors are of the opinion that the net value of governments needs to have a more prominent role in the debt debate. Boskin et al. (1987), Buiter (1983), De Kam et al. (1990), Eisner (1985, 1986), Eisner and Pieper (1984), Van Muiswinkel (2002).

[4] Elmendorf and Mankiw (1998), De Kam et al. (1990).

districts due to the relatively small size of these governments. Of every euro spent within a province of the Netherlands, for example, about half leaks away.[5]

Classical economists believe that public bodies can only disrupt the capital market. This disruption should be kept to a minimum. Public bodies should not take on debt at all, or only for productive investments. They argue that public debt crowds out private investments. However, the influence of individual public bodies is too small to have any significant influence on the capital market or economy.

The Ricardian equivalence theory argues that citizens anticipate the fact that future taxes go up to pay off debt. Hence, it does not matter if public expenditure is financed by taxes or debt. This theory is based on, among other things, the following three assumptions. First, the present citizens are the same ones who carry the burden. This is already doubtful for nations, let alone local governments or other public bodies. In the Netherlands, every year on average four percent of the population moves to another municipality.[6] Secondly, the theory assumes that citizens are aware of the volume and development of government debt. Thirdly, citizens adjust their saving habits based on the level of government debt. Allers et al. (1998) prove that these last two assumptions are not true in the case of the Dutch national government. It is doubtful that these assumptions hold true for the local governments or non-governmental organizations, especially when taking into account that the national budget deficit is much more of a topic in the media than the increase or decrease of the debt of other public institutions.[7]

3.3. Capital structure theories

There are two mainstream areas in the capital structure literature of firms, the trade-off theories and the agency theories. Modigliani and Miller (1958) constructed a model in which the optimal capital structure of firms could be determined by looking at the total of cost capital (equity and debt) given a certain capital structure. This model became the basis for research to the capital structure of firms. Many economists tried to relax the strict assumptions of the Modigliani and Miller trade-off theory.

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[5] CBS and RUG (1999).

[6] Statistics Netherlands, www.statline.nl.

[7] Because Dutch public bodies use the accrual system, changes in the volume of debt are seen as less relevant.

Jensen and Meckling introduced a new concept in 1976, called “the agency theory”. According to this literature, agency costs depend on the capital structure of the firm. Agency costs are the costs connected to asymmetric information between the different interested parties. Asymmetric information refers to the situation that different interested parties, the principal and the agent, have different information and diverging objectives. Each party will try to maximize his own welfare.

But why can these theories not be applied to public bodies? The risk of a company going bankrupt is acceptable as long as the expected return rate of the invested capital is high enough. Haugen and Senbet (1978, 1979 and 1988) argue that bankruptcy is even irrelevant. A firm that goes bankrupt only changes its owners. The creditors become the new owners and the production process can go on, if possible. Creditors of public debt cannot take over the ownership of public organizations. Furthermore, bankruptcy of public organizations is not seen as an option in many countries.

Another difference between public organizations and firms is that public organizations are income-spending entities, whereas companies are income-earning entities. Firms cannot cut back costs when efficiency is already optimal, because decreasing production or quality reduces income by at least the same amount. Public organizations can often reduce costs by adjusting quantity and/or quality of provided services, without their income decreases by at least the same amount. Many public organizations are also able to increase their income without increasing costs, because they often have a monopoly on the provided services or can raise taxes and/or levies.

4. Why public bodies need equity

Why do public organizations need equity and how much do they need? To answer this question one should first determine which purposes equity can serve. Section 3.1 discusses the purposes equity has and the minimal level of equity desired for these purposes. In this paper the assumption is made that public bodies need enough equity to secure the continuation of the public services provided. This means three things. First, a public body needs enough capital (equity and liabilities) to finance the assets needed for its production process. Secondly, a public body needs to be able to raise sufficient income to provide the public goods. Thirdly, a public body needs equity to avoid bankruptcy.

Section 3.2 looks at the disadvantages of having too much equity. Section 3.3 determines the desired level of equity of a public body, taking into account the functions and disadvantages of equity and the fact that equity can fulfill different functions at the same time.

4.1. Functions of equity[8]

Buffer function

Public bodies need financial resources to meet potential future setbacks and/or losses in order to guarantee the continuity of the public administration. Equity of public bodies therefore has a buffer function. Equity is not the only financial buffer public organizations have. Local authorities for example can raise taxes or tap other income sources. Furthermore, public organizations are often able to cut back costs or stop producing some of their public goods or services without losing an equivalent amount of income.

The minimum level of equity needed is the level that guarantees to a sufficient degree the continuity of the public activities. The minimum level of equity therefore depends on, among other things, the risks of the organization.

Financing function

Equity has by definition a financing function. After all, all equity and debt is used to finance public assets. Less equity caused by setbacks or non-funded expenditures need to be refinanced by debt.

