Local Government Budgeting in Hungary

Assessment of Quantitative Techniques for Local Business Tax Forecasting in Cities with County Status

By

Ádám Németh

Submitted to

Central European University

Department of Public Policy

in partial fulfillment for the degree of Master of Arts in Public Policy

Supervisor: Professor Károly Zoltán Jókay

Budapest, Hungary

2012

Abstract

This thesis analyzes local government budgetary forecasting in cities with county status in Hungary. Discrepancies within the decentralized governance system call for initiating state-of-the-art local managerial approaches. Current budget forecasts techniques are solely based on expert judgments. Major findings of his thesis include that municipal tax revenue forecasts are volatile and inaccurate. Moreover, these forecasts systematically underestimate tax revenues. Four quantitative models were analyzed with respect to the possibility of introducing them. Two types of trend analyses were found inaccurate, but time series and multivariate regression models could be considered to be used by local forecasters in order to assist their budgetary process.

Key words: Decentralized finance, Local government budgeting, Hungary, Municipal tax revenues forecasting,

Acknowledgements

I would like to express my gratitude to Professor András Vigvári and Profesor Róbert Kovács for providing useful insights. However, first and foremost I would like to tender my thanks to Professor Károly Jókay, my supervisor who guided my research.

Table of Contents

Introduction

Hungarian local governments are experiencing fundamentally new challenges since they were erected after the fall of communism. The current financial crisis has not only heavily impacted them mainly through foreign currency denominated loans, but the process of decentralization seems to be reversing, leaving less and less room for local governments to manoeuvre. Given the fiscal distress that recently characterizes the Hungarian economy and the historical peak of long-term debts sub-national governments have accumulated, more prudent and accurate planning is desired to be initiated into local budgeting.

Sub-national government revenues represent 13% of the Hungarian gross domestic product (GDP) of Hungary .Considering that 3,194 local governments (the capital and its 23 districts, 23 cities with county status, 274 cities, 146 villages and 2,708 small villages) Hungary is one of the most decentralized countries in Central Eastern Europe (Vigvári, 2010:52). However, the revenues of sub-national accounts mainly rely on government transfers, particularly from assigned personal income tax and earmarked transfers. These sources of revenue are determined by a redistribution process. However, local taxes, dominantly from local business tax, still represent a significant portion within municipal revenues. Local governments have direct impact on these municipal taxes, either in terms of setting its rate and determining tax bases. Therefore, local financial managers are obliged to forecast local taxes within the budget cycle. Since little assistance is provided from the central government to these processes, and given the fact that local government finance has been operating in a relatively short period, local financial decisions, especially budgetary forecasting, are solely determined by qualitative techniques, i.e. expert judgments.

Despite the fact that the underlying literature assumes that quantitative methods are superior to qualitative ones in terms of accuracy, no widely accepted empirical evidence has been found to underpin this assumption. Moreover, emerging and transition economies are frequently cited as unfruitful soil for quantitative, financial planning, especially forecasting revenues. Main reasons for this are the lack of appropriate data and the lack of local expertise for applying and monitoring quantitative models. Therefore, in most of the cases qualitative, commonly expert judgements are used in the budgetary cycle. In light of the aforementioned difficulties, many studies find that more accurate budget forecasts could even be achieved by using these techniques (Frank and Ginakis, 1993; Forrester, 1991; Rubin, 1987; Wildavsky, 1989). However, Reddick (2006) highlights that despite all the difficulties quantitative techniques notwithstanding should be considered to be implemented in order to make budgetary processes more reliable and transparent. Budgetary forecasts, entirely based on expert judgements, can be easily influenced by influential members of local communities; therefore, a systematic bias will be built in to local government budgeting (2006:599).

Unfortunately, the Hungarian system is no exception. Sub-national revenue planning is outrageously driven by expert judgements, not by quantitative models. Only few initiatives (Tönkő, 2007) were launched to implement quantitative forecasting techniques in local government budgeting, but they failed to strike roots. However, very little research has been carried out both on assessing local government budgeting forecasting techniques, and on actually looking at the possibility of applying quantities models to municipal revenues. Additionally, previous studies mainly focused either on the entire country, or just the capital. Cities with county status, most dominant determinates of regional economy have received very few academic attention.

This thesis has two major questions to answer: Firstly, *how accurately local managers of cities with county status could forecast municipal taxes in the last five years?* Secondly, could *quantitative financial models increase accuracy of local business tax forecasting if they were implemented in cities with county status?* Given the limitations originating from deficient data and that the literature suggests that more complex models in this field do not increase accuracy, this paper only investigates three relatively basic types of quantitative techniques: trend analysis, time series analysis and multivariate regression analysis. Each technique is assessed by comparing the mean average percentage errors (MAPE) of the different models in compared to the simples, *naïve* model in which the value of the previous year is taken as the best estimate. The models are applied to each city individually. All the data used are secondary sources, provided by the State Audit Office, Hungary and the Hungarian Central Statistical Office.

In order to provide an answer the main questions this paper tests the following hypotheses:

H1 Local tax forecasts of cities with county status are inaccurate and volatile.

H2 Local tax revenues are systematically underestimated

H3 Basic trend analysis and time series analysis cannot increase forecasting accuracy

H4 Multivariate regression analysis can significantly increase accuracy

The goal of using these models is not to determine the most suitable quantitative models to each city, nor to provide a full presentment of quantitative forecasting techniques in local government budgeting, but to initiate the exploration to implement quantitative budgetary forecasts in this sector. Limitations rooted in the current public sector scheme, especially in terms of budgeting and accounting creates considerable limitations to this paper. However, it is not a goal to propose changes to these problems, but to incorporate them into the analysis. Therefore, this paper will assuredly fail to identify one single quantitative model that could replace the current practice. However, the coexistence of these quantitative approaches with expert judgements could avail local financial forecasting to be based on multiple pillars and increase prudent local financial management.

The paper is structured as follows: the first chapter briefly introduces Hungarian decentralized governance and municipal taxes. The second chapter depicts local government budgeting. The third chapter demonstrates the challenges and practices of local government revenue forecasting and briefly introduces forecasting the aforementioned forecasting techniques. The fourth chapter aims to assess the accuracy of local government forecasting in cities with county status in Hungary. The fifth chapter applies these quantitative models to the local business taxes in these cities, and evaluates their accuracies for historical data.

1 Decentralized governance in Hungary

Fiscal decentralization is mainly seen to incorporate two distinct advantages: first, fiscal decentralization promotes local economic development; driven by the belief that local revenue generation capacity is more efficient than central (Kopányi et al, 2004:15). Secondly, decentralization also reduces the distance between voters and the elected government, i.e. accountability and transparency will be enhanced (SAO, 2011:11). Despite the fact that after the fall of communism the establishment of Hungarian decentralization system was mainly captivated by these motifs, nowadays, from numerous aspects the Hungarian system remains unfinished and calls for structural changes. This chapter briefly looks at the Hungarian sub-national governmental system, how it has evolved in the last twenty years, and its place in an international comparison. Decentralized governance systems can be evaluated with special respect to two aspects: number and size of local governments, and financial decentralization.

1.1 Size of local government sector in Hungary

The optimal size of local governments can guarantee the achievement of economic efficiency, promote democracy at a decentralized level, and could be an alternative for checks and balances; it could contribute to effective distribution and development as well (Swianiewicz, 2002). However, no unanimous principle is widely accepted concerning the desired size of decentralized governments: two basic methods are applied based on two dimensions: population and geography. In the Hungarian system only the population of local governments is taken into consideration when the minimum threshold is drawn (Vigvári, 2010:54).

Among transition countries Hungary took a leading role in decentralizing its state administration by delegating responsibilities to local governments. Public administration consists of three levels of elected public officials. At the third level we find the capital consisting of 23 districts, 23 cities with county status, 274 cities, 146 villages, and 2,708 small villages. Compared to the population of Hungary, roughly 10 million people, it can be considered as a highly decentralized country. Only 10% of local governments have more than 5000 inhabitants (Vigvári, 2010:52-4). However, one of the major shortcomings of the current legal regulation on local governance is that it fails to create groups of local governments in terms of rights and obligations. Therefore, a city of multiple thousands of inhabitants falls under the same obligations of tasks as a remote village. Moreover, local governments are entitled to undertake mandatory and non-mandatory functions as well provided they are financially capable of accomplishing that task. However, the borderline between mandatory and non-mandatory functions, in many cases, remains unclear (Halmosi, 2009:101). Hungary, therefore, from the perspective of local government size, is one of the most decentralized countries in Europe.

1.2 Size of cities with county status

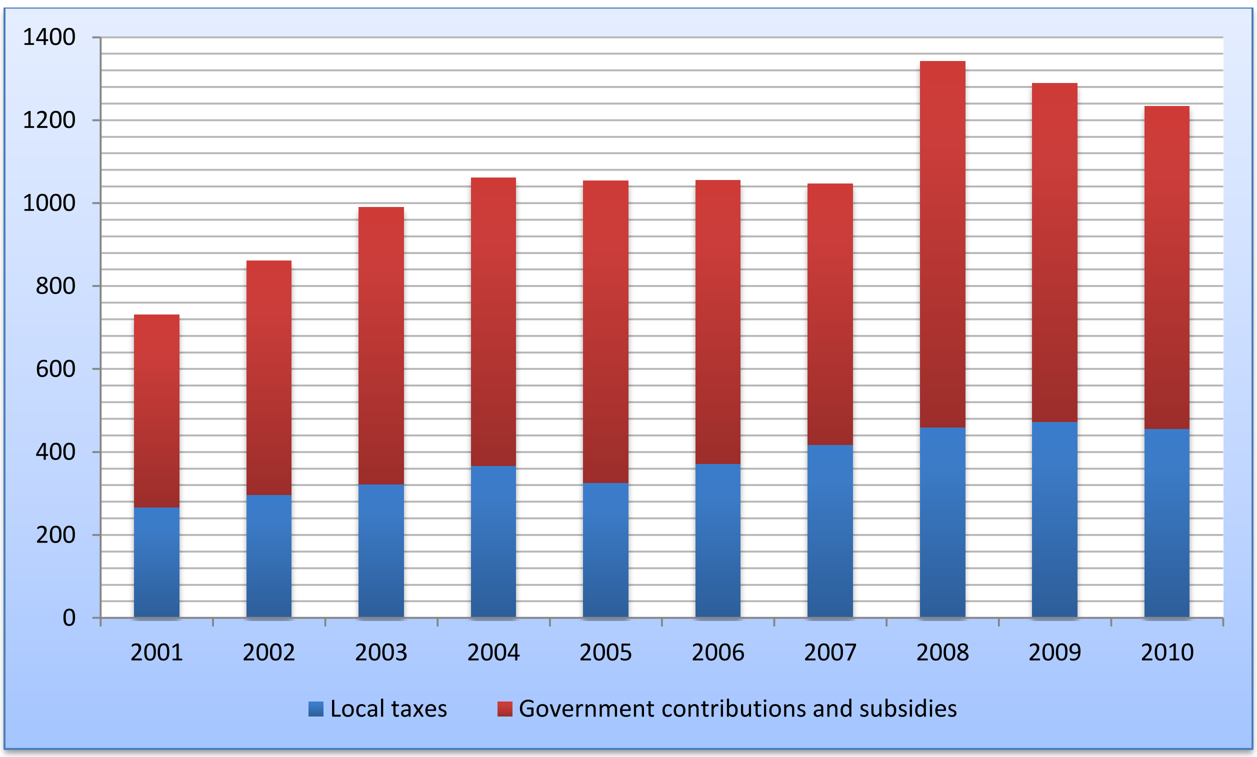
Within the sub-national system cities with county status play a special role. According to the Act LXV of 1990 On Local-Self Governments, every city with a population exceeding 50,000 was awarded this title. Initially, in 1990 the following 20 cities were nominated with the title: Békéscsaba, Debrecen, Dunaújváros, Eger, Győr, Hódmezővásárhely, Kaposvár, Kecskemét, Miskolc, Nagykanizsa, Nyíregyháza, Pécs, Sopron, Szeged, Székesfehérvár, Szolnok, Szombathely, Tatabánya, Veszprém, Zalaegerszeg. In 1994 two further cities received the title: Salgótarján and Szekszárd. In 2006, Érd, a city situated within the agglomeration of Budapest was awarded the title as well. Therefore, in total the number of cities with county status is 23. The reason why this paper only looks at the local budgeting of these cities is led by theoretical and practical reasons. Cities with county status, besides the capital, play a crucial role in the Hungarian economy. They both have been the target of numerous investments and fulfill essential public administration roles. Figure 1 in the Appendix demonstrates that they have represented roughly 20% of the Hungarian population in the last ten years. Moreover, from the size of local governments, they also find themselves in a special position, as only 23 local governments have to serve the need of more than 2 million people, as the average population of a local government is 5,000. Cities with county status, therefore, face greater challenges in terms of financial planning, mainly because of the multitude of inhabitants. On the other hand, as practical reason for the focus of the analysis, only these cities provide publicly available and detailed data that suffice the requirements of the analysis. Additionally, cities with county status have attracted little academic attention, as prevalently studies focus either on the entire sub-national governmental system, or the capital itself.

