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A Model for Safe Borrowing to Finance Local Government's Infrastructure

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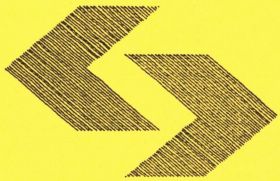

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A MODEL FOR SAFE BORROWING

TO FINANCE LOCAL GOVERNMENT'S INFRASTRUCTURE

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Abstract

This paper develops a dynamic model for determination of a maximum capacity to borrow and a safe level of debt for a municipality, when budget liquidity safety measures and legal regulations are observed. At each time period, over a given optimization horizon, the model solution determines maximum feasible level of total debt and relative safety measures – ratios of total debt to revenue, cost of debt service to revenue, and the cost of debt service to surplus current revenues. The solution ensures liquidity of municipality's budget, satisfactory level of operating expenditure and a given level of investment.

Real life examples of the model implementation in two Polish cities demonstrate ways of accessing a maximum capacity of a municipality to borrow.

JEL: E47, E62, R10

A MODEL FOR SAFE BORROWING TO FINANCE LOCAL GOVERNMENT'S INFRASTRUCTURE

1. Introduction

Local government infrastructure projects require large outlays of money that are beyond the currently available resources of most local governments. One solution is to borrow the necessary funds. Borrowing places the burden of repayment on tomorrow's citizens and limits the future financial flexibility of a local government. Nonetheless, there are sound economic and public policy reasons for local governments to borrow to finance public infrastructure. Most public infrastructure is essential to the future economic prosperity of the community, and delays in its development mean economic opportunities foregone. Moreover, the long-lived nature of most public infrastructure means that future generations will use and benefit from current investment, making it appropriate that they help pay for a fair share of it. While there are economically sound reasons for issuing debt, its usage must be carefully analyzed and monitored over time to be sure that a municipality does not assume more debt than it can afford to repay. The paper considers the design of a decision making mechanism for budgetary policy analyses by a municipality and a selection of an appropriate and safe amount of borrowing to finance local infrastructure investment. The presented model helps determine a maximum capacity to borrow and serves the purpose of safe debt management.

2. Problem Description and Model Justification

Municipality's revenue include tax revenue, fees and charges, state budget grants, and revenue from owned capital and property. The model developed in the paper fits Polish legal regulations. However, it bases on general framework of local government finance and debt management (Bahl, Lin, 1992; Cichocki, Kleimo, Ley, 2001; Josef, 1994; Leonard, 1996) and can be used, after minor changes, for efficient debt management in any economy.

Financing an investment project with a help of debt creates a burden for the future generation (see discussion of an overlapping generation model in Rosen, 1995). However, when the project will benefit future generations, or if future generations are expected to be richer than the present one, then having them pay for it via loan finance is appropriate.

Special grants and government subsidies for financing investment contribute to the local government revenue and impact values of model variables. However, the income effect, as

discussed by Stiglitz, 1998, does not explicitly influence the model solution as the values of projected revenue are exogenous in the model.

In Poland, the sources of funds that flow into local governments' budgets are defined at various levels of detail by: the Constitution of the Republic of Poland, the Law on Public Finance, the Law on the Revenue of Local Governments, and the Local Self-Government Act. Expenditures are defined by the Local Self-Government Act according to the specificity and the scope of their responsibilities (tasks). Revenue from loan proceeds, from sales of capital shares owned by a municipality and from previous time budget surplus are considered non-revenue, and serve to finance budget deficit. Likewise, the expenditure does not include amounts allocated for the repayment of loan principal - they also make up proceeds. *In order to obtain an actual and undistorted picture of the financial status and financial management in the local government, one should base the analysis not exclusively on the revenue and expenditure, as defined in the law. The analysis should include additional financial flows defined in the budget as non-revenues and non-expenditures, as well as the actual cash flows between the local government and other entities.*

In the model we introduce notions of *gross* and *net* operating surplus, and the real financial yield, which do not function in Polish regulations, neither in local government financial reporting. The *operating surplus* - revenues in excess of operating expenditures - can be used to fund capital expenditures and is not needed to fund operating expenditures. Thus, the available resources to fund capital public infrastructure projects consist of surplus current revenues, special grants, and the proceeds from borrowing (loans and bonds). The maximum debt depends on constitutional and statutory limits. These limits are often stated as a percentage of a jurisdiction's assessed valuation (Leonard, 1996; Cichocki, Leithe, 1999; Law of public finance). However, very often this percentage is selected arbitrarily. Mistakes can be made, which lead to so called *indebtness trap.* The debt issuer must assess the effect of debt service outlays on future budgets to determine the practical (safe) limits of debt service capacity. The developed model helps determine limits of debt capacity nominally, and in relation to revenue, as well as limits of debt service capacity in relation to revenue and operating surplus. For any new debt we estimate how much new debt service would be added from a planned loan and bond issue to the existing debt service costs. Then, the combined total of projected new debt service payments is calculated, added to the costs of the existing debt service and we receive the total costs of debt service payments.