The minimum level of equity needed for the financing function equals the total value of assets needed, minus the borrowing capacity of the organization. The borrowing capacity depends on the chances of an organization to go bankrupt and therefore on its financial buffer. After all, creditors are willing to provide cheap capital as long as an organization has sufficient resources to set off potential setbacks.

Expenditure or tax smoothing function

An organization has the possibility to save money before spending it. When an organization saves money in order to spend it later for incidental expenditures, one can speak of equity with an expenditure function. In this way, income does not have to follow the same pattern as

[8] This section is based on Gerritsen (2000) and Gerritsen and Allers (2001)

expenditures. This enables a public organization to smooth taxes. In addition, public organizations do not have to spend surpluses as soon as they arise, but can rather save them for a more convenient time.

The minimum level of desirable equity depends on how much equity is needed for tax smoothing, which, of course, can differ each year.

Income function

A public organization does not pay interest or dividends on its equity. The saved interest can be used in different ways. The interest can be added to the equity, or it can be used for financing structural or incidental expenditures. Equity has an income function when its proceeds are used for financing structural expenditures. In this case, equity cannot be used for anything else. When this equity is used for financing expenditures or a setback, a deficit occurs. This deficit needs to be counteracted by increasing income or cutting back on other public goods.

As long as an organization can create enough income for necessary expenditures, it does not need equity for the income functions. The level of equity for income function must at all times (also after setbacks) be adequate to finance the necessary expenditures. The level of equity needed for the income function depends on the interest it needs to save to equal total costs and income.

4.2. Disadvantage of having too much equity

Section 4.1 discusses the minimal level of equity needed. However, having too much equity can also have disadvantages.

When we assume that equity of public bodies ultimately belongs to their citizens, saved interest can be seen as hidden taxes. That is, citizens could have invested the money themselves (or spent it). By using saved interest to finance public services, the level of taxes and levies paid is lower than the total cost of those services. If voters do not recognize that there are hidden taxes, which is quite likely, they will choose a higher level of public goods than they would have, had they been completely informed. The costs of public goods, in this case, look lower than they actually are.[9]

[9] Allers (2000).

Another disadvantage of equity is that it creates an unbalance between the moment of benefit and the moment of paying for public goods. Citizens, who are no longer around, paid for public goods of present or future citizens.

An organization with a surplus of equity can, without the risk of endangering its continuity, easily spend money on undesirable projects. Politicians and/or employees of such a public organization might be tempted to purposely budget a prestigious project too low in order to get the project accepted or spend public money for their own benefit. Then politicians and/or employees benefit through better working conditions, prestige and/or more voters, while other stakeholders (the taxpayer) pay the price. This phenomenon is known as "rent seeking" or "agency costs". The danger of rent seeking might be bigger when an organization has more equity, because it faces less risk of going bankrupt. Furthermore, politicians and/or employees might be less critical of expenditures than an organization with less equity.

Both agency theory and mental accounting theory can give valuable explanations for the influence of the level of equity on agency costs. The lower the level of equity the higher the chances of bankruptcy are, or the chance that the organization has to fall back on guarantees given by a third party. In case of financial distress, the supervisor, media and others might try or demand more insight into the public organization's finances and especially in the reasons for that distress. This might lead to loss of face. A politician/employee will balance his potential prestige and electoral gain of extra spending with the costs of loosing face and loosing voters.[10]

The mental accounting theory[11] argues that the source and size of income influences expenditure decisions of economic subjects. An organization with a lot of equity might think it is rich and therefore can easily endure some setbacks. Such an organization will take on risks more easily, protects itself less against risks and feels less of a need to make (good) risk analyses (before initiating new projects). Furthermore, a "rich" government possibly has to make more costs to

[10] Dutch municipalities with financial problems can fall back on Article 12 of the Municipal Law. This allows them to receive extra money, but in return, they loose a large part of their autonomy. A participant of a discussion meeting organized by the Ministry of Home Affairs agreed that the instrument of blaming and shaming in case of Article 12-status works well. Managers and politicians of municipalities claiming Article 12-relief find the restrictions extremely unpleasant. In case politicians and managers believe they cannot be blamed for the financial problems, this blaming and shaming plays less of a role. (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties (2004, p. 29 and p. 34)).

[11] For an overview of the mental accounting literature, see Thaler (1999).

explain the necessity of a tax increase to its citizens.[12] An organization with large debt might be regarded as poor. Such an organization might face less problems and opposition from stakeholders when reducing costs.

4.3 Optimal level of equity

The marginal cost of equity is expected to increase with the solvability of a public body as discussed in section 4.2. The marginal cost of debt is constant or increasing, because the creditors' risk does not decrease when debt increases. The cost of capital is minimal when the marginal cost of equity equals the marginal cost of debt.