1.3 Local government financing in Hungary

Another way of analyzing decentralization is assessing the way local governments finance their operations. Kopányi et al (2004:34) highlight that local taxation capacity, compared to other countries, is limited in Hungary, and local governments have remained reliant on central government transfers. Figure 2 and 3 in the Appendix, from an OECD study of 2012 also confirms that either with respect to autonomous taxes, tax sharing and grants as a percentage of general government tax revenue, or taxes for which sub-central governments may set tax rates and/or the tax base, as a percentage of total tax Hungary is one of the least decentralized of OECD countries. Despite Figure 2 in the Appendix pictures 1995, conditions have not fundamentally changed. Local governments can only have a marginal impact on setting the tax rate of the total tax revenues they receive. More than 70% of local government revenues are coming from the central budget (Aczél and Homolya, 2008:22).

As far as current revenues are concerned, as Figure 1 illustrates, local governments in Hungary have managed to gather more and more current revenues in the last ten years. On the other hand, even though municipal taxes nominally increased by 70% from 2001 to 2010; since government contributions and subsidies also rose by 67% in this period, the ratio of dominant governmental transfers has remained constant. Assigned personal income taxes continue to be the most dominant component of government transfers accounting for 47% on average in this period. Central government subsidies have shown a significantly decreasing trend. Subsidies to underprivileged local government which lack resources, however, followed a different trend: in spite of the fact that, if 2001 compared to 2010, this category declined by 64%, in 2006 central government transfers peaked at the double of the original value. [1]

Figure Current revenues of the local government sector in Hungary (bHUF)
Source: the author based on data from the Hungarian Central Statistical Office



Subsidies to bankrupt local governments to resolve their debt liabilities have low in between 2001 and 2010. However, Jókay et al (2004) provide an alternative explanation for this phenomenon.

[1] Capital type revenues, especially sales of tangible assets, revenues from other sources than the central government, and other capital gains are excluded from the analysis as current revenues better reflect

They point out that this might be accountable to the fact that under the current legislation none of the involved parties of a contingent bankruptcy has an interest in initiating liquidation, as it is commonly seen as inadequate means harming all involved interests.

Mainly highlighting the contrast between the size and financial decentralization, the current system has been subject to criticisms mainly highlighting the fact that it fails to "address the aspects of spatiality or, to use an economic concept, those of 'overflow' or size-efficiency, and, in many respects, it even went against the typical international trends"(Pálné, 2010: 519). Moreover, the discrepancy between the tasks and sources, and the uncertainty local governments are surrounded by have largely contributed to a situation full of conflicts and an exaggerated agency-principle dilemma. Local governments created "buffers" against contingent unfavorable decisions (Vigvári, 2010). Moreover, public sector reforms are especially absent in this sector. Even the legal boundaries local management acts within have numerous shortcomings. Lack of a state-of-art accrual accounting system disables certain processes and activities to be detected and analyzed. Furthermore, the series of reports carried out by the State Audit Office, Hungary (SAO), indicated that both local statistics and data, and the financial information provided by sub-national governments are many times deficient and artificially overcomplicated (2010:20).

1.4 Cities with county statues

The State Audit Office, Hungary launched its series targeting to audit cities with county status in the early 2000s. However, each city was audited only in 4 years time on average. Reports on final accounts, however, were initiated to be available to the public through local government websites as of 2005. Therefore, my analysis mainly relies on data obtained either from the period of 2007- 2011, or secondary data of TeIR.[2] As Figure 1 of the Appendix demonstrates, compared to the national

[2] National Development and Planning Information System, run by the VÁTI non-profit Ltd

figures cities with county status have gathered 24.6% of all municipal tax revenues. Considering that they only account for 20% of the population, it is above the national average. Moreover, municipal tax revenues have shown an increasing trend in the last 10 years reaching a peak in 2008. However, government transfers and subsidies also exceeded the population rate, meaning that these cities on average were overrepresented in terms of received government sources compared to the national average. As Figure 4 in the Appendix demonstrates all types of municipal revenues have shown escalation of cities with county status. Municipal taxes, considered per se, can also be seen as a success, since nominal revenues originating from this source almost doubled. However, similar to the national panorama, cities with county status, in fact, continued to be basically reliant on government transfers and subsidies. Current revenues growth was fueled by undertaken loans and bonds. Sub-national governments had been unwilling to undertake long-term loans for 15 years. However, as of 2006, fueled by a great "boom" of bond issuance, they undertook significant long-term liabilities. Within 2 years the long-term debt of the municipal sector rose from 2.3% to 3.2% of the gross domestic product (GDP). Additionally, most of the loans undertaken were denominated in Swiss franc which put local governments in significant exchange rates risk, as they received their revenues in HUF. However, a significant part of these loans has not been utilized as investments, but as a bank deposit (Homolya and Szigel, 2008:20). Since the exchange rate risk aggravated through these deposits, local governments are facing novel challenges increasing the tension among local and central public managers.

To conclude, the Hungarian local government system can be characterized as being two-faceted. On the one hand, in terms of size, Hungary is one of the most decentralized countries both in Europe and among OECD countries. On the other hand, if we take into consideration the financial aspects, Hungary remains profoundly centralized, where local governments play a limited role in terms of influencing their revenues. Additionally, local government sector experts (Halmosi, 2009; Vigvári,

2010) claim that the sub-national government sector has long been considered as a "conflict container." Central government decisions put local governments in charge of functions without allocating the necessary resources adequately enabling to financially perform them.

1.5 Municipal taxes

Article 82 of the Act LXV of 1990 On Local-Self Governments local governments regulates the range of municipal taxes local governments can have a direct impact on the introduction, or the applied tax rate, or the tax expenditures. Concerning municipal taxes the Act C. of 1990 on Municipal Taxes determines three major types of taxes falling under the legislation and regulation of local governments: 1. Regular taxes on wealth (building tax), 2. Communal taxes (communal tax on individuals and tourist taxes) and 3. Local business tax. In the last 20 years 18.1% of GFS revenues came from local taxes (SAO, 2010:5). Revenues from municipal taxes are determined by three factors: first, legal changes in the Act C. of 1990 on Municipal Taxes, i.e. alterations of tax rates or the tax base. Second, initiating certain municipal taxes, which local governments have the autonomy not to introduce. As of 1991 many local governments decided to apply only few municipal taxes, only 10% used any municipal taxes at all (Járja, 2006). Szalai (2005) argues that a tax competition folded out, where larger communities, i.e. cities had a comparative advantage because of their attractiveness for companies; therefore, they could allow using higher tax rates. Szalai (2005:56) also highlights that the higher nominal local business tax revenues are not attributable to population size, but only to greater tax base. Furthermore, his further finding concludes that if population and tax base effects are separated, a marginal increase of population has even a negative impact on the tax rate. However, by 2002-3 the number of local governments having introduced their own taxes reached 96%, reaching a stable rate. In 2009 only 45 local governments (1.4%) were left not applying any municipal taxes, and 87% of them had introduced local business tax even though with different rates, tax bases and concessions (SAO, 2010:11). The third factor is the region, the economic environment the particular local government operates within. The types of municipal taxes were greatly determined by the industrialization of the local economy, for instance. This resulted in regional disparities, as the capital (around 16% of the population) gathered 52% of national local taxes from 2002-06. However, municipal tax revenues were approximately equally distributed in other regions. In 2006 the average municipal tax per capita was HUF 110,215, significantly higher than the HUF 44,608 national average. As far as the internal distribution among the three different types of municipal taxes is concerned, local business tax has always played a determinate role, accounting for more than 80% of local taxes since 1990s (Járja, 2006).

Given the focus of my paper, and the fact that local business tax has been the determinate element of municipal taxes in cities with county status, my paper solely looks at the changes local business tax has undergone. Since 1990 more and more local governments decided to introduce local business tax regardless the economic environment. Nowadays, more than 90% of local governments utilize this type of municipal tax; mostly small villages opt out in the hope of attracting more companies. However, with no exception, municipal taxes are mostly dominated by business tax in cities with county status. As Figure 5 in the Appendix demonstrates local business taxes on average contribute to all local taxes more than 80% in cities with county status. However, a moderate shrinkage is particularly attributable to the fact that other types of local taxes outgrew the growth rate of local business tax. As Figure 5 in the Appendix demonstrates, local business tax in cities with county status soared from the nominal value of HUF 51.7 billion in 2000 to HUF 18.7 billion in 2010, reaching a maximum in 2008.

The tax base of local business tax is also outlined in the Act C. of 1990 on Municipal Taxes: basically 80% of net sales revenues of the underlying company, or in the case of self-employment 120% of personal income provided it does not exceed 80% of sales revenues, but maximum 5000 HUF per day. The maximum tax rate was 1.4% until 1998, 1.7% in 1999 and since then 2%. Under the current regulation, no individual tax expenditure can be initiated; however, a tax concession is guaranteed if a company increases the number of its employees, HUF 1 million per person.

Hungary's accession to the European Union did not require any fundamental restructuring of the municipal tax system. However, in certain aspects harmonization and amendments with the European laws were required to be carried out. Even in 2002 the Amendment of the Act C. of 1990 on Municipal Taxes carried out some preparation in terms of limiting tax expenditures and concessions to companies with a tax base of a maximum HUF 2.5 million. As of 31 December, 2007 all municipal decrees providing either tax expenditures or tax concessions were abolished.

The report of the State Audit Office, Hungary (2010:12) underlines that the planning local business tax has been surrounded by high uncertainty. Budgetary numbers are not based on fact numbers, but expert judgments, and mainly last year tax bases and figures. This uncertainty was even exaggerated by central policies and laws that aimed to amend municipal taxes. The Parliament, for instance, by passing the Act CXIX of 2005, voted to cease local business tax. All these measure were carried out without having done any thorough analysis how local governments would have addressed the problem of abolishing the major revenues source of local governments. However, the Supreme Court claimed these laws to be unconstitutional and abolished them (2010:17-18). The next chapter looks at local government budgeting, and how cities with county status managed to internalize this uncertainty, and to forecast local business tax.

2 Local government budgeting

Local government budgeting has received little academic attention, especially in transition countries. One of the reasons that I also had to encounter is the lack of appropriate data at the local level. Shortcomings originating from public sector reforms, the reliability of longitudinal data even can encumber experts of the local government sector to produce benchmarks of transitional countries. However, as decentralization gained ground, local governments commenced to have a greater impact on national economies; and it was realized that "city budgeting would have profound effects at the federal level" (Wildavsky, 1989). Therefore, both at the central and the local level the demand arose to examine various facets of good local governance. This chapter introduces the reader to local government budgeting, the role and concept of a budget to the budgetary process in Hungary, constraints and challenges local public managers face, and the different revenue forecasting techniques.

Since local public managers, by definition, operate to the closest to voters, they constantly face challenges occurring from the fundamental contradiction how local communities intend to shape policies. Blom and Guajardo (2001:1) point out that most citizens, when asked about the current service level provided by the government, claim that it should be improved; while they are almost against any tax or fee increase, and would prefer to see a decrease. However, obviously, this phenomenon raises an unsolvable paradox that public managers are supposed to solve. On the other hand, one means to overcome this problem, which occurs to be one of the main drivers of decentralization as well, is increasing transparency, letting taxpayers know what their taxes are spent on (SAO, 2011:11). Local government budgeting, therefore, is not only an accounting procedure, relieving resources to be kept track of, but meeting local needs as well. Even the way how the budget and the budgetary process are perceived, either by public servants, either by citizens, differs from country to country.

Lee (2003:17-8) distinguishes four roles budgets can fulfill: budget as document, description, explanation and preferences. Tönkő (2007) applies similar framework to local government budgets in the context of the Hungarian system, by identifying roles good budgets shall perform: Budgets as policy statements, shall "guide the activities of people who are budgeting" (2007:110). Budgets shall outline policy goals and line, reflecting how the local managers perceive the future. This facet of the budget is mainly oriented to the expenditure side. However, budget as a financial plan involves both the revenue and the expenditure sides by projecting into at least the upcoming year. Tönkő (2007) also mentions that, to some extent, explanations shall be included into the budget how and why financial conditions might have undergone certain changes, and how local debt changed. Obviously, this role involves a detailed analysis of revenues and expenditures, including a backward looking section as well. Local government budget shall also serve as an operations guide. It shall outline activities, services and functions effectuated, including the measurement techniques of assessing the performance based on previous data. Finally, budget shall also serve as a communications tool. An accessible and understandable budget can bring citizens closer to policies, bridge the gap between the aforementioned paradox of demanding better service and lower taxes at the same time (2007:110-2). To conclude, budget is not only a document, but an intermediate means transmitting different pieces of information both to outside and inside of the organization; it is the most significant control instrument of local governments (Hőgye, 2002:7).

Moreover, since Hungary, similarly to the majority of transition countries, uses line-item, or traditional budgets[3] both at the central and the local level, many obstacles are incrementally set towards budget analysis. From the perspective of this thesis two distinct concerns have to be mentioned: first, line-item budgeting sets a constraint on one of the core aims of a budget: strategic,

[3] [3] "Line-item budget presents expenditures by inputs and resources purchased… classified by disaggregated objects of expenditure and by operating and capital expenditures." (Shah and Shen, 2007:128)

i.e. medium and long-term financial planning, as "line item budget is a product of history, not of logic" (Wildavsky, 1986:313). Even the format of line-item budgeting inevitably places the emphasis on accomplishing instead of planning. Linkages between the expenditure and revenue sides of a budget remain hidden. Since local politicians prioritize investments and revenues to appear on the shortest term, line-item budgeting, which only provides a snapshot of the base and consecutive years, decidedly hinders long-term planning. Annual budgets will be influenced by "the burden of past policy, budgetary and legislative decisions leaving little room for maneuvering" (Axelrod, 1995:288). New budgets, therefore, are mostly sole adjustments to previous year's budget, pressuring local public mangers to be able to be accurate only using minor amendments (Fölscher, 2007:112). Line-item budgeting, the focus on cash basis instead of volume, disables local financial managers to overcome such seemingly simple problems as internalizing inflation risk (Wildavsky, 1986:317). Another problem originating from line-item budgeting is the lack of performance indicators leaves no other room for most of the policies than being designed and carried out without the possibility of monitoring the outputs and outcomes. Obviously, line-item budgets are hardly comprehensive for citizens, therefore, per existence, undermine transparency, and reduce the function of the budget to pure track keeping (Mikesell, 2011:238).