The net operating surplus is defined as operating surplus less costs of spending for service of the existing and planned debt. The larger the level of these resources the more funds for financing investment.

The annual *real financial yield* (ARFY) determines an amount of funds which remain in the municipality's budget at the end of the fiscal year (see Cichocki, 2001 and Cichocki , Hawlik, 2000). It equals *net* operating surplus less planned investment expenditures, plus newly borrowed funds. The *cumulative real financial yield* (CRFY) is defined as the sum of ARFY and the CRFY from the previous year. The newly borrowed funds added to the *net* operating surplus, and the value of CRFY from the previous year could be, in all, used for financing investment. The above financial flows are presented graphically in Figure 1 (Cichocki, 2000 and 2001.

The objective function of the model is to maximize the total funds (from budget surplus and from debt) for financing investment. However, these funds, through imposition of appropriate constraints ensure satisfactory level of operating expenditures, budget liquidity, and safe and legally justified level of debt. Along with a capital improvement program, each local government should have a written debt policy establishing guidelines for the use of debt. These guidelines should include (Leonard, 1996; Joseph, 1994):

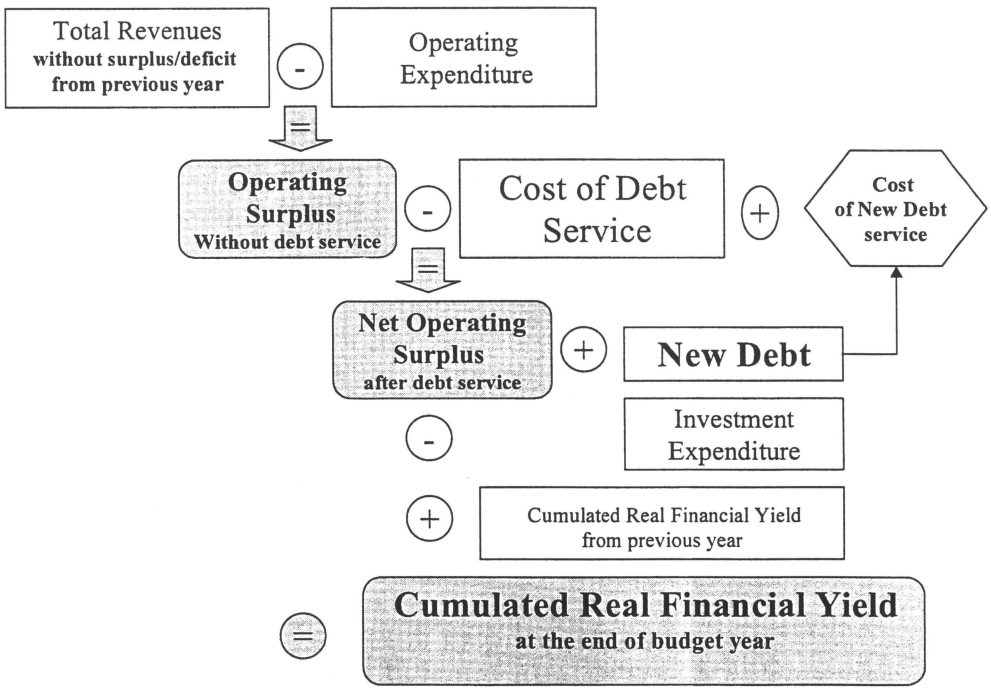
1. Maximum amount of debt that can be issued each period
2. The types of long-term debt that will be issued (various credits and bonds)
3. The debt maturity schedule for each debt.

Some Polish cities, for example the city of Szczecin, each year sets -in a city council resolution - a maximal, nominal value of debt that can be issued, as well as practical levels of indicators of debt service to revenue, and the debt service to operating surplus (constraints (2) and (3)). However, these cities do not know the nominal limits for the debt, as in their analysis they do not estimate the maximum resources for investment. Their decisions are arbitrary, however based on experience.

3. The Model

The developed model enables assessment of debt capacity of a municipality, determination of a safe level of debt, and helps determine *debt structure* - bond covenants and loan terms, including repayment structure of debt. The model has assisted several Polish local governments in efficient financing of local infrastructure (Cichocki, 2001; Cichocki, Hawlik, 2000). The model is dynamic (intertemporal). Solutions at time t impact solutions at time t+1.