In this point, the capital structure is optimal when, and only when, the restriction that the continuation of the public services is secured, is satisfied. If the restriction is not satisfied, then the optimal capital structure depends on the minimal level of equity needed to secure the continuation. A public body needs, at all times, to be able to raise debt or have direct access to cash to ensure its continuity.

Creditors are only willing to lend to organizations if they believe their investment is safe or when the interest rate is sufficiently high. Hence, the public body needs a financial buffer to meet its potential future setbacks. Furthermore, an organization can have some equity to smooth taxes. Equity for the function of income is not generally wanted. The minimum level of equity equals the amount of equity needed for the buffer function, plus perhaps some equity to smooth taxes. The next chapter introduces a concept which links the risks of an organization with its financial buffer.

5. Financial resilience[13]

Financial resilience is the financial capacity of a public organization to cover its risks. Boorsma et al. (1983) were the first to introduce this term in relation to public organizations.[14] They acknowledged that solvability is important information in determining the financial situation of a firm, but that solvability for municipalities is largely irrelevant. The authors present a list of

[12] The publication of the individual equity levels of all Dutch municipalities (Gerritsen en Allers, 2001) received a lot of media attention. According to an alderman of one of the "richest" municipalities, they suddenly had to make a lot of effort to explain an already-proposed tax hike.

[13] This section is based on Gerritsen (2000) and Gerritsen and Allers (2001), Gerritsen (2003), Gerritsen and Sterks (2005).

[14] They coined the word 'weerstandsvermogen', which can be translated as financial resilience.

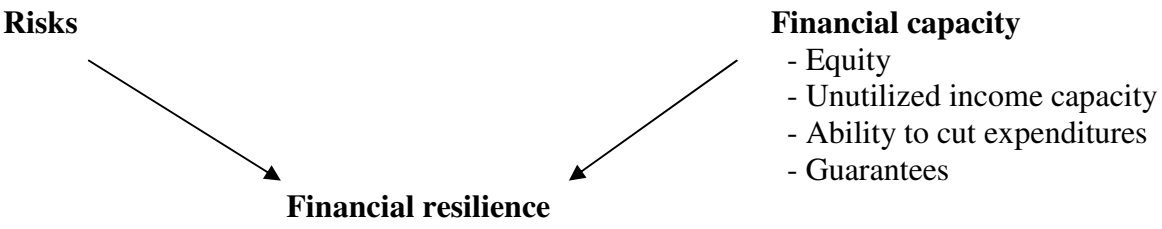
factors influencing the financial resilience of Dutch municipalities, such as unutilized tax capacity and guarantees. Feenstra and Van Helden (1999, 2002) discuss different frameworks for Dutch academic hospitals to determine how much equity they need to meet potential future setbacks. One of the models, the so-called "Coopers & Lybrand model", not only takes the possible setbacks into account, but also the time a hospital needs to adjust its expenditure level to a new income level.

Some public organizations have the opportunity to increase their income, for example by raising taxes, levies or prices of publicly provided goods. The concept of financial resilience incorporates all these aspects. The Dutch decentralized governments currently use this concept.

5.1. Concept of financial resilience

Creditors only provide capital to an organization if they can reasonably expect that the loan will be paid back with interest, or that liquidation of the public organization's assets generates enough money to pay off the loans. Therefore, risks incurred by a public organization must be balanced by equity, unutilized income capacity (e.g. taxes), possible expenditure cuts and guarantees, for instance from the central government.[15] Figure 1 shows the relation between risks and the financial capacity of an organization. The financial capacity of a public organization to cover its risks is called "financial resilience".

Figure 1



The financial capacity of a public organization consists of several elements. The first element is equity. The more equity an organization has, the less risk creditors run. When the creditors' risk

[15] Existing theories concerning public debt to date have never included the link between risks and required equity. Capital structure theories for firms clearly make this link, although not always explicitly. Feenstra and Van Helden (2003) and Tuckman and Chang (1991) are among the few to acknowledge this link for non-profit institutions.

of losing its investment is smaller, they will grant loans easier and charge less interest. Public organizations can, in general, increase their income or cut back on costs to counter setbacks. Thus, unutilized income capacity and ability to cut expenditures are also a part of the financial capacity of public organizations. The last element of financial capacity is "guarantees". An example for this is when a third party takes over an organization's financial commitments if that organization cannot uphold its obligations.

To guarantee continuity of operations, the financial resilience needs to be sufficient. So, given certain unutilized income capacity, a certain ability to cut expenditures and certain guarantees, the minimum level of equity needed can be calculated. The requirement of continuity puts a restriction on the desired capital structure. However, it does not imply anything about the optimal capital structure (see section 4.3).

