

# DEBT ANALYSIS OF CZECH MUNICIPALITIES

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**Abstract:** The paper presents the current state of municipal indebtedness in the Czech Republic. Further, there is a model design for the analysis of the municipal debt in the Pardubice region. Regression analysis is used for the modelling. The influence of economic and political factors on the debt of municipalities is analyzed.

**Keywords:** Municipal debt, debt policy, regression modelling, economy of municipality

## 1. Introduction

Public debt and deficits have become one of the key areas of theoretical and practical research in public and local finances. Debt policy of municipalities [4,8,11] is influenced by the strength and structure of local governments and by the possibilities of municipalities to finance their activities through debt. These options are based on both the absolute amount of debt (the size of the debt, debt service) and the assessment of municipal creditworthiness [9].

Modelling the debt of municipalities is currently oriented on the quantification of the impact of various factors on the total debt of municipalities [1,5]. Weak Government Hypothesis, the election cycle theory, the state regulation of the debt, interest rates and the size and wealth of the population are considered to be the key factors.

The idea of the so-called Weak Government Hypothesis lies in the fact that fragmented governments have larger deficits and debts [15]. Recently, this hypothesis been analysed for Norwegian [3,17], Danish [14] and Flemish [1] municipalities. The hypothesis was confirmed by [1,3] whereas no significant evidence was observed by [17].

More complex econometric models was designed by [1,5] as most of the municipal debt factors has been statistically tested. According to [1], there is evidence of a long-term relationship of debt to income, population and the cost of servicing the debt. Additionally, it is evident that the long-term debt income ratio diminishes with the wealth in per capita terms of the municipality. However, evidence of a long-term effect of political events and fragmentation is weak. In the short-term, there is strong evidence of an electoral cycle affecting debt with rises in debt occurring prior to elections. With respect to fragmentation, the evidence is in line with the notion that political decision-making under fragmented government is less flexible.

An econometric model was developed by [5] using panel data stratified by population size to measure indebtedness in Spanish municipalities. Ratio of real investment to GDP, debt service, level of competencies, municipal borrowing trend, ratio of own tax revenues, maximum legal borrowing limit and GDP per capita are the determinants of municipal borrowing. According to [5], the evidence obtained appears to support the effectiveness of institutional borrowing restrictions to introduce some financial discipline in the borrowing policies adopted by local governments in Spain.

There has been further studied the impact of economic input variables on the debt of Spanish municipalities [2]. Geographic location, level of the economy, population, the proportion of capital expenditure, and the proportion of investment and tax revenue have shown significant impact.

The article has the structure as follows. First, the current state of municipal indebtedness in the Czech Republic is evaluated. Further, there is a model design for the analysis of the municipal debt in the Czech Republic. The influence of various factors on the debt of municipalities is further analyzed, as well as the quality of the proposed model.

## 2. Municipal Indebtedness in the Czech Republic

Municipal indebtedness has been affected by economic transformation in the Czech Republic. Debts of municipalities rapidly increased in the nineties, while only slight growth has been shown in the past ten years [13]. New competences allowed municipalities to increase their revenue by credits or loans practically without any restrictions [12]. The assets of municipalities served as a guarantee in loan applications, and they required a significant amount of funds for reconstruction or modernization at the same time.

The high proportion of shared taxes in municipal revenue guarantees a certain income, which allows increasing debt. The growth of municipal debt was accompanied by the growth of state debt, even if the dynamics of the two components have been different. The growth of public debt in recent years has significantly slowed down by the privatisation and sale of state and municipal assets, see Table 1.

Table 1 The proportion of debt to GDP [%]

Debt	2002	2003	2004	2005	2006
State	18.4	21.7	21.1	23	24.8
Municipal	2.3	2.8	2.8	2.8	2.8
Total	18.4	21.7	23.7	25.7	27.4

Source: [13]

Currently, there are more than half (52.3% in 2006) of the municipalities (about 6250) indebted. However, four statutory cities (Prague, Brno, Ostrava and Plzen) contribute to more than half of the municipal debt (58.6%). After the admission of the Czech Republic to the EU, the development of municipal debt was influenced by the fact that a number of projects financed from the European funds require financial participation of the municipality [13].