Figure 1. Financial flows in a municipality's budget



3. 1. Definition of model variables

Model variables are defined for all time instants $t = (t_0, t_1, .., T_N)$, where t_0 denotes an initial period of analysis, (usually beginning of a budget year or first quarter of a budget year), T_N is the last period of analysis, and N is integer (number of quarters, or years). Model variables include:

- $t = [tc_1, .., tc_m, tb_1, ..., tb_p]$ - time instants, at which new debt is issued, where m is a number of new credits NC_t, p is a number of new bond issues NB_t, and $m \leq N$, $p \leq N$;

- $ND_t = \{NC_t, NB_t\}$ - a level of new debt (credits and bonds);

- $tr = [trc_1, .., trc_n, trb_1, ..., trb_q]$ - time instants at which credits are repaid and bond issues redeemed, where n, is a number of credits repayments RNC_t, and q is a number of bond repurchases RNB_t, $n \geq m$, $q \geq p$;

- $RND_t = \{RNC_t, RNB_t\}$ - a level of each debt repayment, and/or repurchase of bond issues

- TDO_t - Total Debt Outstanding at the end of period t;

- DS_t - Debt Service over period t;

- $OpSnet_t$ - *net* Operating Surplus, equals Operating Surplus less costs of debt service;

- $CRFY_t$ - Cumulative Real Financial Yield, defined by equation (6c) - the amount of funds available in the budget at the end of period t.

The above variables determine how much is borrowed and when, and how and when the debt is repaid.

In addition, in the model we define the following exogenous variables:

- D_{t0} - indebtness (old debt), resulting from debt contracts concluded until t_0;

- DS_{t0} - Debt Service resulting from debt contracts concluded until t_0,

and forecasts of:

- the interest rates: $ic_{1t}, .., ic_{mt}$, and $ib_{1t}, ..., ib_{pt}$ - charged for all planned credits and bonds (all debts).

- $TREV_t$ - Total Revenue at the end of period t, for all $t \in \{t_0, T_N\}$

- Inv_t - investment expenditures over period t, for all $t \in \{t_0, T_N\}$

- $OpExp_t$ - operating expenditures, for all $t \in \{t_0, T_N\}$.

3. 2. Model constraints

Debt burden of an issuer depends on the gross amount of outstanding debt. There are no fixed standards for assessing an issuer's debt burden. However, there are many useful guidelines, which relate the debt and debt service to the anticipated revenue and taxable fixed assets. These guidelines are included either in legal regulations, city council resolutions or practical recommendations, both in western countries, in USA or in Poland (Leonard, 1996; Cichocki, 2000, Cichocki, Hawlik, 2000; Budget of the city of Szczecin for 2000). In addition, debt burden is often evaluated on a per capita basis (Leonard, 1996; Cichocki, Leithe, 1999; Cichocki, 2002). In the model we introduce two types of constraints. The first two constraints result from binding legal regulations in Poland; they include pledges of collateral or "coverage" requirements by which revenues must exceed debt, and debt service. The additional four constraints result from practice of financial management and ensure budget liquidity and continuity of investment financing.

3.2.1. Constraints resulting from legal regulations

Polish national Law on Public Finance require that at every time instant t:

(1). The total debt outstanding, as a percentage of total revenues, does not exceed 60%

(2). The total debt service as a percentage of total revenues does not exceed 15%.

The constraint (1) also regards the state budget: public debt can not exceed 60% of GDP. The law introduces a relational feedback between public debt and GDP, and debt issued by local government. For example, when the value of total public debt outstanding exceeds 55% of GDP, then debt service in local budget, by law, cannot exceed 12% of its total revenues. Any percentage of public debt to GDP over 50% imposes additional restrictions on new debt issuance and budget deficit of local governments. When the value of total public debt exceeds 60% of GDP, then no deficit is allowed in the state and local government budgets. No debt can be issued and guarantees granted either by the state or local government, and a three-year macro-economic program is introduced, which decreases public debt to GDP ratio to the level below 55%.

In many countries in western Europe and in the USA it is customary to issue debt ,which is below 60 percent of total taxable municipality's revenue.

3.2.2. Constraints resulting from practice of sound financial management

Although the legal ceiling for debt service is 15%, the affordable level for a particular municipality very often is less. However, there is no one percentage that is right for all local

governments and at all times. This value can be obtained from solution of the model for each municipality separately.

Surplus revenues must be left for financing investment, and operating surplus cannot in all be spent for debt service. The following "efficient management" financial indicators (Cichocki, Leithe, 1999; Cichocki, 2000 and 2001) are used as model constraints:

(3). The total debt service as a percentage of operating surplus - should be less than a given positive number, smaller than one.

(4). Cumulated resources at the end of each period (CRFY) are greater than 1% , and do not exceed 10 % of the operating surplus (approximately 3% of the total revenue for small towns and 5% for large cities). CRFY should ensure an amount of resources at t, for financing operating expenditures in the beginning of period t+1 (when gmina revenues, from state budget transfers, are not yet secured).