On the other side of financial resilience are the risks. Public organizations deal with a large variety of risks. For determining the financial resilience, only those risks, which can have financial consequences, are relevant. When estimating the total risk, it is important to recognize that not all risks will happen at the same time, and that some risks can be correlated. Information on probabilities and magnitude of risks is generally not readily available. A discussion about the difficulties of quantifying the risks of public organizations goes beyond the scope of this paper. In the next section, we will focus on the elements of financial capacity.

5.3. Financial capacity

Financial capacity consists of four different elements: equity, unutilized income capacity, the ability to cut expenditures and guarantees.

Equity

Equity is not a physical chest of gold, which an organization can spend freely. Equity is nothing more than the difference between the value of assets and the value of liabilities. The largest bottleneck one faces when trying to value assets is that many public assets are barely tradable, or not at all. The value of roads, public greenery and some public buildings are hard to estimate, because there is no market for these goods. Not only is attempting to assess the value of public

assets difficult, but defining which assets should be taken into account to calculate the equity is equally complex.

Creditors are, however, only interested in those assets they can sell when a public organization goes bankrupt. Real estate, vehicles, furniture, and computers can be sold off easily. Parks, roads and some specialized equipment cannot be sold and are therefore not relevant for the financial capacity of public organizations.

The amount of equity, presented by public organizations on their balance sheet, generally does not reflect the amount of equity relevant for the calculation of the financial resilience. Accounting rules for public bodies are often less strict than those for firms. The rules are also at the root of the difference between the actual value of equity and the presented value on the balance sheet. Assets generally need to be valued at historical costs minus depreciation, while the market value often increases through time (e.g. by inflation).

Unutilized income capacity

Some public organizations can raise their income by raising taxes, levies or prices of publicly provided goods. The extra income an organization can make, minus the costs of collecting this income, is the unutilized income capacity. The size of unutilized income capacity can differ widely between public bodies. Local governments which can raise their own taxes can increase their income significantly, while other public organizations are restricted by the financial resources granted or by (maximum) tax rates or levies set by others.

Depending on the possibilities to raise income, it can either be easy or difficult to calculate the amount of unutilized income capacity of an organization. The tax rates of Dutch provinces are capped. This makes it easy to calculate the unutilized tax capacity. Dutch municipalities, however, can set their tax rates freely. At the moment there are no maximum rates. The unutilized income capacity depends on the tax capacity of taxpayers and on how much they are prepared to pay. People do not accept when their tax rates differ widely from neighboring municipalities.[16] On the other hand, an organization might face less resistance after raising taxes when the citizens

[16] Allers and Elhorst (2004) shows that Dutch municipalities mimic their neighbors' tax-rate. Allers also gives an overview of literature of mimicking by local authorities in other countries.

believe there are convincing reasons for it, for example when an organization is confronted by major setbacks.

Another problem for calculating the unutilized income capacity is that it is not constant in time. Citizens might accept a steady increase over time, while an abrupt tax hike can cause resistance. Moreover, regulations from the central governments may put restrictions on the moment and the number of times an increase can take place. Dutch municipalities have to set their tax rate before the beginning of the year. They are only allowed to lower tax rates after this deadline. Therefore, the unutilized income capacity is likely to be larger in the long run than in the short run.

Ability to cut expenditures

Some firms can reduce costs through expenditure cuts. However, lower quality or service levels will reduce sales and therefore income. When an efficient firm cuts back on costs, it will face at least the same decrease in income. Public organizations are often able to decrease the quantity or quality of their products and services without significant consequences on their income.

The ability to cut expenditures can also differ widely. While some public organizations have narrowly defined tasks, others have a broad mandate. Dutch authorities, for example, can partly decide which public goods to produce.

When calculating the total possible expenditure cuts, one should assume the fact that expenditures cannot always be reduced in the short run. A lot of the cost are fixed, because investment cannot be undone (e.g. sewerage). In the long run, the ability to cut expenditures is larger. Organizations can, for instance, postpone or even cancel the replacement of non-marketable assets.

Guarantees

In the Netherlands, municipalities with financial difficulties are bailed out by the central government. They are then placed under financial control of the central government. In return, it receives financial aid. Guarantees do not always have to be as specifically defined as for the Dutch municipalities. The guarantees can also be implicit, for example when it is clear that a public body in financial distress will be aided. A central government (or other institutions) will generally not let a police district, a fire department or an important hospital go bankrupt.

Guarantees can result in both public costs as well as gains. Public organizations that are backed by guarantees can borrow money cheaper than those who are not backed up. Suppliers of capital run less risk and therefore charge lower interest rates. Furthermore, less public capital needs to be fixed for the buffer function. The financial risk of a group of public bodies is lower than the sum of the individual risks of these public bodies.

On the other hand, guarantees can lead to the risk that public bodies invest in more risky projects, underestimate the costs of investments or produce a higher level of public goods than optimal. After all, the costs of failure are incurred by those who offer the guarantee, while the profit (in financial, prestige or political terms), in case of success, goes to the public bodies or its managers.