These disadvantages are especially valid to the Hungarian system. Local managers of cities with county status experience great distress as tax bases across the country show significant differences. As demonstrated in Figure 6 in the Appendix, cities with county status also have highly different local business tax revenues per capita. Figure 6 in the Appendix also reveals the concerns about regional disparities as outlined above. Hungary is commonly seen to be divided into east and west; west being more developed, this graph partially confirms this assumption. Eastern cities, on average have lower revenues from local business tax. However, many eastern cities are exception from this assumption. It is worth mentioning that this source of revenue Győr skyrocketed in 2007 and 2008.

It is a good characteristic of drivers of local business tax. The main drivers of this growth was the settlement of large investments, especially the Audi factories. Therefore, few large investments were able to more than double the per capita business tax revenues of two cities, meanwhile mainly one city was targeted by these investments.

In spite of the aforementioned disadvantages and constraints, rooted either in the nature of local budgeting or in the traditional budgeting system Hungary uses, local government budgeting, also has distinct advantages. Mikesell (2007) highlights the following ones: Local governments possess the potential to alter central policies in order to meet local needs. Since no population is homogenous, local governments can take into account the underlying differences of citizens' need and formulate or shape central policies to satisfy a higher level of local demand. This strength plays more a important role when regional differences are intense, e.g. economic, geographic disparities are dominant. Second, local governments are the essential means to involve citizens into local decision making. The policy process, therefore, will not be separated from the target population. This facet gained larger field by the widespread of information technology. Thirdly, local governments, given the fact that they are numerous, will serve as a basis for experimentation and innovation for the central government. Driven sovereign wills, certain best practices can be utilized in other local governments. Fourthly, acting close to the citizens will certainly increase the need for accountability public service delivery and public funds usage. Additionally, local public decision makers are also members of the local community, i.e. they incrementally represent their community. As a fifth advantage, citizens are likely to be more willing to accept tax increases if they encounter what their taxes are spent on, on an every-day basis. Moreover, services delivered by local government are the ones citizens are most sensitive about, i.e. any changes will immediately influence them. Finally, local governments are the most effective leverages to represent sub-national minorities (2007:16-19).

On the other hand, immense disadvantages curtail local government budgeting. In many cases, inevitable overlaps of responsibilities will arise leaving local managers in doubt about their duties. Local decisions are greatly influenced by external, macro variables, creating unexpected obstacles in front of local financial planning. Local decision maker are claimed to lack technical capacity that are present at the central level. One of the main reasons for it is the economies of scale; overhead costs of these decisions cannot be allocated, given the small size of local governments. Another disadvantage of local government budgeting, from central perspectives, is that one general fiscal system will have fundamentally different effects due to regional dispersion of resources (Mikesell, 2007:20-26).

2.1 Local budget cycle in Hungary

Budgeting of Hungarian local governments is regulated by the Act XXXVIII. Of 1992 on General Government and the interim circular issued by the Minister of Finance. According to this Act the following financial reports have to be provided: budget conception, local decree, periodical reports, final accounts any contingent amendments to the budget. In the final accounts the following documents have to be brought to public: consolidated balance sheets, budgeted values previously projected, detailed summaries of the previous year on revenues and expenditures. Concerning the budget cycle the budget concession has to be carried out by 30 November and 15 December. Within 45 days the budget concession is accepted, and a decree on the budget has to be published as well. The deadline for the final accounts is 30 April. Intra-year amendments to the budget with respect to changes compared to the budgeted values can be initiated quarterly: 30 April, 30 June, 30 September, and 31 December.

3 Local budget forecasting

Local budget forecasting literature is mainly concentrated on analyzing budgeting in very developed countries, especially in the United States of America. One of the main drivers, besides academics of this field being active and the highly decentralized nature of economy, is the availability of accessible and adequate longitudinal data. The most important reason why local public managers face even greater financial constraints and stress concerning regulating fiscal deficit than at the central level is the capacity of central government to regulate money supply (Schiavo-Campo, 2007:257). Local governments face probably even higher distress than central government. Their forecasting techniques, because of economies of scale, are less advanced than central one; they require extensive trainings, time and resources (Forrester, 1991:334; Frank and Zhao, 2009:18-9). Additionally, forecasting becomes more difficult as local governments tend not to collect revenues from reliant property taxes, but economically dependent, i.e. more volatile taxes, as property taxes are less elastic than other sources (Ginakis and Frank, 1993:131; Frank and Zhao, 2009:21). Therefore, local governments have to find an optimal output influenced by three major limited inputs: monetary, personnel and legal. Chang (1979:38) provides the example of the municipality of New Jersey, USA, as, in its budget, it cannot exceed previous numbers, unless for valid reason.

Wildavsky (1989) highlights the complexity of local budgeting roles, especially of the mayor. Mayors have to pay attention to four, in many cases contradictory, aspects: firstly, they have to recommend a balanced budget in order to safeguard fiscal discipline. Secondly, the current level of services has to be maintained. Thirdly, wages of city employees, if possible, should be increased. Fourth, all the above-mentioned measures should be carried out without increasing the tax burden on local community (1989:183). Circincione et al.(1999:26-7) highlight that inaccurate forecasts can lead to a lower level of productivity. Therefore, it is crucial for local management to have as accurate revenue forecasts as possible in order to avoid contingent cuts at the expenditure side, or raising taxes. Even though inaccurate revenue forecasts are commonly attributed to an unpredictability of economy, lack of knowledge, or too simplistic estimation models, it might be a conscious political decision as well. The fact that revenues are under-forecasted creates a "buffer" against shocks, i.e. unexpected revenues falls, or cuts in government transfers. Accurate forecasting, provided it becomes a public piece of information, embodies the risk of overestimating. Consequently such a buffer can be utilized to cushion administratively and politically costly, i.e. sensitive, decisions. Hence, the greater the uncertainties surrounding local financial management, the more incentives to under forecast the revenues of the budget. Since poorer countries are associated with higher risks, it is no surprise that their local governments are more likely to produce forecasts with a built-in buffer (Rubin, 1987:83-4). Therefore, one means to overcome the possible costs of inaccurate forecasts is to incorporate a systematic bias, i.e. under-forecasting, towards negative scenarios within the budget (Frank et al, 2005; Gianakis and McCue, 1999:31; Reed and Swain, 2010:173-4).

However, these buffers do not provide long-term solutions for assessing local financial challenges. Central government officials, for instance, become also aware of the fact that local governments provide forecasts below the actually anticipated values. From the perspective of the central government these buffers are seen as local governments trying to maximize government transfers. That is why, following the principle-agent model, the central government will automatically cut transfers, believing cuts to be covered by the buffer. Local governments, therefore, can only have short-term gains from creating these built-in buffers. Therefore, in the long-run under-forecasting only contributes to the risk factor local governments have to tackle.

Another factor that would appear as a severe challenge either in the private or the public sector is that the initial forecasting starts before public managers could learn base year results. Internal cash transfers and detailed final data are only available after the end of the budgetary process. Hence, budget forecasts are essentially carried out for two years in advance. This factor calls for frequent revision and amendments of the budget based on the actual values and changes of presumptions (Gianakis and McCue (1999:32). Therefore, timing in the budget cycle plays a crucial role. In order to increase accuracy of the forecasts shall be revisited during and before the budget cycle (Grothe and MacManus, 1989:389).

3.1 Forecasting accuracy

As mentioned beforehand, forecasting is an optimal outcome of scarce resources facing constraints from monetary, personnel, and legal perspectives (Chang, 1979:38). Therefore, assessing forecasting accuracy is a complex issue as well. Since the increasing accuracy of forecasts is coupled with significant costs, a decision has to be made whether the gains of more accurate forecasts could overweight its costs. Moreover, despite the costs can be well calculated, when the decision about investing into more accurate forecasting techniques, the gains remain uncertain.

Better forecasts, therefore, from a local perspective can be interpreted from the following angles: first and foremost accuracy, i.e. minimizing the error between budgeted and actual revenues. Secondly, forecasts clearly identify the underlying assumptions the budget is based upon. Thirdly, the outlay of the budget is easy to understand both for public servants and citizens. And fourth, the forecast is easy to replicate (Forrester, 1991:335).

Forecasting techniques

Local revenue forecasting techniques, similarly to any other forecasts fall into two major categories: qualitative and quantitative methods. "Qualitative revenue forecasting procedures estimates of future revenue yield with the aid of non-statistical techniques….include naïve, judgmental, consensus, expert, and Delphi forecasting" (Blom and Guajardo, 2001:29). On the other hand, "quantitative revenue forecasting refers to the process of producing estimates of future revenue yield with the aid of statistical techniques….Quantitative methods discover mathematical relationship in the historical data between the revenue source and the relevant factors that influence it" (2001:41). A further division of quantitative methods shows great variety; however, in my paper I follow a simplified distinction proposed by Blom and Guajardo (2001) and Schroeder (2007) and distinguish four major sub-categories that I apply to the Hungarian cities with county status:

1. Naïve model
2. Trend analysis
3. Time-series techniques
4. Statistical models.

Hereunder Table 1 illustrates how the literature considers these models.

Table Evolution of revenue forecasting techniques

Source: Reddick, 2006:599

Judgmental or expert (Naïve) →	Extrapolative or Trend (Incremental) →	Deterministic and Econometric (Casual)

Mainly driven by the general belief that more complex models provide more accurate forecasts, the literature suggests an evolution of local forecasting models. However, this evolution rather reflects a general, private sector belief than the obtained accuracy through applying these models.

Naïve model is solely based on previous value, assuming that the best indicator of future is the immediate past. The main underlying assumption is that revenues follow a random walk around a given value. Therefore, the best estimate of this value is the value of the previous period (Cirincione et al., 1999:42). Hereunder described equation depicts the mathematical formula for the naïve model.[4]

$$Y_t = Y_{t-1} \quad \text{..Equation 1}$$

WhereY_t is the forecasted value at year t, and Y_{t-1} is the actual value at time t-1.

Trend analysis generates forecasts based on the assumed patterns in historical data. Two types of trend analysis can be distinguished: one that is based on the average percentage change, the other uses the average change of the nominal values (outlined in Equation 2 and 3). A calculated change rate is then applied to forecast for the next year values that are multiplied by either the average rate of change in percentage or the change of nominal average value. Equation 1 depicts the trend model based on percentage changes:

$$\Delta\mu = \frac{\sum\frac{(p_t - p_{t-1})}{p_{t-1}}}{n} \quad \text{.....................................Equation 2}$$

Where $\Delta\mu$ is the trend component (in percentage) $p_t$is the value of the base period, $p_{t-1}$is the value of the previous period, n is the number of periods (Blom and Guajardo, 2001:42).

$$\bar{\mu} = \frac{\sum(p_t - p_{t-1})}{n} \quad \text{......................................Equation 3}$$

Where $\bar{\mu}$ is the trend component in a nominal value.

Trend analysis is known to have numerous distinct advantages: firstly, multiple scenarios can easily be generated compared to more sophisticated methods; it is easy to use, since it applies consistent methodology. It requires few historical data, therefore, might be more accessible for a wider public.

[4] Despite the fact that naïve models are qualitative models, the usage of them is justified by further the analysis of Hungarian data of this paper, as they will be used as a basis of comparison for other methods.

On the other hand, trend analysis is associated with many disadvantages as well: atypical periods require treatment, otherwise will greatly bias the results. Additionally, it completely eludes economic and environmental changes that might have been present or are likely to occur (Blom and Guajardo, 2001:44).

Time series techniques, similarly to trend techniques, are also incremental forecasting techniques. "Time series revenue forecasting derives a revenue projection for a particular revenue source from historical data collected at equally spaced time intervals" (Blom and Guajardo, 2001:44). Even a range of time series techniques are applied, they have the following characteristics in common: "They assume an underlying pattern of historical that can be discovered. Time series techniques do not demand a need towards exploring the various other factors influencing revenue sources. Above all, they are based on the assumption that past is a good-enough predictor of the future" (Blom and Guajardo, 2001:44). Great advantages of time series techniques are that they are easy to conduct; the methodology used is consistent, there is no excessive need for data. On the other hand, these techniques do not take into account the economic, environment and policy changes, as they provide no easy solution to include them into the model. Moreover, they simply overlook important historical events and the correlation of data (2001:58). In my paper the most simplistic time series is applied. [5] Equation 4 demonstrates the logic of time series forecasting

$$\widehat{Y_t} = \propto + \beta t \text{ ……………………………………Equation 4}$$

Where $\widehat{Y_t}_t$ is the forecasted value, α is the f(x) axis intercept, t is the time component and β is its coefficient (Blom and Guajardo, 2001:45).

[5] Given the simple nature of this time series method, some of the literature does not even categorize it as time series. However, Blom and Guajardo (2001) claim that this techniques is times series. Therefore, I use this model as a time series. However, more sophisticated methods could only be applied if longer time series was available. Khan (1989) for instance, highlights that in order to apply Box-Jenkins model a time series consisting of 50 or more observation should be used.