The Czech Republic is one of the countries where the regulation of the municipal debt is moderate (allowed debt service share of income is relatively high and the penalties for its violation is more or less theoretical) [10]. In 2004, the Government of the Czech Republic adjusted the regulation of the municipal debt using indicator of debt service. These municipalities and regions, which exceed the specified amount of debt service indicator of 30%, should take measures to avoid the excess in the next period. The Ministry of Finance considers all the factors that led to the violation of the limit. In the event that municipality or region exceeds the limit of the debt service indicator in the next year, the Ministry of Finance forwards a list of these municipalities and regions to providers of funds from the state budget and state funds. Then, these providers take account of this fact when dealing with applications for a grant or loan. The debt limit is defined by the so-called cautious indebtedness, i.e. such a debt, which does not threaten the financial stability of the municipality at present and, above all in the future.

The weight of the individual debt instruments are changing in favour of loans, to the detriment of financial assistance and interest-free loans as presented in Table 2. Loans accounted for nearly 60% of the total debt of municipalities in 2006. Only statutory cities had debt in the form of municipal bonds in the given period.

Table 2: The structure of the municipal debt (in billions of Czech Crowns)

	2002	2003	2004	2005	2006
Loans	27.3	35.2	38.5	43.7	47.1
Bonds	15.9	21.7	23.9	23.5	22.9
Others	12.6	13.5	12.4	11.8	10.9
Total	55.8	70.4	74.8	79.0	80.9

Source: [13]

### 3. Regression Model Design

The model design of municipal debt aims to realize the problem of regression, where the dependent variable is represented by the size of the municipal debt. Both the economic variables (population size, the debt cost, the concentration of local economy, own revenue, assets and the income of population) and the political variables (the election cycle, the introduction of the debt regulation and the strength of the local government) represent the inputs of the model [16,18]. The model is tested for the sample of the municipalities in the Pardubice Region. Input data set contains information on 452 municipalities of the Pardubice Region for the years 2002-2006. The modelling consists in the testing of input factors influence on the municipal debt. The model can be design as follows

$$y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}), \quad (1)$$

where:

y is the size of the municipal debt,

$x_1$  is the population size,

$x_2$  is the debt cost,

$x_3$  is own revenue,

$x_4$  is the concentration of local economy,

$x_5$  the income of population,

$x_6$  is the size of municipal assets,

$x_7$  is the municipal size category,

$x_8$  is the phase of the election cycle,

$x_9$  the introduction of the debt regulation,

$x_{10}$  is the Herfindahl index of political fragmentation, and

$x_{11}$  represents the majority of single party in the council.

Higher value of the variable  $x_1$  entails higher municipal tax revenues especially. Larger municipalities have higher share in tax yield, because the more populated municipalities have higher expenditures for the infrastructure and other public goods. Therefore, higher population guarantees future municipal revenues for the creditors. On the other side, more populated municipalities are likely to have higher demands for public expenditures, leading to higher levels of public debt.

The variable  $x_2$  is represented by an interest rate on long-term government bonds, measuring the cost of loan financing. The higher debt cost lead to a reduction in the size of the municipal debt [6].

Higher proportion of own revenue in total revenues entails higher fiscal autonomy of the municipality. Consequently, higher fiscal autonomy leads to lower indebtedness. According to [2], the size of the fiscal autonomy affects the municipal debt policy. Municipal management chooses a combination of the own revenue and the debt on public goods financing. The higher is the fiscal autonomy of the municipality, the smaller the need for the debt as a financing tool.

Variable  $x_4$  represents the concentration of employment in economic sectors. Low concentration means a long-term flexibility of the municipal economy, as well as protection against bankruptcy of one sector. Therefore, these municipalities are better prepared to possible economic recession.

The income of population  $x_5$  has an impact on the demand for public services. Population with higher income require for better public goods and services. On the one hand, municipality may receive additional funds resulting from higher fees for services provided. On the other hand, it is necessary to invest in better social and technical infrastructure.

The banks grant a credit only on condition, that the collateral assets are liquid enough, i.e. cashable in a short time. The liquid assets of the municipality include suitably situated extensive land properties, commercial buildings, agricultural land properties and assets for commercial use being in possession of the municipality.

The size category  $x_7$  represents the competences of municipality. Larger competences force municipalities to provide more public goods, leading to the growth of expenditures and debt. Additionally, municipal tax revenues depend on both the population size and the coefficient indicating the size category.

Variable  $x_8$  measures the time before election (in years). It includes the effect of political budget cycles [7]. Local politicians, motivated by their chances of re-election, increase expenditures before elections. This leads to higher debt before elections [1].