(5). In addition, the fifth constraint implies continuity of investment process. It ensures that some investment are financed every period. When the combined total of projected debt service payments are very close to the value of operating surplus, then no new investment can be financed, usually, for a period longer than one year.

(6). Equality constraint (6a) defines the net operating surplus - the model control variable, and (6b) - the operating surplus which is exogenous in the model. Equality (6c) defines the real financial yield, which must be positive in the model, and (6d) provides the definition of the debt service.

Often, municipalities are very ambitious - they start investment they can not afford, and which are not safe for their future budgets. They plan financing large (often needed) investment from borrowed money, which later they can not repay (cost of debt service turns out to be higher than operating surplus). Then, a municipality experiences "investment – indebtness trap". As a result of too high investment and too high debt, a municipality has to drastically decrease investment expenditures (number of investment projects), often for several years, or even stop financing an uncompleted investment project.

3. 3. Model formulation

For every time instant t: $t = (t_0, t_1, .., T_N)$, find such values of new debt $ND_t = \{NC_t, NB_t\}$, instances $[tc_1, .., tc_m, tb_1, ..., tb_p]$ of taking credits and issuing bonds, and levels of each debt repayment $RND_t = \{RNC_t, RNB_t\}$, and times $tr = [trc_1, .., trc_n, trb_1, ..., trb_q]$, $n \geq m$, $q \geq p$, at which credits and bonds are repaid, which maximize planned new debt and *net* operating surplus (access revenue and borrowed funds for financing investment)

Maximum [ND_t + $OpS\ net_t$],

where the *net* operating surplus is defined by (6a) and (6b),
subject to the following constraints:

Total Debt Outstanding to Total Revenues ratio is less than 60%:

(1) $TDO_t / TREV_t < .60$, where

(1a) $TDO_t = TDO_{t-1} + ND_t - RND_t$, $t = t_1,.., T_N$

where $TDO_t = TCO_t + TBO_t$, and $TDO_{t1-1} = TDO_{t0}$.
TCO_t and TBO_t are cumulative credit debt, and bonds debt outstanding at year t, TDO_{t0} is a level of an initial debt outstanding.

Total Debt Service to Total Revenue ratio is less than 15%:

(2) $DS_t / TREV_t < .15, \quad t = t_1,.., T_N$

where DS_t is defined by equation (6d).

Total Debt Service can not exceed the Operating Surplus

(3) $DS_t / OpS_t \leq (1-a), \qquad 0 < a < .99$

and Cumulative Real Financial Yield at the end of period t, $CRFY_t$ must be positive. It constitutes a portion of the Operating Surplus which ensures resources for financing operating, and sometimes investment expenditures at the beginning of period t+1.

(4) $CRFY_t / OpS_t \geq f(a)$,

$f(a) = 0.01 + 0.9\ a, \quad 0 < a < 0.99, \ Inv_t > 0,$

and the resources, which can be used for financing investment are defined by

(5) $OpS\ net_t + ND_t + CRFY_{t-1} - f(a)\ OpS_t \geq Inv_t$

The value of the *net* operating surplus at t, is defined as operating surplus minus costs of debt service

(6a) $OpSnet_t = OpS_t - DS_t$, $OpSnet_t > 0,$

where the operating surplus (gross available resources, with debt service included) are defined as total revenues minus operating expenditures

(6b) $OpS_t = TREV_t - OpExp_t$, $t = t_1,.., T_N$

where $TREV_t$ and $OpExp_t$ are exogenous variables.

The cumulative Real Financial Yield at the end of period t is defined as

(6c) $CRFY_t = OpSnet_t + ND_t - Inv_t + CRFY_{t-1}$, $CRFY_t > 0$.

The costs of debt service are calculated for each credit and each bond issue separately. The interests are computed on cumulative credit outstanding at time t , (credit outstanding at time t-1 plus new credit at time t, minus credit repayment at t), and on cumulative bond issues outstanding at time t. Debt Service is defined as

(6d) $DS_t = RNC_t + RNB_t + i\,c_t\,[TCO_{t-1} + NC_t - RNC_t] + i\,b_t\,[TBO_{t-1} + NB_t - RNB_t]$,

where $DS_{t1} = DS_{t0} + NDS_t$, and DS_{t0} is an initial debt service resulting from commitments made prior to t_0.

Debt service includes costs of service of both, the existing "old " debt, and the new debt and therefore the interests $i\,c_t$ and $i\,b_t$ are vector values and vary for each credit and each bond issue.

The values of total revenue, operating and investment expenditure,: $TREV_t$, $OpExp_t$ and Inv_t have to be projected over the period of time, over which we solve the model, $t = t_0, \ldots, T_N$ - usually, over a period of the longest debt maturity. These values are exogenous in the presented model. There is a separate model, which is used for revenue projection.