Statistical analyses show an immense variety ranging from relatively simple models to more complicated ones. This paper only uses multivariate regression analysis. Regression analysis, in general, assumes a set of independent variables that predict the dependent variable. These analyses can be particularly utile if only a very limited number of independent variables determine the dependent variable. Regression analysis assumes causal relationships to be linear. However, if any non-linearities are present they can basically impair the results. Equation 4 delineates the formula of multivariate regression analysis:

$$\widehat{Y_t} = \propto + \beta_1 X_1 + \beta_2 X_2 + \cdots .. + \beta_n X_n + \epsilon \text{ ....Equation 5}$$

Where $\widehat{Y_t}$ is the forecasted value, α is the f(x) axis intercept, X is the value of independent data, β is its coefficient and ϵ is the error factor.[6]

Multivariate linear regression analysis displays many advantages. First and foremost, it can assist local managers to understand the main drivers of a revenue source. However, it can also be visualized in order to make the forecasts comprehensive for general public. Moreover, it uses consistent methodology based on historical data. On the other hand, regression analysis is based on assumptions – linearity of causal relationships, for instance – that are likely to be violated. For local forecasters, it requires intense trainings and statistical knowledge and highly detailed data that might not be available. Coefficients, i.e. the relationships between the independent and dependent variables, have to be frequently revisited, as the underlying assumptions might show changes (Blom and Guajardo, 2001:45).

The next sub-chapter looks at the findings of literature, whether which models provides more accurate results.

[6] Regression analysis assumes that the errors are independent from each independent variable, as otherwise in some for errors could be included into the analysis.

3.2 Local Revenue Forecasting Accuracy

Grothe and MacManus (1989:390) highlight a common assumption about local revenue forecasting models that the more sophisticated models provide better predictions. However, when it is empirically tested results show different picture. They point out –by citing Wachs (1982:562)- that expert judgments result in more accurate estimates than other models. Investigating municipalities in Florida, US, Circione et al. (1999) arrive to the conclusion that trend line fitting models and simple time series techniques provide very low accuracy. However, more complex models, such as moving average and single exponential smoothing come to better results. They also mention the work of Downs and Rock concluding similar results that Autoregressive–moving-average model (ARMA) gives more accurate forecasts than other univariate models. Kong (2007) finds econometric models to have the best accuracy among quantitative models: "Simpler, but readily communicated models generally perform at least as well as more complex methods" (2007:185).

Hence, even the underlying literature finds no clear evidence that expert judgment or other qualitative methods are inferior in terms of accuracy. However, Reddick (2006) touches upon important aspects why quantitative methods should replace, even if partially, qualitative ones.

> Judgmental technique has considerable limitations. First, the accuracy of this approach is almost always inferior to the more rigorous quantitative methods. There is the difficulty of determining why the forecast was correct or incorrect as well as the difficulty in determining long-term projections. Second, high level public officials are usually more knowledgeable on general subjects and less able to provide forecast detail. In addition, if the expert forecaster were to leave, the model would be lost. Third, the resulting projection can be influenced by the most powerful member of the group. This can negate the advantages of specialized viewpoints and lead to forecast biases. Finally, the lack of an explicit model limits the use of the technique for estimating the effects of external factors or discretionary policy changes (2006:599).

Therefore, using quantitative methods is not only the matter of increasing accuracy, but also of making local policies more accessible and transparent.

4 Assessing Local budget forecasting in Hungary

Unfortunately Hungary does not make an exception from the rule that Schroeder (2007:53) claims according to "sub-national forecasting in developing and transition economies is stymied by the lack of empirical information on which to base analysis. It appears that local governments in developing and transition countries seldom attempt to forecast fiscal conditions in a systematic manner." With no exception cities with county status apply expert judgments to budgetary forecasting. Even though Szolnok attempted to launch quantitative based forecasting model, it could not take roots.[7] As mentioned in Chapter 2, Hungarian local government budgeting is constraint by the shortcoming of line-item budgeting: budgetary processes are incremental, and based on non-transparent expert judgments. The lack of multi-year planning appearing in annual budgets prevents experts to thoroughly examining financial conditions. Series of reports launched by the State Audit Office of Hungary underline these inadequacies in local finances (SAO, 2011; SAO, 2012).

These shortcomings also have an immense impact on the accuracy of municipal tax forecasts.[8] Figure 2 and 3 below demonstrates the aggregate figures on how total and budgeted - estimated – municipal tax revenues changed from 2007 till 2011; either as an aggregate estimate, or as a percentage of the actual values.

[7] Based on an interview with András Vigvári, professor of Budapest Business School and Tönkő (2007)

[8] All the figures on estimated and actual municipal tax revenues are based upon the analysis of only data accessed from the Final Accounts of each city with county status. The reason why the longitudinal analysis starts in 2007 is that most of the local governments are only obliged to publish these pieces of information of local decrees as of 2005. Given the fact that Final Accounts of local government only make data accessible for the overall municipal tax revenues, but the local business tax per se, I had to analyze municipal tax revenues estimates. However, , as mentioned in Chapter 1, these revenues are outrageously dominated by local business tax (more than 80%), and the other taxes are less volatile driven by their nature. Therefore, local forecasters, as some of the very few examples where detailed analysis for local business tax estimates were given, confirm that the main difference between estimated and actual revenues are rooted in the uncertainty of local business tax. The estimates of communal taxes, or land slot taxes, for instance, have a more reliant, relatively well predictable tax bases. Therefore, even though the actual values cannot be decomposed, the difference between the estimated and actual local business tax is highly likely to exceed the differences outline in this chapter. However, due to the lack of data, no such statistics can be provided to confirm this assumption. This problem raises further concerns in the next chapter, as these statistics cannot serve a basis of comparison for quantitative methods as local business tax is only a sub-set of municipal taxes.

Figure Forecasted and actual municipal tax revenues of cities with county status (bHUF)

Source: the author based on aggregate data obtained from final accounts

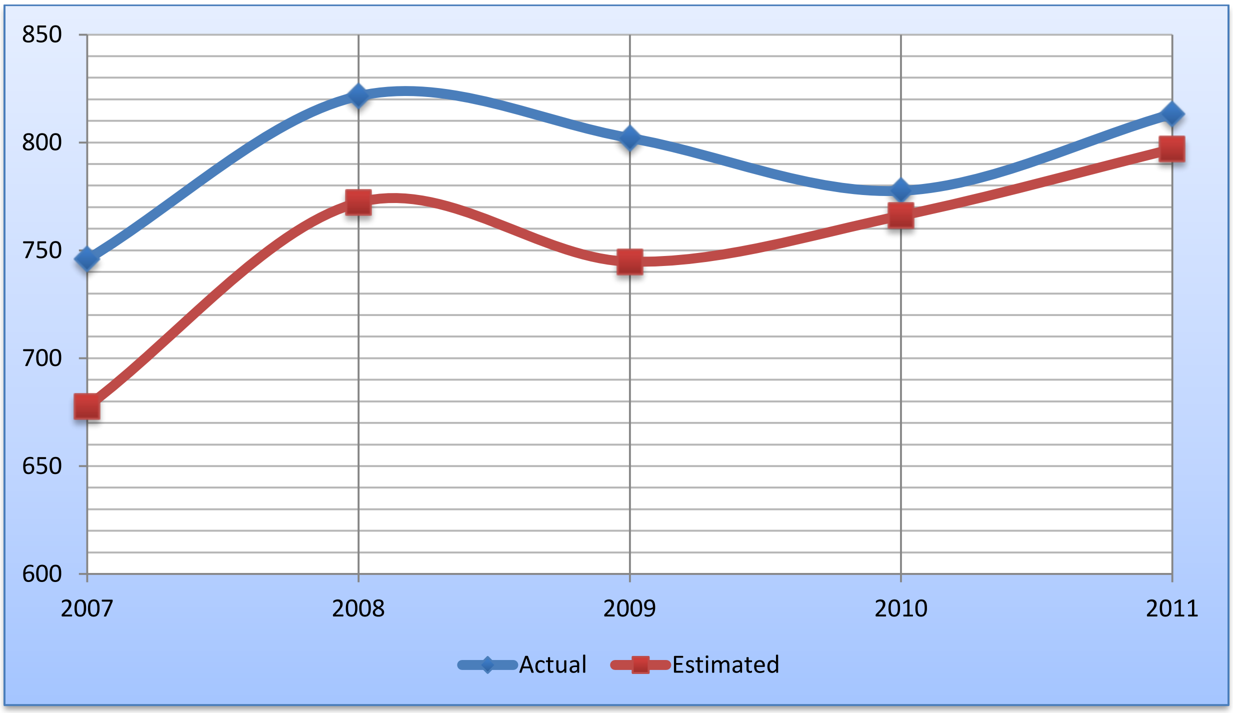
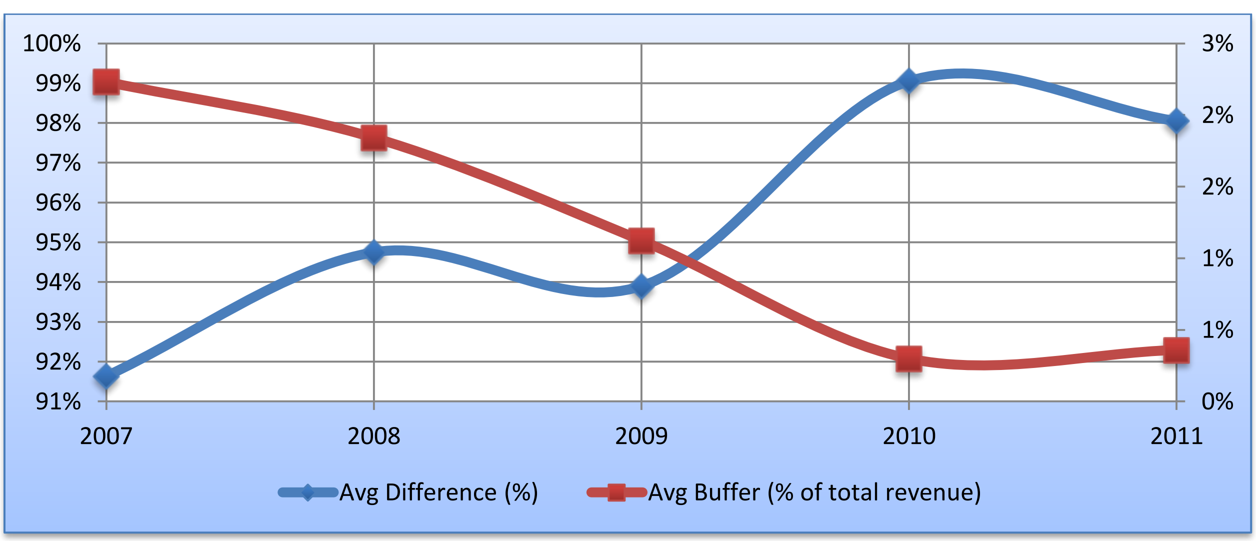


Figure Difference of aggregate estimates as a function of actual municipal revenues and total revenues

Source: the author based on aggregate data obtained from final accounts



These figures evidently underpin the fact that aggregate estimates have taken values below the actual ones. In the investigated period, the aggregate errors display the largest difference in 2007, and 2010 was the most accurate in term of total estimates. However, these are aggregate data, therefore, which has to be decomposed, and the dispersion also has to be taken into consideration. Figure 9 in the Appendix demonstrates the boxplots of the dispersion of errors. In 2007, with the exception of Szombathely, all the cities underestimated the actual revenues by 10% on average. 50% of the observations fall into approximately between 85% and 95% leaving a considerable gap between the estimates and actual values. Despite aggregate data show that 2010 was the most "accurate", a different picture is drawn if the dispersion is also taken into account. This year shows the highest deviation, with many cities having overestimated their municipal tax revenues over 10%. Therefore, from this perspective these estimates were not accurate at all, only the dispersion influences the aggregate data in the direction of closer to 100%. However, both Figure 9 show a slight improvement from 2007 to 2011.

Table 1 in the Appendix depicts the relationships between the budgeted and actual revenues for each city with county status. As it can be observed, this analysis is only based on 18 cities out of 23, not including Dunaújváros, Győr, Hódmezővásárhely, Miskolc and Zalaegerszeg. Since these cities do not provide detailed enough statistics in their Final Accounts published on their websites, they are excluded from this analysis. However, where data for one year were available for these omitted cities, it can be concluded that these cities show similar characteristics as the included ones. Hódmezővásárhely, for instance, in 2011 forecasted a really accurate value (0.3% error); but the 2010 estimate exceeded the actual municipal taxes by 9.3%.

If compared to the "acceptable" error of forecast being less than 5% proposed by the studies investigating municipalities in the United States, municipal tax forecasts show high inaccuracy; in

Hungary In many cases these errors are way beyond this value. These results confirm that expert judgment forecasting faces great limitations in terms of accuracy. Cities without exceptions have produced forecasts with errors that would not be acceptable in the United States, for instance. The main reason for forecasting errors cannot be attributed to the expertise of local forecasters, but rather the nature of expert judgment itself. Local forecasts showed a relative reliability in terms of avoiding very extreme forecasts. Therefore, within these constraints local experts have performed in an assumptive range. If these forecasting errors are compared to the total revenues of each city, we see that they have a considerable impact on annual revenues of the budget. Figure 3 (depicts that these errors on average account for 3%-1% of total revenues. It is worth mentioning that these total revenues also include capital gains, realization of real estate etc., not only government transfers, subsidies and municipal revenues. Hence, even 1% error could largely undermine the financial planning of a city. Since the average error always remained above 0%, average forecasted revenues, were less than average actual municipal revenues. This fact confirms the theory outlined in Chapter 2 according to local governments will systematically under-forecast revenues in order to create a "buffer" against unfavorable conditions and to maximize government transfers. Figure 10 and in the Appendix and Figure 3 above also depict the dispersion of such buffers and demonstrate this buffer for each city. In 2007, 50% of these 18 cities had a built-in buffer of 1-2% of the total revenues. As of 2007 the rate of these buffers show a decreasing trend, but with greater dispersion. Since this indicator is composed by the total revenues, the relative decrease is also due to the increase of total revenues, as the wedge between actual and forecasted cannot outweigh the relative increase of total revenues. This is especially true since all these cities accumulated great amount of long-term debts which add to the total revenues.