6. A model[17]

Financial resilience is traditionally calculated as the ratio of the net present value of the financial capacity and the net present value of the risks. By calculating the net present value, a large amount of information is lost. In theory, creditors base their interest rate on the financial resilience. In other words, creditors estimate the chance that a borrower will pay back the loan and interest.

The net present value method only calculates the financial resilience of a public organization at a certain point of time; it does not show the dynamics over time. The model presented here captures the dynamics over time. It can also calculate the effect of budgetary changes.

Guarantees are not included in the model for several reasons. Features of guarantees can differ for each guarantee. Guarantees can therefore not be modeled in a general way. Secondly, in some cases the guarantee makes the calculation obsolete. After all, the guarantee alone is already a sufficient buffer. However, calculating the financial capacity without guarantees can be valuable. A Dutch municipality in financial distress can always fall back on the central government. Municipalities, therefore, cannot go bankrupt and creditors will always be prepared to supply capital if needed. However, falling back on the guarantees can have huge (non-financial) disadvantages. The municipality loses a great deal of its autonomy. In these cases, an organization generally wants enough financial capacity to avoid using the guarantee.

[17] This chapter is based on Gerritsen (2003) and Gerritsen and Sterks (2005)

5.1. The model

Financial capacity (FC) is defined as an array in which the first element represents the financial capacity at time t, which equals the amount of equity it can have at this time. The second element is the amount of equity the public organization can have at time t+1 if it takes the necessary steps at time t, etc. The array can be written as follows:

$$FC_t = \begin{pmatrix} fc_{t,t+0} \\ fc_{t,t+1} \\ \vdots \\ fc_{t,t+N} \end{pmatrix}, \text{t } \varepsilon \text{ [0,1,2,3,…)}$$

Note that the financial capacity has two time dimensions. First the time (t) at which the financial capacity is calculated and secondly the time (t+s) for which the possible level of equity is calculated given the situation in time t.

The elements of financial capacity: equity (E), unutilized income capacity (U) and the ability to cut expenditures (A) are defined in similar ways:

$$E_t = \begin{pmatrix} e_{t,t+0} \\ e_{t,t+1} \\ \vdots \\ e_{t,t+N} \end{pmatrix}, \; U_t = \begin{pmatrix} u_{t,t+0} \\ u_{t,t+1} \\ \vdots \\ u_{t,t+N} \end{pmatrix}, \; A_t = \begin{pmatrix} a_{t,t+0} \\ a_{t,t+1} \\ \vdots \\ a_{t,t+N} \end{pmatrix}$$

Equity (E_t) is an array consisting of the elements $e_{t,t+s}$, s = 0,1,2,…,N. $e_{t,t+s}$ is the budgeted equity at time t+s, given the situation in time t. The unutilized income capacity (U_t) consists of the elements $u_{t,t+s}$, where $u_{t,t+s}$ is the unutilized income capacity that the organization at time t expect to have at time t+s. The ability to cut expenditures (A_t) consists of the elements $a_{t,t+s}$. $a_{t,t+s}$ are the gains from possible expenditure cuts at time t+s compared to the budget made in time t. The financial capacity can be calculated as follows:

$$(6.1) \quad fc_{t,t+s} = e_{t,t+s} + \sum_{i=0}^{s} u_{t,t+i}(1+r)^{s-i} + \sum_{i=0}^{s} a_{t,t+i}(1+r)^{s-i}$$

where r = interest rate

We assume that in the starting point equity stays constant through time. This means that the budget is balanced. The following equation holds:

(6.2) $e_{t,t+i} = e_{s,s+j} \quad , \forall i, j, t, s$

Assume the budget of the public organization is constant over time. There is no inflation and the ability to cut expenditures and unutilized income capacity are the same every year. Therefore,

(6.3) $u_{t,t+i} = u_{t+j,t+j+i}$

(6.4) $a_{t,t+i} = a_{t+j,t+j+i}$

It logically follows that the financial capacity does not change through time. In other words, the financial capacity (FC_t) in time t equals the financial capacity in time t+i (FC_{t+i}). See equation 6.5.

(6.5) $fc_{t,t+i} = fc_{t+j,t+j+i}$

EXAMPLE

Table 6.1 Elements of financial capacity at time t (in millions of euros)

	s=0	s=1	s=2	s=3	s=4	s=5	s=6	s=7	s=8	s=9	s=10
Equity	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Unutilized income capacity	0.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ability to cut expenditures	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Interest rate	5.0 %										

Table 6.1 presents some basic data for municipality X. X can have three million extra euros of income per year by raising its tax rates to the maximum rate allowed. The tax increase can take place no sooner than the following year (s=1). X can also decide to cut expenditures this year. This can lead to one million euros less cost the following year (s=1), two million euros less cost in the year after that (s=2) compared to the situation at time t, etc. The financial capacity is calculated in table 6.2 based on this information.