The debt service indicator  $x_9$  introduced by the Government of the Czech Republic in 2004 led to change in the regulation of the municipal debt. The result is that  $x_9=0$  in 2003, while  $x_9=1$  since 2004.

Fragmentation of government can be measured using Herfindahl index, where  $x_{10} \in (0,1)$ . The higher value of  $x_{10}$  represents a stronger government,  $x_{10}=1$  for single party. Additionally,  $x_{11}=0$  holds for coalition governments, while  $x_{11}=1$  holds for single party majorities.

Multinomial regression analysis belongs to the methods suitable for the realization of general regression problem. Multinomial regression analysis has been already used for municipal debt modelling [1,5].

#### **4. Analysis of Results**

Modelling the debt of municipalities is implemented as a regression problem. This is realized by using multinomial regression analysis (MNRA). Input data sample consists of 452 Pardubice region's municipalities. Data are preprocessed for the purposes of modelling. Logarithms of input variables are used in the case of multinomial regression analysis in order to achieve a normal distribution of the data. The quality of models is measured using the correlation coefficient  $R$ . The effect of input variables is tested for the MNRA on significance level  $p=0.05$ .

The results of modelling are presented in Table 3. The original model with an input variable  $x_1$  is supplemented by further input variables with the aim of progressively improving the regression model. This corresponds to an increase in adjusted squared correlation coefficient  $\text{adj}(R^2)$ . Statistically significant variables are marked with asterisks.

Table 3 Results of regression model

MNRA		
R	0,913	
Input variables	Beta	adj(R <sup>2</sup> )
x <sub>1</sub>	0.47	0.7004*
x <sub>2</sub>	-0.11	0.7004
x <sub>3</sub>	-0.33	0.7353*
x <sub>4</sub>	0.03	0.7348
x <sub>5</sub>	0.02	0.7338
x <sub>6</sub>	0.50	0.8265*
x <sub>7</sub>	0.09	0.8271*
x <sub>8</sub>	0.06	0.8164
x <sub>9</sub>	-0.11	0.8281*
x <sub>10</sub>	-0.07	0.8267
x <sub>11</sub>	-0.22	0.8331*

The MNRA model explained 83.96% of the original variability ( $R^2=0.8396$ ). Beta coefficients show the strength of influence along with the positive or negative effect of input variables. Input variables  $x_1, x_3, x_6, x_7, x_9$  and  $x_{11}$  have proved to be statistically significant.

There is strong evidence of a relationship of debt to population, own revenue (fiscal autonomy), assets, competences, debt regulation and political fragmentation. Demand for public goods, influenced by the size and income of the population, leads to an increase in the municipal debt. The supply of public goods is also affected by the scope of municipal competences. A higher interest rate leads to the reduction of municipal indebtedness. However, the influence is insignificant as the level of interest rates was at a low level and its changes were minor during the period.

Increased fiscal autonomy allows municipalities to replace the debt with its own revenue. Concentrated economy may cause economic problems to municipalities. This is however not a factor, which would cause fiscal problems in a short period. Moreover, the Czech economy was at the stage of economic growth during this period. The influence of this factor should be examined in particular during the economic recession. Municipalities may sell their assets or use it as a guarantee for a bank loan. According to the positive Beta coefficient, municipalities invest in the maintenance and development of their assets.

The closer is the time of election, the higher is the debt (election cycle). However, the influence is insignificant, the examined period seems to be too short. It is clear that the introduction of debt regulation has led to a reduction in the debt of municipalities. This effect, however, may prove to be a short-term one, depending on how the central government will penalize highly indebted municipalities. With respect to fragmentation, the evidence is in line with the notion that political decision-making under fragmented government is less flexible [1]. Thus, political negotiations are more complicated in the case of fragmented governments. In addition, each political party tries to implement its political agenda, usually requiring a large investment. Stronger government leads to less debt, especially for single party majorities.

## 5. Conclusion

The article presented the current state of municipal debt in the Czech Republic. Furthermore, the regression models were designed in order to quantify the influence of input variables on the debt of municipalities. Statistical methods were used for modelling. Models

have been applied to the data sample of municipalities in the Pardubice Region. The impact of economic and political variables on the debt of municipalities was examined during one political cycle (4 years). The demand for public goods, the fiscal autonomy of municipalities, their assets and political fragmentation has shown to be key factors.

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