4.1 Testing of Hypothesis 1 and 2

This thesis has aimed to test four hypothesis; the first two of them are:

H1 Local tax forecasts of cities with county status are inaccurate and volatile.

H2 Local tax revenues are systematically underestimated

In light of the analysis performed above, the conclusion can be drawn that local forecasts, based on solely expert judgments are highly inaccurate. Even when the aggregate forecasts show an advance, approximating the actual values, this is only due to higher standard deviation of the errors. None of the 18 cities have been able to provide highly reliable forecasts. However, some turn out to be more accurate than others. This which is likely to be attributed to the differences of predictability among the local economic environments and expertise of local forecasters. In light if this analyis, Hypothesis 1 is accepted.

If errors showed a normal distribution around 0, i.e. both in negative and positive directions with, that would prove that there is no built-in bias into municipal forecasts. However, the fact that average errors of estimates have only positive values and dispersion confirm that cities with county status systematically under-forecast their revenues from municipal taxes. Therefore, the Hypothesis 2 is also accepted.

5 Quantitative Forecasting Techniques

Any external forecaster intending to utilize quantitative models will have to face great obstacles as municipal budgeting requires extensive local knowledge. This disproportioned situation between external and internal forecasters sets great limitations to any quantitative models. Expert judgments of local financial managers, therefore, could never be completely replaces, but only assisted by these quantitative models. No model is able to predict, for instance, the possibility of establishment of a large factory that will inevitable boost local revenues. On the other hand these techniques could be helpful in three main aspects: first, they could assist exploring the underlying trends revenues follow. Secondly, as outlined by Reddick (2006:599) they increase transparency and accountability of local government budgeting. Thirdly, if causal techniques, e.g. regression analysis are applied; the process of forecasting, *per se*, could also assist local policies to maximize local revenue generating capacity. This chapter briefly introduces the basic quantitative methods, and assesses their applicability for increasing local business tax forecasting accuracy.

This analysis is based upon the assumption that the local business tax rate and base have not changed from 2000 to 2010. The underlying reason why these assumptions have to be applied is mainly the scarcity of data with respect to this field. Only Kecskmét decided that as of 2008 it would gradually reduce its tax rate from 2% to 1.6%.[9] However, no further data are provided how it influenced the actual tax base of local companies. And any policy changes will alter the behavior of companies in term of local investments. Therefore, this paper considers both the tax rate and base unchanged during this period.

[9] http://adozona.hu/archive/20071129_iparuzesi_ado_csokken

In statistical forecasting mainly two methods are used to determine the accuracy of forecasts: the First is an extrapolative technique. It applies historical data, and leaves out some of the known observation from the time series. After exploring the trends and causalities in the historical data (not including ones that are left out) it projects the established model to the left-out data, and measures the accuracy to the projection. The second technique does not leave out observation, but only establishes a model, and investigates how accurate these models can are. Extrapolative techniques have the immense advantage of actually testing the forecasting models. The second technique, by definition, will be incremental, as it does not actually forecast into the future. (Jennings et al., 2008; McGee and Yafee, 2000). Since this analysis is only based on data of 10 years, this would only allow leaving the last year out. But it would lead to considerable bias given the fact 2010, the last year is only one observation that is not sufficient to draw adequate conclusions, and the current financial crisis might hinder to scrutinize the real trends and causalities. Therefore, my analysis is rather limited to exploring the possibility of using models to historical data, i.e. the second technique.

Additionally, the fact that my analysis is applied to 23 cities at the same time will partially addresses this incrementalism. Since if only one city were analyzed, the best fitting historical model would be the exact values as estimates. However, the same function cannot be utilized to 23 cities at the same time.

In order to make the applied quantitative methods comparable the mean absolute percentage error (MAPE)[10] is used:

$$\text{MAPE} = \frac{1}{n}\sum_{t=1}^{n} \left| \left(\frac{y_t - \hat{y}_t}{y_t} \right) 100 \right| \quad \text{...Equation 6}$$

[10] MAPE cannot be used if the series is very sparse, since it overestimates nominally low values compared to higher ones. However, in this case the time series of local business tax does not show such a sparse distribution that would not indicated the use of MAPE.

$$\text{MAPE} = \frac{1}{23}\sum_{1}^{23}\left(\frac{1}{n}\sum_{t=1}^{n}\left|\left(\frac{y_t - \hat{y}_t}{y_t}\right)100\right|\right) \quad \text{.................................Equation 7}$$

Where y_t is the value of the current year, $\hat{y}_t$ is the forecasted value, n is the number of observation, i.e. number of years (Jennings et al., 2008:51.3). Since an average MAPE is calculated for the population, i.e. for all the cities, as described in Equation 6, all the individual results will have to be calculated in order to obtain one indicator for one technique. Therefore, if MAPE is equal to zero, the model provides a perfect forecast. The larger the MAPE is, the least accurate forecasts the model generates. One limitation of MAPE is that there is no upper value that the MAPE can take. However, it provides a comprehensive measure of accuracy that can be used across models.

In the next section the following five quantitative models are compared with respect to their MAPEs for the local business taxes of the 23 cities with county status from 2000 to 2010:

1. Naïve
2. Trend analysis using average percentage rate
3. Trend analysis using average nominal value change rate
4. Basic time series model
5. Multivariate regression analysis:

Given their characteristics outlined in Chapter 3, only the choice of independent variables for the multivariate regression analysis requires further elaboration.

5.1 Multivariate Regression Analysis

Multivariate Regression Analysis (MRA) is not only a simple statistical forecasting model, as it also includes numerous assumptions that have to be tested and revisited. Even though this paper does not aim to establish the best MRA model for local business tax, however, a simple, basic model is applied, the choice of independent variables have to be carefully elaborated. Independent variables of this model are selected based on two criteria: firstly, is benchmarking and best practices applied in other countries. However, since such a local business tax is a fairly unique municipal tax of Hungary, no perfectly descriptive benchmark could be applied. Secondly, a more practical criterion must be taken into consideration. Independent variables must have adequate longitudinal data and have to be available for local managers. Another decision is whether to include only micro, i.e. city level, or even macro level variables as well.

Doamekpor (2007:4) lists the literature and identifies the following categories which could determine municipal tax revenues in general:

1. Macroeconomic and cyclical effects
2. Social, political and institutional
3. Human and organization
4. Aggregate money supply
5. Unemployment rate
6. Per capita income and median income
7. Non-agricultural employment
8. Government bonds
9. Environmental factors
10. Public debts
11. Population
12. Grant-in-aid
13. Time

Doamekpor's analysis, therefore, includes all the variables to consider. However, because of the special characteristics of Hungarian local business tax most of these cannot be considered. Chang (1979:49-50) investigates business license revenues of the municipality of Mobile, Alabama, US. He finds that two main factors, population and inflation are highly accurate predictors of the issuance of local business licenses. However, these licenses still greatly differ from my analysis, as their tax base is only a right to operate. Therefore, this MRA model is based upon the following macro and micro (i.e. country or city level data) independent indicators:

1. Number of companies operating in the city in thousands companies (micro)
2. Population of the city in thousand inhabitant(micro)
3. Historically index of consumer prices (HICP)[11] as a percentage (macro)
4. Gross domestic product change, as a percentage (macro)

Equation 8 depicts the components of this MRA used to each city:

$$\widehat{Y_{tax}}_t = \propto + \beta_{comp} X_{comp_{t-1}} + \beta_{pop} X_{pop_t} + \beta_{HICP} X_{HICP_t} + \beta_{GDP} X_{GDP_t} \text{....Equation 8}$$

Where $\widehat{Y_{tax}}$is the forecasted local business tax, $\propto$ is the intercept of the Y axis, β_{comp}, β_{pop}, β_{HICP}, β_{GDP} are the coefficients of each independent variable; $X_{comp_{t-1}}$is the number of companies in the year before the forecasted year, X_{pop_t} is the population of the forecasted year, $X_{HICP_t}$is the HICP growth that for the same year, $X_{GDP_t}$is the GDP growth for the forecasted year. Only the number of companies is presented at base minus one year.

Given the special characteristics of forecasting in local government budgeting, this equation assumes that local population, national GDP and HICP are perfectly forecasted. By the time local

[11] HICP is an inflation index developed by the European Central Bank. Slight difference compared to the US inflation is two respects: inclusion of rural consumption and exclusion of owner inhabited housings.

government forecasts are carried out, statistics about the expected GDP and HICP are also published. Moreover, population, because of its least volatile nature, can be reliably forecasted. However, all these conditions raise great concerns about the actual reliability of the values of independent variables. This fact also has to be accounted when MRE is evaluated.

Results, as outlined in Table 4 in the Appendix, demonstrate this utility of this MRE model greatly varies from city to city. It can be concluded from Table 3 that MRA analysis has very different predictor factors. Adjusted-R^2[12]s vary from the lowest 50.3% of Győr to 90.2% of Érd. These values are well below what econometric theory considers to be acceptable. Moreover, the significance statistics of the coefficients of independent variables also show that the selected four explanatory variables are way beyond the generally accepted 5% significance level.[13] Surprisingly the significance of both macro and micro variables show similar low significance level. Therefore, in general it can be claimed that this MRA model needs to be fundamentally revisited.

One general conclusion to draw from the MRA is that local business isdriven neither as the function of number of companies, nor as the population. This is likely to be caused, as the literature points out, by the fact that some large companies pay the majority of the tax. Moreover, even GDP growth and inflation have low significances. This might be attributable to the fact that no regional data were included in the analysis with respect to these variables. Compared to all the low significances, however, the all the significance explanatory power of the model, i.e. the adjusted-R^2 in some cities is high enough not to abandon these models. However, as it becomes clear that amendments, especially to local environments, are crucial.

[12] Adjusted-R^2 determines that to what percentage the MRA model can predict the variations of local business tax values.

[13] P and T value both depict the level of significance of the coefficients of independent variables. As a generally accepted rule-of-thumb a p value less than 0.05, i.e. 5% is desired in order to claim that a variable is significant in terms of explanatory power. An absolute value of t value less than 1 would indicate that variable to be omitted from the model. However, it is worth noting that, as one disadvantage of this model, the insignificant variables, if included in the model, also have a negative impact on other variables.

5.2 Testing of Hypothesis 3 and 4

This section is assigned to test the additional two hypotheses:

H3 Basic trend analysis and time series analysis cannot increase forecasting accuracy

H4 Multivariate regression analysis can significantly increase accuracy

In order to compare the different quantitative techniques, the MAPEs of each city, and the aggregate MAPE for each model is calculated. The results are displayed in Table 2 below:

Table 2 Comparisons of quantitative models -Mean Average Percentage Errors

Source: the author based on data from TeIR

Cities	Municipal tax	Naive	Trend (%)	Trend (HUF)	Time series	Regression
Bekescsaba	5.16%	7.32%	8.46%	6.37%	3.58%	3.91%
Debrecen	7.16%	10.54%	10.56%	8.08%	6.47%	22.03%
Dunaujvaros	N/A	13.70%	16.29%	17.74%	14.66%	6.72%
Erd	9.86%	10.85%	11.65%	34.44%	6.32%	4.93%
Eger	8.61%	7.49%	9.31%	8.20%	4.61%	4.43%
Gyor	N/A	14.94%	16.84%	20.78%	20.76%	17.48%
Hodemzovasarhely	N/A	8.17%	8.57%	8.76%	5.14%	3.52%
Kaposvar	7.22%	10.62%	12.50%	12.10%	6.37%	4.21%
Kecskemet	9.98%	10.20%	11.59%	10.20%	6.38%	5.59%
Veszprem	N/A	9.80%	9.08%	6.94%	5.21%	5.52%
Nagykanizsa	8.85%	10.88%	3.76%	8.24%	7.49%	7.23%
Nyiregyhaza	8.19%	9.94%	9.73%	8.36%	5.87%	4.59%
Pecs	7.89%	10.29%	11.74%	9.15%	5.67%	4.64%
Salgotarjan	6.41%	6.72%	7.09%	7.22%	5.58%	3.95%
Sopron	7.79%	10.57%	6.97%	6.81%	6.70%	4.15%
Szeged	5.51%	9.01%	8.45%	5.81%	4.63%	4.29%
Szekszard	7.17%	21.02%	17.23%	14.65%	15.64%	11.13%
Szekesfehervar	11.63%	6.88%	4.89%	5.16%	4.71%	5.22%
Szolnok	6.93%	7.93%	11.74%	10.89%	5.59%	4.05%
Szombathely	3.92%	9.50%	12.41%	10.07%	7.38%	7.56%
Tatabanya	7.92%	14.63%	18.39%	11.39%	8.69%	7.60%
Veszprem	3.79%	10.58%	16.52%	12.56%	10.25%	5.05%
Zalaegerszeg	N/A	12.28%	13.23%	12.69%	7.33%	5.10%
Average	**7.44%**	**10.60%**	**11.17%**	**11.16%**	**7.61%**	**6.65%**

The second column of the table demonstrates the MAPEs of current forecasts of municipal taxes, as calculated in Chapter 3. However, the other MAPEs are related to only the local business tax. Therefore, it cannot be directly interpreted from this table that any model would be better than the current forecasting practices, as local business tax is only a subset of municipal taxes. However, as local business tax is the most influential element of municipal taxes, the second row can provide a relative basis of comparison to other methods. Additionally, Figure 11 and 12 in the Appendix visualize how the aggregate values of models are related to the actual local business tax revenues. Since these are also aggregate data, no conclusion can be drawn to individual cites.