As a result of the model solution we obtain, for each time instant $t = t_0, \ldots, T_N$, values of new debt ND_t , (credits and bonds), which the gmina issues at times $t = [tc_1, .., tc_m , tb_1, ..., tb_p]$, and values of debt repayments (principals) RND_t , at times $t = [trc_1, .., trc_n , trb_t, ..., trb_q]$, $n \geq m, q \geq p$. The above values satisfy the constraints (1) – (6), and approximate a maximum capacity to borrow, which is safe for future municipality's budgets. Then, for given optimal values $OpSnet_t$ and ND_t we calculate values of the indicators (1) - (4), which together with the nominal value of new debt determine a practical limit of debt for each individual municipality. It turns out that safe levels of indicators (1) and (2), in most cases, are well below the levels determined administratively by law.

4. Examples of model solution

This section presents and discusses solutions of the model used for budget preparation and determination of a safe level of debt in two Polish cities. Figures 2 and 3 present values of exogenous variables for a large city (No 1) over a fifteen year period. These values include: total revenue, operating surplus and investment over a period 1996 - 2010. For the city No 1 we solve

the model over a period of 2001 – 2010. The year 2000 is as initial optimization period. We analyze the period of 1996 -1999 to prepare a prognosis of the above exogenous variables and to check the past behavior of financial indicators which appear as constraints (1) - (4) in the model. For the city No 2 we solve the model over a period 2001 – 2007, with the year 2000 as initial period.

In the solution procedure of the model we first check if the constraints (1) - (4) are satisfied. When constraints (1) - (3) are satisfied and the CRFY is negative, or below the value resulting from (4), we must bring the CRFY to the appropriate positive value. Then, for positive values of CRFY, which satisfy constraints (1) - (4) and (5) we compute the maximum values of safe debt (which in the city No 1 must be lower than initially assumed) and the resulting values of constraints (1) - (3).

4.1. City No 1; Model constraints - an initial scenario

In Table 1 we present for two cities, city No 1 (a large Polish city) and a city No 2 (small town), values of "legal indictors" - constraints (1) and (2), and the values of "management indicators" represented in the model by constraints (3) and (4). Additionally, a very important value of the operating surplus as a percentage of revenue is presented. The value of the total amount of the planned and the existing debt outstanding as a percentage of revenues (constraint (1)) is below the legal ceiling of 60 % over the whole period 2000 – 2010. It assumes values of 31% to 37% in 2001-2002, exceeds the value of 40% in 2003 and approaches 50% in 2005 - 2007. The total debt service as a percentage of total revenues equals 9.4% or less, except in 2003, when it approaches 11%. The city indebtness seem to be very safe. The share of debt service in revenue could grow by another 4 percentage points to reach the upper limit of 15% . The share of debt outstanding in revenue is 10 percentage points below the level determined by law. The city officials could come to the conclusion that they could use new debt to finance additional investment in 2001 -2003. However, *this is not true, because the city lacks funds for debt service.* The values of the indicator of debt service to operating surplus are above 1 (above 100% in Table 1) over the period 2001 - 2003. This means that the cost of anticipated debt service exceeds operating surplus, and the constraint (3) of the model is not satisfied. The operating surplus in relation to total revenues decreases dramatically from 18.7 % in 2000 to 7.1% in 2001 and assumes values below 9% over a period of five years: 2001 – 2005 (Fig. 2). The level of operating surplus in 2001 equals only 40% of that in 2000, and stays below the 2000 level until 2009. The presented financial and debt policy was originally designed by city No 1. This policy

can not be implemented because it would require a drastic decrease in investment expenditure in 2002 - to the level of 40% of the investment in 2000. The city could not invest more than 50%