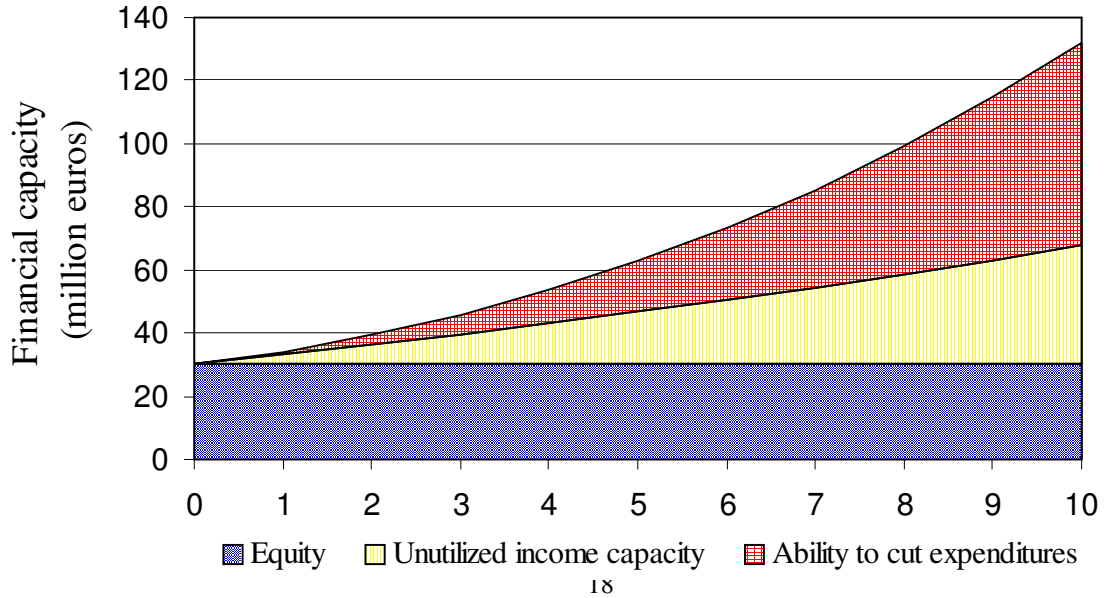
Table 6.2 Calculation of financial capacity at time t (in millions of euros)

	s=0	s=1	s=2	s=3	s=4	s=5	s=6	s=7	s=8	s=9	s=10
Equity	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Unutilized income capacity[1]	0.0	3.0	6.2	9.5	12.9	16.6	20.4	24.4	28.6	33.1	37.7
Ability to cut expenditures [1]	0.0	1.0	3.1	6.2	10.5	16.0	22.8	31.0	40.5	51.6	64.1
Financial capacity	**30.0**	**34.0**	**39.2**	**45.7**	**53.4**	**62.6**	**73.2**	**85.4**	**99.2**	**114.6**	**131.9**

[1] Cumulative amounts.

Because the budget is balanced, the budgeted amount of equity stays the same every year. Municipality X can raise its taxes by three million a year, starting the following year (s=1). Therefore, if X raises its taxes permanently, it can increase its equity in year one by three million euros. In year two, an extra three million euros worth of income can be created. Furthermore, municipality X receives interest or saves interest costs on the extra income received in year one. In year two, municipality X can have 6.2 million (3 + 3 + 0.05*3) euros more equity. The same calculation can be made for the ability to cut expenditures.
The financial capacity is presented graphically in figure 2.

Figure 2 Financial capacity at time t



6.2 Risks, utilizing income capacity and cutting back expenditures

When a public body experiences a financial setback, the financial capacity will be lowered according to the following equation:

$$(6.6)\quad \overline{fc}_{t,t+s} = fc_{t,t+s} - \sum_{i=0}^{s} (1+r)^{s-i} setback_{t,t+i}$$

$$\text{where } setback_t = \begin{pmatrix} setback_{t,t+0} \\ setback_{t,t+1} \\ \vdots \\ setback_{t,t+N} \end{pmatrix}$$

$Setback_{t,t+s}$ is the setback at time t+s, which is known or expected at time t.

A setback will not only lead to reduction of equity of the same amount as the setback, but also to a shortage of capital. Because a public organization cannot raise equity in the short-run, the shortage has to be replenished by raising debt, and more debt means more interest costs. To balance the budget the organization needs to increase its taxes, raise its prices or reduce expenditures.

As has been shown in this paper, the minimum level of equity needed to ensure the continuity of an organization determines the optimal capital structure (apart from some extra equity in order to be able to smooth taxes). By inserting the setbacks an organization faces in the worst case scenario, this minimum can be calculated.