Naïve models on average could predict local business tax leaving only 10.6% of MAPE. Both types of trend analyses underperform naïve forecasting method, generating similar results. Therefore, neither the naïve model, not any of the trend analyses could result in more accurate forecasts. Only Nagykanizsa has a 3.6% MAPE for the first type of trend analysis. Time series analysis, however, provide more reliable forecasts. Even the total MAPE is 7.6%, but this is mainly because of some outlier values. Therefore, this model could be applied to more than one third of the cities without resulting in great forecasting errors. However, in other cities, such as Győr, time series model is one of least accurate models. Therefore, based on these results, Hypothesis 3 can only be partially rejected. Both trend models are least accurate than even a naïve model. However, to certain cities time series model could provide high accurate forecasts with low MAPE relative to the naïve model.

Multivariate regression analysis, despite its highly complicated characteristics, could only generate slightly more accurate forecast than time series analysis. If the contingent inaccuracies resulting from the assumption these external forecasts are perfectly accurate, are taken into account, this could easily worsen the MAPE of MRA: originating from these variables MRA could easily result in least reliable forecasts than time series. However, as indicated beforehand, the accuracy of MRAs could be increased by revisiting and adjusting them to the local environment. However, the difference between their complexities compared to other models does not indicate that these models should be prioritized. Therefore, Hypothesis 4 is also rejected.

Conclusion

This thesis analyzed decentralized finance in Hungary. Firstly, it pointed out the current discrepancy between the highly decentralized size of local governments and financing. Despite the fact that Hungary is one of the most decentralized countries among OECD countries in terms of local government size, municipal taxes continue to play a limited role, and local government depend on state transfers and subsidies. Local government can only have a direct influence in few municipal taxes. Cities with county status, the most significant drivers of local economy, are especially concerned by long-term sustainability of financing. Revenues from these taxes cannot be further increased as local taxing capacity has almost reached its maximum. Therefore, local government budgeting, especially concerning municipal revenues forecasting faces challenges to assist sustainability and prudency local financing.

Despite the fact that the introduction of quantitative techniques into local government budgeting has numerous distinct advantages both for local manager and for the general public as well, it is assumed that local government budgeting in transition countries, such as Hungary can solely be governed by qualitative, mainly expert judgements. Hence this thesis proposed four hypotheses to test. The first assessed the current local forecasting accuracy of municipal taxes of cities with county status. If found that forecasts show great inaccuracies, and systematically underestimate municipal tax revenues. The main reasons for this are likely to be shortcomings of expert judgements, and the uncertain environment municipal taxes are surrounded by. The second hypothesis test that these forecasts are systematically underestimated driven by the intent to maximize government transfers and subsidies. Since the average forecasts in the last five years were always less than the actual revenues, this hypothesis was accepted as well. However, among the 23 cities differences can be observed in terms of forecasting accuracy.

Hypothesis 3 and 4 aimed to inquire the possibility of applying quantitative techniques to local business tax forecasting in cities with county status. Four basic quantitative models were analyzed: two types of trend analysis, time series analysis and multivariate regression analysis. Using benchmarking literature four independent variables were applied to the multivariate regression analysis: number of companies, population, inflation and gross domestic product growth. These models were applied to the historical local business tax revenues from 2000 to 2010. The accuracy of them was measured by mean average percentage error (MAPE). Each MAPE was compared to a naïve model in which the previous year is taken as the best estimate of the future. Results show that both types of trend analysis provide least accurate fit to the historical data, even less accurate than the naïve e model. Time series analysis turns out to be more accurate than naïve model or .any of the trend analyses. Multivariate regression analysis, despite its complexity, resulted in only slightly better MAPEs than time series analysis. Results underpin that no unique techniques could be proposed for all the 23 cities with county status. However, based on their MAPE results, either time series and multivariate regression could be considered to apply.

Results of this thesis face several limitations. Tax base and rate of local business tax was assumed to be constant. But in fact several local decrees altered how tax bases were calculated. The lack of data and the comprehensive publication of these amendments, however, disabled to take these changes into consideration. This is one of the reasons why these results corroborate that quantitative models could never substitute the expertise of local experts, but only assist them. Quantitative methods are especially avail tools for long-term local government financial planning. Therefore, all the results obtained could have greater impacts, especially in the long-run.

Also further research should be done on testing more sophisticated time series model; and creating a more accurate multivariate regression model that takes into consideration the local economic environment. Furthermore, if more detailed data could be obtained on the current errors of local business tax forecasting and on the assumptions local experts have that could assist to understand how quantitative models could be ameliorated.

References

Aczél, Ákos, and Dániel Homolya. 2011. "Local Government Indebtedness from the Perspective ofFinancial Stability Risks (in:HUN.:Az önkormányzati szektor eladósodottságának kockázatai pénzügyi stabilitási szemszögből)." MNB-Szemle (October): 7-14.

Axelrod, Donald. 1995. Budgeting for Modern Government. Ed. 2. New York: St.Martin's Press.

Blom, Barry, and Salomon Guajardo. 2001. Revenue Analysis and Forecasting. Vol. 2. Chicago, IL: Government Finance Officers Association.

Blöchliger, Hansjörg, and Camila Vammalle. 2012. Reforming Fiscal Federalism and Local Government Beyond the Zero-sum Game. OECD Publishing, February 15. doi:10.1787/9789264119970-en. http://www.oecd-ilibrary.org/taxation/reforming-fiscal-federalism-and-local-government_9789264119970-en.

Chang, Semoon. 1979. "Municipal Revenue Forecasting." 10, no. 4: 38. Business Source Complete." Growth & Change 10 (4): 38-46.

Circincione, Carmen, and Gustavo A Gurrffiri. 1999. "Municipal Government Revenue Forecasting : Issues of Method and Data."

Forrester, John P. 1991. "Budgetary Constraints and Municipal Revenue Forecasting." Policy Sciences 24 (4): 333-356.

Frank, Howard A, Gerasimos A Gianakis, and Clifford P. McCue. 2005. "WILL GASB 34 INDUCE CHANGES IN LOCAL GOVERNMENT FORECASTING PRACTICE? A PRELIMINARY INVESTIGATION Howard A. Frank, Gerasimos A. Gianakis, and Clifford P. McCue." Journal of Public Budgeting, Accounting&Financial Management 17 (4): 557-573.

Frank, Howard A, and Youngfeng Zhao. 2009. "Determinants of Local Government Revenue Forecasting Practice: Empirical Evidence from Florida." Journal of Public Budgeting, Accounting&Financial Management 21 (1): 17-35.

Fölscher, Alta. 2007. Budgeting and Budgetary Institutions. In Budget Methods and Practice, ed. Anwar Shah, 109-134. Washington, D.C.: World Bank Institute.

Gianakis, Gerasimos A, and Howard A Frank. 2012. "Implementing Time Series Forecasting Models : Considerations for Local Governments." State&Local Government Review 25 (2): 130-144.

Halmosi, Péter. 2005. "Az önkormányzati rendszer kockázatai a stakeholderek nézõpontjából." Public Finance Quarterly 1: 100-110.

Homolya, Dániel, and Gábor Szigel. 2008. "Önkormányzati hitelezés – kockázatok és banki viselkedés." MNB-Szemle (September): 20-29.

Hőgye, Mihály, ed. 2002. Local Government Budgeting. Network. Budapest: Local Government and Public Service Reform Initiative, Open Society Institute.

Járja, Ildikó. 2007. "Brief Review of Municipal Tax System 1991-2006 with an emphasis on local business tax (in:Hun.:A helyi adórendszer rövid áttekintése 1991 – 2006 között , különös tekintettel a helyi iparűzési adóra)", December 1. http://ado.hu/magazin/ado-lap/2007-14-15/a-helyi-adorendszer-rovid-attekintese-1991-2006-kozott-kulonos-tekintettel-a-helyi-iparuzesi-adora.

Jókay, Károly, László Osváth, Gyula Sóvágó, and György Szmetana. 2004. Az önkormányzati adósságrendezések oknyomozása 1996-2003.

Khan, Anan. 1989. "Forecasting a Local Government Budget with Time Series Analysis." State&Local Government Review 21 (3): 123-129.

Kong, Dongsung. 2007. "Local Government Revenue Forecasting: the California County Experience." Journal of Public Budgeting, Accounting&Financial Management 19 (2): 178-199.

Lee, Ronald Johnson. 2003. Public Budgeting Systems. 7th ed. Sudbury: Jones and Barlett.

Macmanus, Susan A, and Barbara P Grothe. 1989. "Fiscal Stress as a Stimulant to Better Revenue Forecasting and Productivity" 12 (4): 387-400.

McCue, Clifford P., and Gerasimos A Gianakis. 1999. Local Government Budgeting: a Managerial Approach. Ed. Inc. Greenwood Publishing Group. Westport, US.

Mikesell, John L. 2007. Mikesell in shah.pdf. In Local Budgeting, ed. Anwar Shah, 15-49. Washington, D.C.: World Bank Institute.

Mikesell, John L.. 2011. Fiscal Administration: Analysis and Applications for the Public Sector. 8th ed. Boston, MA: Wadsworth Cengage Learning.

Montgomery, Douglas C., Cheryl L. Jennings, and Murat Kulahci. 2008. Introduction to Time Series Analysis and Forecasting. New Jersey: Wiley&Sons. Inc.

Noel, Michel, Anita Papp, Sahir El Daher, Deborah Wetzel, and Mihály Kopányi. 2004. Modernizing the Subnational Government System. In Intergovernmental finance in Hungary : a decade of experience, 1990-2000, ed. Mihály Kopányi, Deborah Wetzel, and Sahir El Daher, 15-75. Budapest: Local Government and Public Service Reform Initiative, Open Society Institute.

Pálné Kovács, Ilona. 2011. "Local Governance in Hungary – the Balance of the Last 20 Years." Discussion Papers Centre for Regional Studies of Hungarian Academy of Sciences 83: 2011.

Reddick, Christopher G. 2004. "Assessing Local Government Revenue Forecasting Techniques." International Journal of Public Administration 27 (8-9) (July 27): 597-613. doi:10.1081/PAD-120030257. http://www.tandfonline.com/doi/abs/10.1081/PAD-120030257.

Rubin, Irene S. 1987. "Estimated and actual urban revenues: Exploring the Gap." Public Budgeting and Financ 7 (4): 83-94.

Schiavo-Campo, Salvatore. 2007. The Budget and Its Coverage. In Budgeting and Budgetary Institutions, ed. Anwar Shah, 53-87. Washington, D.C.: World Bank Institute.

Schroeder, Larry. 2007. Forecasting Local Revenues and Expenditures. In Local Budgeting, ed. Anwar Shah, 53-76. Washington, D.C.: World Bank Institute.

State Audit Office. 2010. Report on the audit of efficiency and effectiveness of municipal taxes succesful (in Hun.: Jelentés a helyi adók rendszerében a hatékonyság és az eredményesség érvényesülésének ellenőrzéséről).

State Audit Office, Hungary. 2012. Summary about the audit of local government finance and managment systems in 2011 (in Hun.:Összegzés a helyi önkormányzatok pénzügyi helyzetének és gazdálkodási rendszerének 2011. évi ellenőrzéseiről). Budapest.

Swain, John, and B.J. Reed. 2010. Budgeting for public managers. Armonk, N.Y.: M.E. Sharpe.

Swianiewicz, Pawel, ed. 2002. Consolidation or Fragmentation? The Size of Local Governments in Central and Eastern Europe. Boston, MA: Local Government and Public Service Reform Initiative, Open Society Institute.

Szalai, Ákos. 2005. "Adóverseny az iparűzési adóban Az 5000 fő fölötti települések adópolitikája a 2000-es években." Discussion Papers Institute of Economics Hugarian Academy of Science 3.

Tönkő, Andrea. 2007. Municpal Budget Reform in Hungary: Have They Made Difference? In Fast Track: Municipal Fiscal Reform in Central and Eastern Europe and the Former Soviet Union, ed. George M. Guess. Budapest: Local Government and Public Service Reform Initiative, Open Society Institute.

Vigvári, András. 2010. "Is the conflict container full? Problems of fiscal sustainability at the local government level in Hungary." Acta Oeconomica 60 (1) (March 1): 49-77. doi:10.1556/AOecon.60.2010.1.4.
http://www.akademiai.com/openurl.asp?genre=article&id=doi:10.1556/AOecon.60.2010.1.4.

Wildavsky, Aaron. 1986. Budgeting: a Comparative Theory Budgetary Processes. 2nd ed. New Brunswick, US: Transaction Books.

Yaffee, Robert, and Monnie McGee. 2000. Introduction to Time Series Analysis and Forecasting with Applications of SAS and SPSS. New York City: Academic Press, INC.