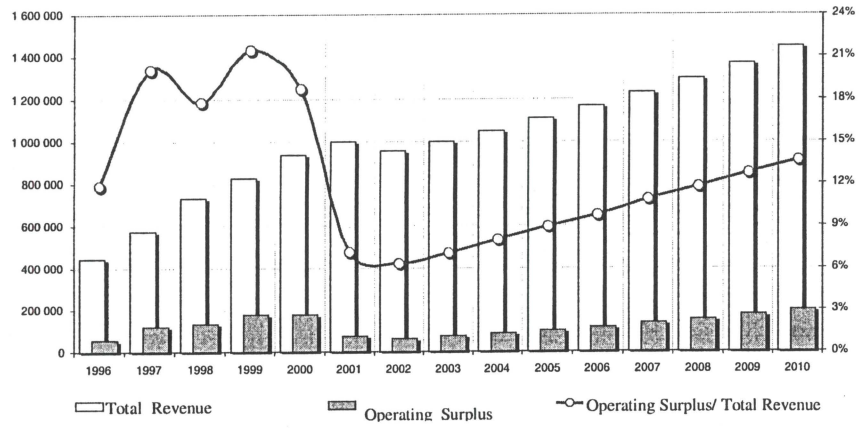


Figure 2. Total Revenue and Operating Surplus; City No 1

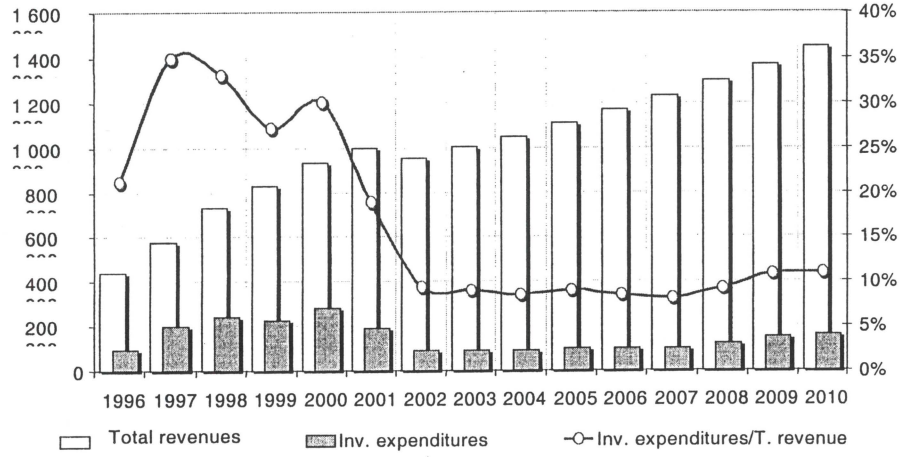


Figure 3. Investment expenditure and Total revenue; City No 1

of the 2000 investments until the year 2007 (Fig. 3). In practice, no city can reduce investment expenditures by half from year to year. It would impede local infrastructure development and cause protests of the city inhabitants. In addition, the city would have to take operating credit for

financing the existing debt in 2001, 2002 and 2003. Also, as a result of too low operating surplus, the value of the indicator (4) -the cumulated real financial yield is relatively high in relation to operating surplus (Table1).

A decrease in the operating surplus in relation to total revenues is very often a sign of increasing indebtness. The value of the operating surplus to revenue below 10% is dangerous for any city.

4.2. City No 2; Model solutions; Determination of Safe Level of Debt

In Table 2 we present, for a small Polish town (city No 2), values of exogenous variables: revenues, operating expenditures, operating surplus and investment, the same we presented in Figures 2 and 3 for the city No 1, and additionally, we show the budget deficit.

Years INDICATORS [%]/ (Model Constraints)	2000	2001	2002	2003	2994	2005	2006	2007
Total Debt to City1 Revenue (1); City2	27.6 32.31	31.0 41.03	37.1 32.67	41.7 25.89	46.8 17.16	48.1 15.21	49.2 6.82	49.0 2.09
Debt Service City1 to Revenue (2);City2	4.8 10.19	9.4 12.55	9.0 14.45	10.9 14.23	7.1 10.35	8.2 8.41	8.8 9.60	9.0 5.30
Debt Service City 1 to Operating Surplus (3);City 2	25.6 55.68	168.7 74.55	142.8 85.05	149.0 96.40	83.3 76.89	89.3 62.49	88.5 71.31	81.9 39.36
CRFY to the City1 Operating Surplus (4) City 2	6.0 10.26	16.8 1.26	21.2 1.86	19.2 4,09	17.0 5,3	15.5 4,87	14.0 4.75	12.0 5.5
Operating City1 Surplus to Revenue City 2	18.7 18.31	7.4 16.84	6.9 16.99	7.2 14.69	8.1 13.46	9.0 13.46	9.2 13.46	10.9 13.46

Table 1. Financial Indicators - City 1 and City 2; Model constraints (1) - (4)

Table 2 presents the model optimal solutions - *the level of new debt, the resulting debt service, net operating surplus and the cumulated real financial yield* in consecutive years. Table 3 presents model solutions in more detail: the maximum, but still safe, *level of new debt and debt repayment by debt category*. There are three categories of debt and debt service: commercial debt (credits and loans), concessionary debt (used for financing environment infrastructure, with interest rate lower than the market rate), and municipal bonds.