In equation 6.7, expenditure cuts and income increases are added to equation 6.6.

$$(6.7)\quad \overline{fc}_{t,t+s} = fc_{t,t+s} - \sum_{i=0}^{s} (1+r)^{s-i} (setback_{t,t+i} + ec_{t,t+i} + inc_{t,t+i})$$

$$\text{where } EC_t = \begin{pmatrix} ec_{t,t+0} \\ ec_{t,t+1} \\ \vdots \\ ec_{t,t+N} \end{pmatrix} \le A_t \quad \text{,and } INC_t = \begin{pmatrix} inc_{t,t+0} \\ inc_{t,t+1} \\ \vdots \\ inc_{t,t+N} \end{pmatrix} \le U_t$$

Expenditure cuts are limited to the ability to cut expenditures and extra income cannot exceed the unutilized income capacity. After a tax raise or expenditure cut, the ability to cut expenditure and unutilized income capacity are lowered according to the following equation:

$$(6.8)\quad \bar{u}_{t,t+s} = u_{t,t+s} - \sum_{i=0}^{s} inc_{t,t+i}(1+r)^{s-i}$$

$$(6.9)\quad \bar{a}_{t,t+s} = a_{t,t+s} - \sum_{i=0}^{s} ec_{t,t+i}(1+r)^{s-i}$$

One can then prove that if setbacks are 0:

$$(6.10)\quad fc_{t,t+i} = \overline{fc}_{t,t+i}$$

Expenditure cuts and extra income planned in time t do not influence the financial capacity at time t. There is solely a shift from one element of the fiscal capacity to another (see difference between table 6.3 and 6.4). However, in the long run the fiscal capacity can be influenced. By definition the following equation must prove true (see for example table 6.4 and table 6.5, with j=5 and i=0):

$$(6.11)\quad e_{t+j,t+j+i} = e_{t+j+i,t+j+i} \quad \text{, if setbacks} = 0$$

In time t+j budgeted equity for time t+j+i equals the amount of equity present at time t+j+i given that the planned policies at time t+j, regarding expenditure cuts and income increases, come into effect and no setbacks occur during this time period.

EXAMPLE

Municipality X faces an incidental setback of ten million euros at time t and a structural setback of one million. If municipality X does not take countermeasures, its equity will decrease every year by the setbacks and extra interest costs by having lower equity.

Table 5.3 Calculation of financial capacity after setbacks at time t (in millions of euros)

	s=0	**s=1**	**s=2**	**s=3**	**s=4**	**s=5**	**s=6**	**s=7**	**s=8**	**s=9**	**s=10**
Equity	19.0	17.5	15.8	14.1	12.3	10.4	8.5	6.4	4.2	1.9	-0.5
Incidental setbacks	*-10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Structural setbacks	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*
Interest costs	*0*	*-0.6*	*-0.5*	*-0.5*	*-0.5*	*-0.5*	*-0.4*	*-0.4*	*-0.4*	*-0.3*	*-0.3*
Unutilized income capacity	0.0	3.0	6.2	9.5	12.9	16.6	20.4	24.4	28.6	33.1	37.7
Ability to cut expenditure	0.0	1.0	3.1	6.2	10.5	16.0	22.8	31.0	40.5	51.6	64.1
Financial capacity	**19.0**	**21.5**	**25.0**	**29.8**	**35.8**	**43.1**	**51.7**	**61.8**	**73.4**	**86.5**	**101.4**

Therefore, municipality X increases tax receipts by 1.5 million and decides to cut back expenditures by a half million. Both measures go into effect in year t+1. The financial capacity is seen in the table below:

Table 5.4 Calculation of financial capacity after setbacks and policy changes at time t (in millions of euros)

	s=0	**s=1**	**s=2**	**s=3**	**s=4**	**s=5**	**s=6**	**s=7**	**s=8**	**s=9**	**s=10**
Equity	19.0	19.5	19.9	20.4	20.9	21.5	22.1	22.7	23.3	24.0	24.7
Incidental setbacks	*-10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Structural setbacks	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*
Interest costs	*0*	*-0.6*	*-0.5*	*-0.5*	*-0.5*	*-0.5*	*-0.4*	*-0.4*	*-0.4*	*-0.3*	*-0.3*
Extra income	*0*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Economic measures	*0*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Unutilized income capacity	0.0	1.5	3.1	4.7	6.5	8.3	10.2	12.2	14.3	16.5	18.9
Ability to cut expenditure	0.0	0.5	2.0	4.6	8.4	13.3	19.4	26.9	35.8	46.0	57.8
Financial capacity	**19.0**	**21.5**	**25.0**	**29.8**	**35.8**	**43.1**	**51.7**	**61.8**	**73.4**	**86.5**	**101.4**