Online sources

http://adozona.hu/archive/20071129_iparuzesi_ado_csokken (accessed: 28/05/2012)

Legal sources

Act LXV of 1990 On Local-Self Governments

Act C. of 1990 on Municipal Taxes

Act XXXVIII. Of 1992 on General Government

Appendix

Figure Cities with county status – comparison to Hungary (Population, local taxes and government transfers and subsidies

Source: the author based on data from the Hungarian Central Statistical Office

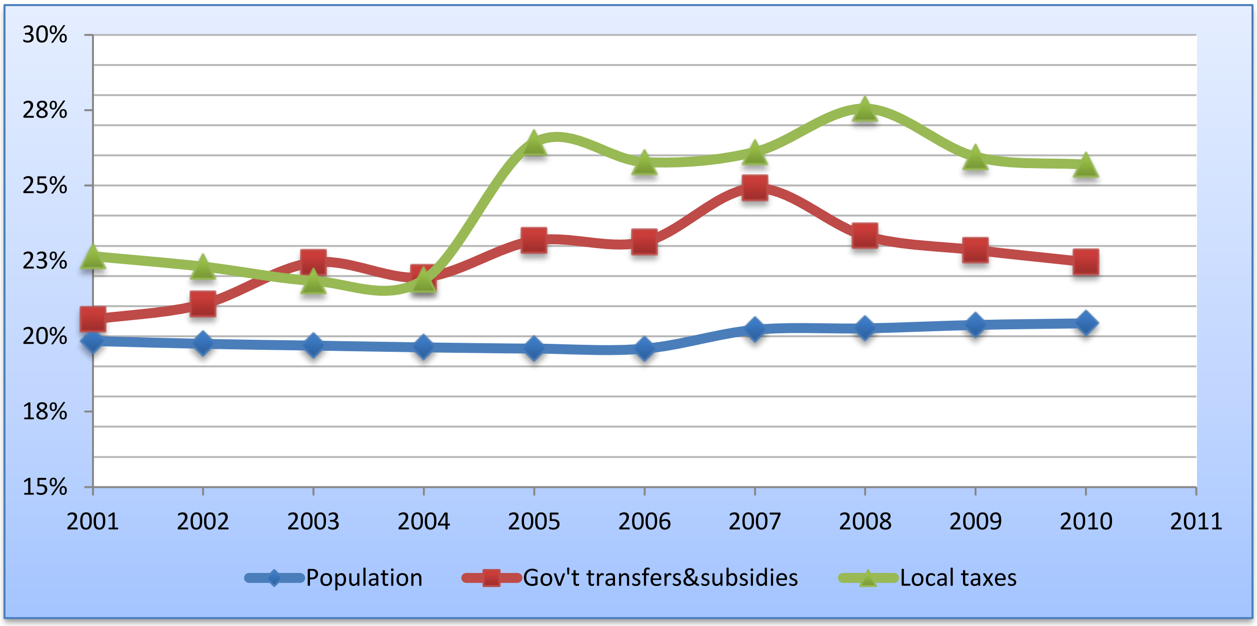


Figure Autonomous taxes, tax sharing and grants as a percentage of general government tax revenue, 2006

Source: OECD, 2012:43

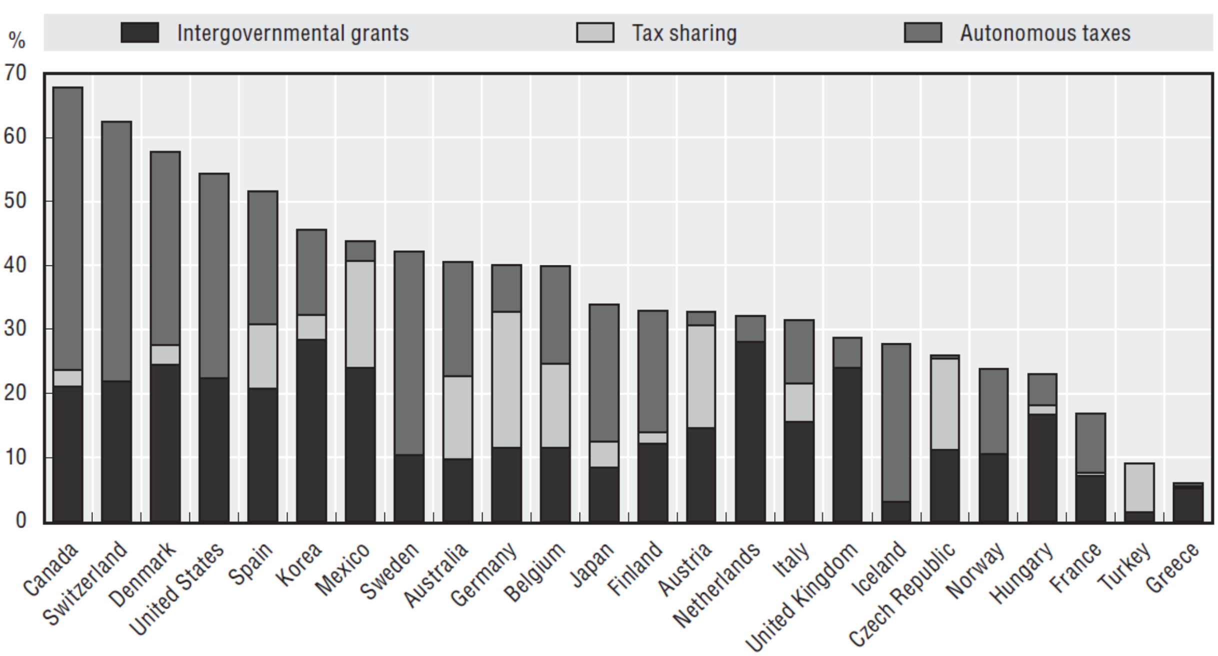


Figure Taxes for which sub-central governments may set tax rates and/or the tax base, as a percentage of total tax (1995)

Source: OECD, 2012:55

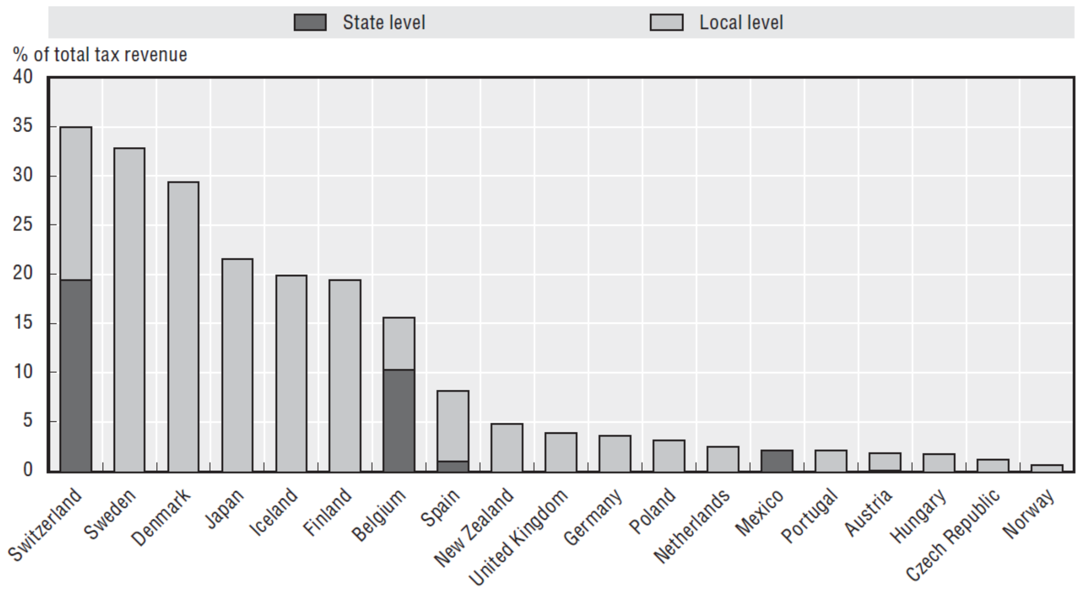
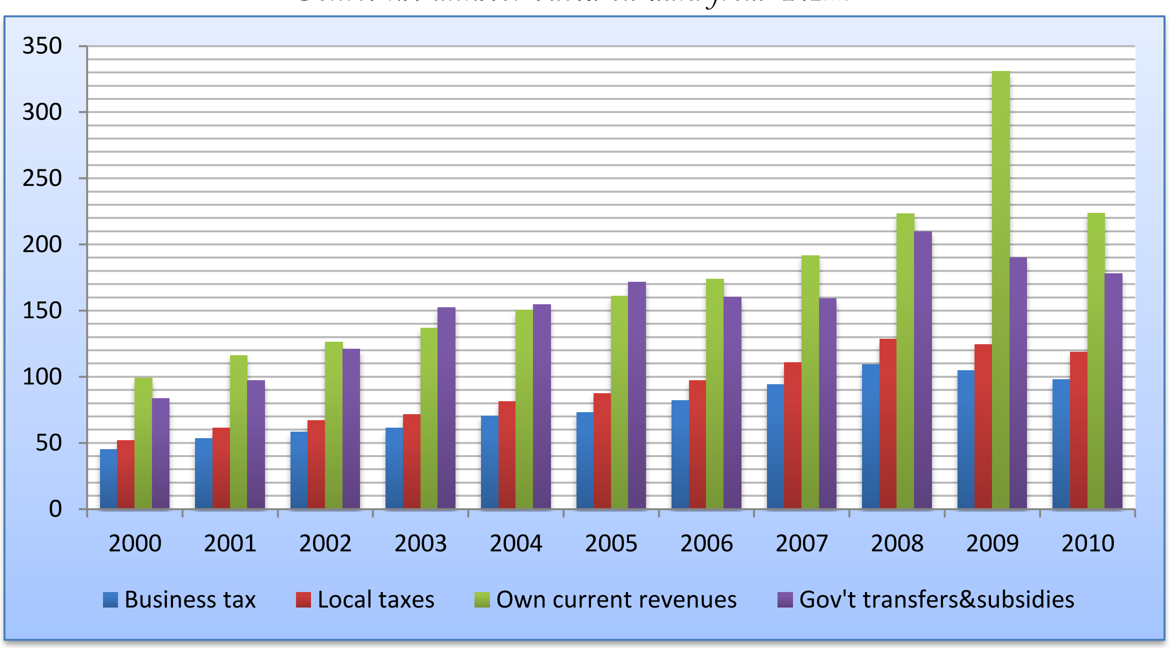


Figure Revenues Cities with county status revenues (nominal bHUF)

Source the autheor based on data from TeIR[14]



[1414] National Development and Planning Information System, run by the VÁTI non-profit Ltd

Figure Local business tax revenues of cities with county status

Source: the author based on data from TeIR

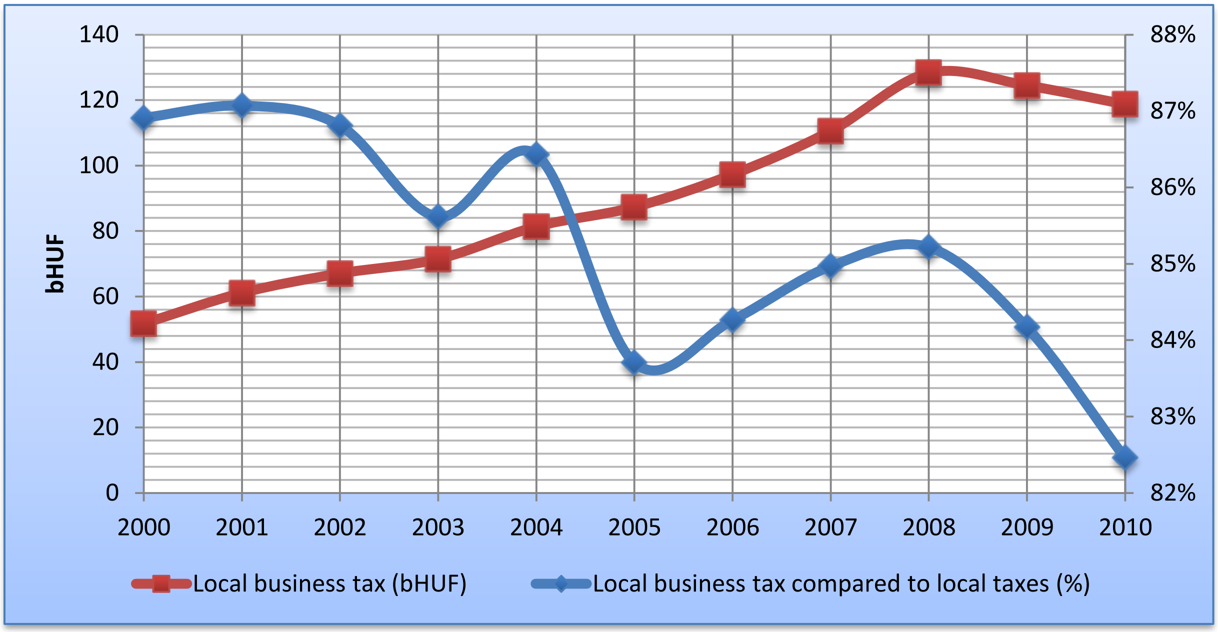
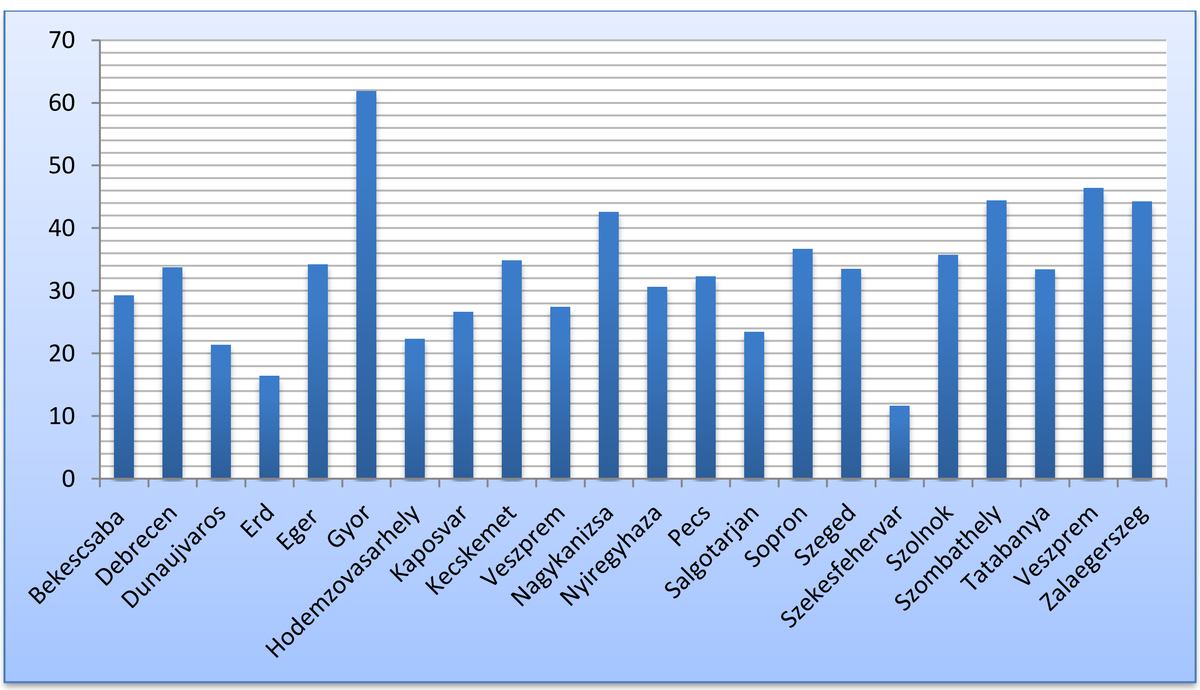