For each year the following values are given: a face value of credit, and bonds issued, the time and value of capital repayment and interest paid. In the final balance section of Table 3 values of

new debt, total debt service and the total indebtness (outstanding debt minus capital repayment) are given. The value of new debt showed in Table 3 as New credits and bonds, are also presented

Year \ Model Variables [thousands ZL]	2000	2001	2002	2003	2004	2005	2006	2007
REVENUES	18 994.8	19 600.0	20 600.0	21 100.0	21. 839.0	22 623.6	23 332. 5	23 967. 2
OPERATING EXPENDITURES	15 517.3	16 300.0	17 100.0	18 000.0	18 900.0	19 579.0	20 192.5	20 741.7
OPERATING SURPLUS	3 477.5	3 300.0	3 500.0	3 100.0	2 939. 0	3 044.6	3 140. 0	3 225. 5
ANTICIPATED IINVESTMENT	2 811.99	4 700.0	2 500.0	1 050.0	650.0	1 150.0	900.0	2 000.0
DEBT SERVICE	1 936.4	2 460.2	2 976. 8	2 988.0	2 259. 7	1 902.4	2 239. 1	1 269. 5
INTEREST	643.27	1 049.45	983.27	854.95	614.69	552.44	389.12	177.50
Net OPERATING SURPLUS	1 541.1	839.8	523. 2	112. 0	679. 3	1 142.2	900. 9	1 956.0
NEW DEBT (Credits and Bonds)	1 380.0	3 545.0	2 000.0	1 000.0				
Annual RFY	109. 05	-315.18	23. 18	62. 00	29. 33	-7. 83	.89	-44.08
Cumulative Real Financial Yield (in 1999 – 248.0)	357. 05	41. 87	65. 05	127.05	156. 38	148. 55	149. 44	105. 36
BUDGET SURPLUS or DEFICIT	22. 24	-2449.45	16. 73	1 095.05	1 674. 31	1 342.16	1 850.88	1 048.00

Table 2. Model Exogenous Variables and Select Solutions - City 2

in Table 2. Credit remissions for commercial credit and guarantees (part of debt service) are not included. The ratios of operating surplus to revenue, debt service to operating surplus, and CRFY to operating surplus help assess real financial situation of a municipality, ensure financial liquidity, and help determine a safe level of debt. *Each municipality has to determine a level of safe debt* (its nominal value and values of indicators (1) - (4)), *individually,* based on the value of operating surplus to revenue indicator, the revenue structure and past debt commitments.

As a result of the model solutions we determine the *safe level of debt.* This solution, for the city No 2, in a short form, for example for years 2001 - 2003, can be described as follows (see Tables 1,2,3):

Year 2001

The value of new debt – maximum 3.5 million PLN; The total debt to revenue ratio – below 41% and the total debt service to revenue below 12.55%; The total debt service to operating surplus ratio – below 74.5%.

Year 2002

The value of new debt – maximum 2.0 million PLN; Total debt to revenue – below 32.67% and total debt service to revenue below 14.45%; Total debt service to operating surplus – below 85.%;

Year 2003

The value of new debt – not higher than 1.04 million PLN; Total debt to revenue – below 25.9% and total debt service to revenue below 14.23%; Total debt service to operating surplus – below 96.4% (an alarming value – which can be maintained only for one year).

The full solution includes additionally the following values: *Year of taking a credit and issuing a bond, nominal value of each credit and a bond, times when the credits and the bonds are repaid, and the value of repayment or, repurchase.* For example city No 2 issued a bond in three series: in 2001, with face value of 1,5 million zl, and in 2002 and 2003, with face values of 1,0 million each. These bonds are to be repurchased in 2005 (.75 million) and in 2006 (1.25 million) and 2007 (1.00 million).

4.3. Comparison of Financial Scenarios of Cities 1 and 2.

The city No 1 lacks its own resources – the operating surplus is too low over 2001 – 2003 to service the planned debt. The operating surplus to revenue ratio is below 10% and the debt service to operating surplus ratio is above 1. The city's capacity to borrow is limited over the period 2001 –2006, unless the city decreases its operating expenditures or increases revenue. In addition, the city uses long term debt (for example 26% of it in 2003) for financing operating expenditures and should make an attempt at reducing operating expenditures. The city does not have problems with liquidity. On the contrary, CRFY in relation to operating surplus is too high in 2002 (21%) and in 2003 (19.2 %) -Table1. It results from too high debt. The model has no feasible solution for values of the constraints resulting from the above presented debt policy scenario.

The city No 2 uses external resources more rationally than city No 1 – only for investment expenditures. The city's capacity to borrow is limited by liquidity in 2001 and 2002. Debt service is acceptable in 2005 and 2006, and constitutes only a small portion (39%) of operating surplus in 2007. The operating surplus to revenue ratio is nearly satisfactory. It should be higher starting 2003. Debt service to operating surplus is too high in 2002 and specially in 2003, when the city uses 96.4% of its surplus for debt service; nearly all investment are financed from external resources. The city may have problems with liquidity in 2001 and 2002. The CRFY is very low. In small towns the value of CRFY to operating surplus indicator could be only above 1%, while in large cities it should be in the vicinity of 6%. For city No 1 we assume that the value of CRFY to operating surplus should be above 1%.