The additional income and revenue from expenditure cuts do not influence the capacity at time t. However, over time the financial capacity increases because income exceeds costs after year 0. The financial capacity at t+5, given the setbacks, tax increase and expenditure cuts can be calculated as follows:

Table 5.5 Calculation of financial capacity after setbacks and policy changes at time t+5 (in millions of euros)

	s=0	s=1	s=2	s=3	s=4	s=5	s=6	s=7	s=8	s=9	s=10
Equity	21.5	22.1	22.7	23.3	24.0	24.7	25.4	26.2	27.0	27.8	28.7
Incidental setbacks	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Structural setbacks	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*	*-1*
Interest costs	*-0.5*	*-0.4*	*-0.4*	*-0.4*	*-0.3*	*-0.3*	*-0.3*	*-0.2*	*-0.2*	*-0.2*	*-0.1*
Extra income	*0*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Economic measures	*0*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Unutilized income capacity	0.0	1.5	3.1	4.7	6.5	8.3	10.2	12.2	14.3	16.5	18.9
Ability to cut expenditure	0.0	1.0	3.1	6.2	10.5	16.0	22.8	31.0	40.5	51.6	63.6
Financial capacity	**21.5**	**24.6**	**28.8**	**34.2**	**40.9**	**49.0**	**58.4**	**69.4**	**81.8**	**95.9**	**111.2**

Note: $e_{t,t+5}$ (see table 5.4) = $e_{t+5,t+5}$ (see table 5.5)

One can see that the financial capacity at time t+5 (array [21.5, …, 111.2], table 5.5) is higher than at time t (array [19.0, …., 101.4], table 5.4), but still lower than the financial capacity before the setbacks (array [30.0, …, 131.9], table 5.2.).

6.3. Budget changes

Setbacks are not the only influence on financial capacity. An expenditure increase also reduces the financial capacity. An increase in expenditure needs to be paid with either debt, additional income or by economizing on other goods or services. This evidently leads to lower equity, less unutilized income capacity or lower ability to cut expenditures.[18] Depending on if it involves investment goods or consumption, the extra expenditures need to be modeled differently. Consumption goods can be modeled in the same way as incidental setbacks. Investment goods do not lead directly to a lower equity, while the depreciations and the interest cost do during the depreciation time.

7. Conclusions and summary

Why do public bodies need equity and how much do they need? Surprisingly there is very little research published which tries to answer this question. This is in stark contrast to the amount of research carried out regarding the capital structure of firms and central governments. However, the existing debt theories for central governments and capital structure theories for firms do not apply to individual public bodies.

[18] New expenditures might also bring extra risk. Risks are exogenous in this model.

Equity of public bodies can have four different purposes. First, public bodies need enough capital (equity and liabilities) to finance the assets needed for its operation (financing function). Secondly, a public body needs equity as a buffer for financial setbacks in order to avoid bankruptcy (buffer function). Furthermore, equity can have an expenditure or tax-smoothing function. An organization can save money in order to spend it later for incidental expenditures. Finally, equity can have an income function. By having more equity, less debt is needed, which consequently leads to less interest costs. When public bodies use these proceeds for financing structural expenditures, equity has an income function.

This paper argues that public bodies do indeed need sufficient equity to counter setbacks. If they have enough equity to guarantee continuity, creditors are willing to provide the capital an organization needs. Equity for expenditure and income purposes, however, is unwanted, except for a small amount to be able to smooth taxes. More equity than needed can lead to agency costs.

When calculating the amount of equity needed, one should take into account that equity is not the only financial source to counter setbacks. Public bodies can sometimes raise their taxes and levies or cut back expenditures. Moreover, many public bodies are backed up by explicit or implicit guarantees by, for example, the central government. A concept that takes all these elements into account is the concept of financial resilience. Financial resilience is the financial capacity of a public organization to cover its risks.

The elements of the financial capacity (equity, unutilized income capacity, ability to cut expenditures and guarantees) cannot simply be added up. The unutilized income capacity and ability to cut expenditures are not constant in time. Citizens might accept a steady increase in taxes over time, while an abrupt tax hike can cause resistance. Furthermore, regulations from central government may put restrictions on the time, frequency and amount of tax increases. The ability for public bodies to cut expenditures in the short term is also often limited. In the long run, the ability to cut expenditures is larger. The unutilized income capacity and the ability to cut expenditures are likely to be larger in the long run than in the short run.

Financial resilience is traditionally calculated as the ratio of the net present value of the financial capacity and the net present value of the risks. By calculating the net present value, a large amount of information is lost. The net present value method, after all, only calculates the financial resilience of a public organization at a certain point of time, and does not show the dynamics over time. By writing the financial capacity at time t (FC_t) as an array, the time

dynamics can be captured in a model. This paper describes such a model. This model also enables public organizations to analyze the impact of proposed new policies or changing risks on their financial resilience. All results can be easily presented in insightful tables or graphics.

8. Literature

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