5. Conclusions

Debt is issued when other sources of revenue (additional user's charges, grants, revenue from property) can not be used. Debt resources add funds for financing investment and can contribute to economic development of a municipality. Using debt for financing an investment project which will benefit future generations is seen appropriate by economists (Rosen, 1995, Stieglitz, 1998) and by many politicians. Common capital projects financed by debt include roads and bridges, sewage purification plants, hospitals and recreational facilities. However, debt should be used efficiently and in a safe way. The model helps develop mechanisms, which justify and explain decisions of city managers regarding safe borrowing and efficient financing of investment projects. The values of the debt service and of the CRFY to operating surplus ratios resulting from the model solution set upper limits to borrowing when the city maintains budget liquidity and sustainable operating expenditures. These ratios, together with observed values for legal limits of the outstanding debt and debt service to revenue ratios, determine upper limits for investment expenditures over a period of the model analysis.

Some cities do not make long-term financial plans, nor analyze long-term debt. These cities very often are exposed to so called *debt - investment trap*. They borrow too much and over-invest. As a result they have to drastically reduce investment expenditures, often for several years, immediately reduce operating expenditures or even stop financing uncompleted investment projects. For example, as a result of model implementation, the city council of the city No 1 decided to reduce the operating expenditures, cut investment expenditure and reduce the planned debt (not to issue a bond in 2001). The operating expenditures were too high and the city's investment program was too extensive.

Other cities make arbitrary decisions regarding the level of debt and sometimes debt to revenue and debt to operating expenditure ratios. For example, the city of Szczecin, in the resolution of the city council (Szczecin, 2000) sets a limit for debt at 200% of operating surplus, and the debt service to revenue at the level of 50% of the operating surplus. In addition, the debt service can not be higher than 70% of the legal limit of 15% of the city revenue. These values are safe, but the city could finance additional investment projects had it knew the real limits to their borrowing. Some American cities require that net debt should not exceed 15% of per capita personal income, or 90 % of the amount authorized by law (Leonard, 1996). The debt is limited in the state of Missouri to 10% of the taxable fixed asset (Chesterfield, MO.) The above values of cited indicators are very useful but the cities do not know the real limits to their borrowing. The developed model helps determine the limits to safe borrowing.

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Debt Balance		2000	2001	2002	2003	2004	2005	2006	2007
Credits and Loans									
Credits & loans		1 380 000	0	0	0	0	0	0	0
Interest		643 272	635 902	446 223	291 953	173 584	129 200	69 200	9 200
Capital Repayments		1 293 166	1 410 730	993 550	1 133 050	600 000	600 000	600 000	92 000
Debt Outstanding		7 430 199	5 907 833	4 178 600	3 025 050	1 892 000	1 292 000	692 000	92 000
Debt at end of year		5 907 833	4 178 600	3 025 050	1 892 000	1 292 000	692 000	92 000	0
Conncessionary Credits	Payments	0	2 045 000	1 000 000	0	0			
	Cumm.Credit	0	2 045 000	2 045 000	1 045 000	0	0	0	0
	Interest	0	184 050	184 050	94 050	0	0	0	0
	Capital payments		0	1 000 000	1 000 000	1 045 000	0	0	0
	Interest r. [%]	19,3	14,5	13,8	13,2	12,6	12,1	11,6	11,2
Bonds Max.	Series Issued	0	1 500 000	1 000 000	1 000 000		0	0	0
Bond length 4	Cummulative	0	1 500 000	2 500 000	3 500 000	3 500 000	3 500 000	2 750 000	1 500 000
	Interest	0	229 500	353 000	468 950	441 105	423 245	319 919	168 301
	Bond Repurchases	0				0	750 000	1 250 000	1 000 000
Final Debt Balance									
New credits & bonds		1 380 000	3 545 000	2 000 000	1 000 000	0	0	0	0
Interest		643 272	1 049 452	983 273	854 953	614 689	552 445	389 119	177 501
Capital repayments		1 293 166	1 410 730	1 993 550	2 133 050	1 645 000	1 350 000	1 850 000	1 092 000
Total Debt Service		**1 936 438**	**2 460 182**	**2 976 823**	**2 988 003**	**2 259 689**	**1 902 445**	**2 239 119**	**1 269 501**
Indebtness		**7 430 199**	**9 452 833**	**8 723 600**	**7 570 050**	**5 392 000**	**4 792 000**	**3 442 000**	**1 592 000**
Debt at end of year		6 137 033	8 042 103	6 730 050	5 437 000	3 747 000	3 442 000	1 592 000	500 000

TABLE 3. Model solutions: New Debt and Indebtness; City No 2