Figure Average local business tax per capita (thous. HUF)[15]

Source: the author based on data from TeIR



[15] In order to obtain a more comprehensive graph Szekszárd was omitted from the graph, as it is an outlier with average of 222,960 HUF.

Table Actual and estimated municipal taxes (in thous. HUF)

Source: the author based on data obtained from Final Accounts

Cities with county status	2007 actual	2007 estimate	Error (%)	2008 actual	2008 estimate	Error (%)	2009 actual	2009 estimate	Error (%)
Bekescsaba	2,545,157	2,265,000	-12.4%	2,791,656	2,664,750	-4.8%	2,727,830	2,669,750	-2.2%
Debrecen	10,043,331	9,030,500	-11.2%	10,856,970	9,635,000	-12.7%	10,826,891	9,850,000	-9.9%
Dunaujvaros	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eger	2,892,643	2,498,800	-15.8%	3,241,079	2,898,616	-11.8%	3,046,085	2,690,300	-13.2%
Erd	1,469,454	1,428,500	-2.9%	1,758,241	1,540,000	-14.2%	1,785,841	1,493,000	-19.6%
Gyor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hodmezovasarhely	N/A	N/A	N/A	N/A	N/A	N/A	1,899,846	2,093,500	9.3%
Kaposvar	2,722,979	2,711,900	-0.4%	3,014,826	2,826,800	-6.7%	3,162,269	2,885,900	-9.6%
Kecskemet	5,815,829	5,520,000	-5.4%	6,395,100	6,099,000	-4.9%	6,028,243	5,994,000	-0.6%
Miskolc	7,236,358	6,495,000	-11.4%	N/A	N/A	N/A	N/A	N/A	N/A
Nagykanizsa	2,794,439	2,433,018	-14.9%	3,361,410	3,183,900	-5.6%	3,714,921	3,193,192	-16.3%
Nyiregyhaza	5,673,831	5,137,500	-10.4%	6,086,483	5,985,000	-1.7%	6,745,116	6,016,000	-12.1%
Pecs	7,112,285	6,342,000	-12.1%	8,593,523	6,925,000	-24.1%	8,351,790	7,810,000	-6.9%
Salgotarjan	1,516,698	1,383,400	-9.6%	1,585,128	1,485,000	-6.7%	1,398,794	1,490,500	6.2%
Sopron	3,316,581	2,820,000	-17.6%	3,523,147	3,310,000	-6.4%	3,731,917	3,359,000	-11.1%
Szeged	8,513,903	7,351,000	-15.8%	8,599,652	8,765,000	1.9%	9,336,529	8,326,000	-12.1%
Szekszard	1,570,365	1,446,954	-8.5%	1,540,849	1,661,954	7.3%	1,580,267	1,532,000	-3.2%
Szekesfehervar	10,181,379	8,506,000	-19.7%	11,766,982	10,509,000	-12.0%	9,848,791	8,308,000	-18.5%
Szolnok	4,146,185	3,824,700	-8.4%	4,367,695	4,150,700	-5.2%	4,048,092	4,376,000	7.5%
Szombathely	5,139,106	5,746,000	10.6%	5,775,924	5,790,000	0.2%	5,214,082	5,379,000	3.1%
Tatabanya	4,390,288	3,747,910	-17.1%	4,943,546	4,510,682	-9.6%	4,805,715	4,496,660	-6.9%
Veszprem	4,790,600	4,608,000	-4.0%	4,807,368	4,915,000	2.2%	4,682,848	4,461,000	-5.0%
Zalaegerszeg	3,160,248	2,539,840	-24.4%	N/A	N/A	N/A	N/A	N/A	N/A
Total	**95,031,659**	**85,836,022**	**-10.6%**	**93,009,579**	**86,855,402**	**-6.4%**	**92,935,867**	**86,423,802**	**-6.4%**

Cities with county status	2010 actual	2010 estimate	Error (%)	2011 actual	2011 estimate	Error (%)	Total actual	Total estimate	Total error in HUF	Average error
Bekescsaba	2,617,941	2,816,590	7.1%	2,590,688	2,577,000	-0.5%	13,273,272	12,993,090	-280,182	-2.6%
Debrecen	10,841,798	10,327,500	-5.0%	10,561,532	10,635,000	0.7%	53,130,522	49,478,000	-3,652,522	-7.6%
Dunaujvaros	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eger	3,045,047	2,936,300	-3.7%	3,499,572	3,154,000	-11.0%	15,724,426	14,178,016	-1,546,410	-11.1%
Erd	1,676,047	1,796,000	6.7%	2,071,084	1,982,500	-4.5%	8,760,667	8,240,000	-520,667	-6.9%
Gyor	15,574,824	14,950,000	-4.2%	18,315,042	15,905,000	-15.2%	33,889,866	30,855,000	-3,034,866	-9.7%
Hodmezovasarhely	1,731,310	2,003,007	13.6%	1,891,027	1,896,830	0.3%	5,522,183	5,993,337	471,154	7.7%
Kaposvar	2,795,307	3,256,550	14.2%	3,041,718	3,169,951	4.0%	14,737,099	14,851,101	114,002	0.3%
Kecskemet	6,512,000	5,555,438	-17.2%	5,555,438	6,940,000	20.0%	30,306,610	30,108,438	-198,172	-1.6%
Miskolc	N/A	N/A	N/A	N/A	N/A	N/A	7,236,358	6,495,000	-741,358	-11.4%
Nagykanizsa	3,772,040	3,422,000	-10.2%	3,774,573	3,672,600	-2.8%	17,417,383	15,904,710	-1,512,673	-10.0%
Nyiregyhaza	6,066,454	6,406,000	5.3%	7,046,243	6,101,000	-15.5%	31,618,127	29,645,500	-1,972,627	-6.9%
Pecs	7,748,756	7,810,000	0.8%	7,535,218	7,680,000	1.9%	39,341,572	36,567,000	-2,774,572	-8.1%
Salgotarjan	1,360,292	1,298,000	-4.8%	1,322,280	1,245,600	-6.2%	7,183,192	6,902,500	-280,692	-4.2%
Sopron	3,527,252	3,359,000	-5.0%	3,656,577	3,541,100	-3.3%	17,755,474	16,389,100	-1,366,374	-8.7%
Szeged	8,830,147	8,876,000	0.5%	8,926,986	8,984,600	0.6%	44,207,217	42,302,600	-1,904,617	-5.0%
Szekszard	1,552,112	1,331,000	-16.6%	1,566,639	1,522,500	-2.9%	7,810,232	7,494,408	-315,824	-4.8%
Szekesfehervar	9,584,811	9,010,000	-6.4%	11,022,754	9,991,000	-10.3%	52,404,717	46,324,000	-6,080,717	-13.4%
Szolnok	3,940,688	4,105,000	4.0%	4,431,823	4,003,000	-10.7%	20,934,483	20,459,400	-475,083	-2.6%
Szombathely	5,492,000	5,379,000	-2.1%	5,367,000	5,492,000	2.3%	26,988,112	27,786,000	797,888	2.8%
Tatabanya	4,402,836	4,690,072	6.1%	4,849,332	4,692,268	-3.3%	23,391,717	22,137,592	-1,254,125	-6.2%
Veszprem	4,839,156	4,561,000	-6.1%	5,066,088	4,945,000	-2.4%	24,186,060	23,490,000	-696,060	-3.1%
Zalaegerszeg	N/A	N/A	N/A	N/A	N/A	N/A	3,160,248	2,539,840	-620,408	N/A
Total	**105,910,818**	**103,888,457**	**-1.2%**	**112,091,614**	**108,130,949**	**-2.9%**	**498,979,537**	**471,134,632**	**-27,844,905**	**-5.5%**

Table Errors as a difference of total revenues

Source: the author based on data obtained from Final Accounts

Cities with county status	2007	2008	2009	2010	2011	Average
Bekescsaba	1.43%	0.59%	0.27%	-0.74%	0.04%	**0.32%**
Eger	1.95%	1.85%	1.94%	0.52%	1.93%	**1.64%**
Erd	0.38%	1.42%	2.20%	-0.78%	0.64%	**0.77%**
Kaposvar	0.06%	0.71%	1.22%	-2.18%	-0.68%	**-0.18%**
Kecskemet	1.20%	0.75%	0.11%	3.28%	-5.51%	**-0.03%**
Nagykanizsa	1.92%	0.78%	2.38%	1.84%	0.47%	**1.48%**
Nyiregyhaza	1.45%	0.25%	2.19%	-1.07%	2.72%	**1.11%**
Pecs	1.83%	2.74%	0.88%	-0.10%	-0.32%	**1.01%**
Salgotarjan	5.35%	0.91%	-0.90%	0.57%	0.67%	**1.32%**
Sopron	2.11%	0.84%	1.21%	0.66%	0.48%	**1.06%**
Szeged	2.20%	-0.35%	2.24%	-0.08%	-0.10%	**0.78%**
Szekszard	1.22%	-1.17%	0.53%	2.43%	0.46%	**0.69%**
Szekesfehervar	4.15%	2.85%	4.00%	1.54%	2.79%	**3.07%**
Szolnok	1.07%	0.83%	-1.20%	-0.70%	1.63%	**0.32%**
Szombathely	-2.35%	-0.05%	-0.59%	0.47%	-0.58%	**-0.62%**
Tatabanya	4.06%	2.17%	1.57%	-1.53%	0.88%	**1.43%**
Veszprem	0.91%	-0.49%	1.06%	0.97%	0.59%	**0.61%**
Average	**1.70%**	**0.86%**	**1.12%**	**0.30%**	**0.36%**	**0.87%**

Figure Boxplots: municipal tax forecast errors as a percentage of actual values (%)

Source: the author based on data obtained from Final Accounts

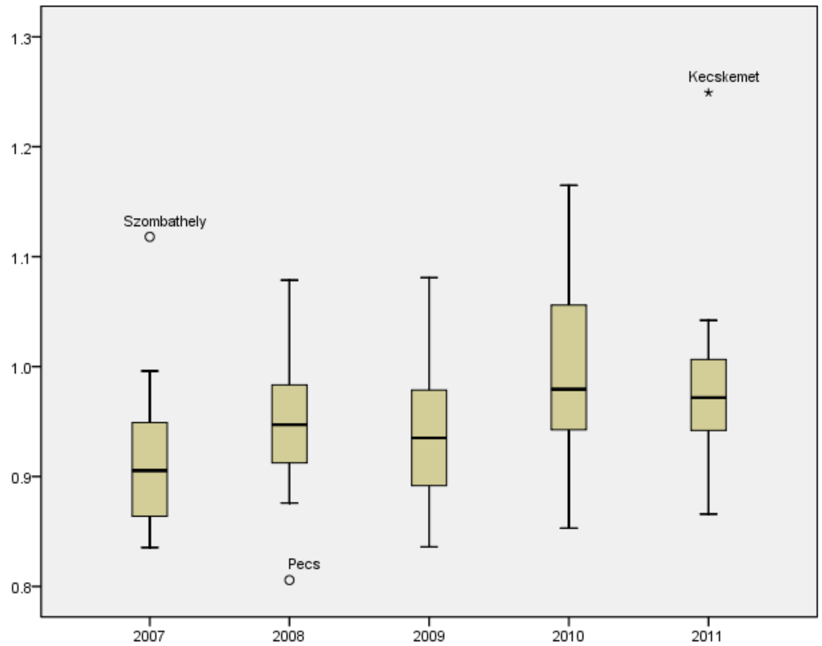


Figure Boxplots: forecast errors (buffers) as a percentage of total revenues (%)

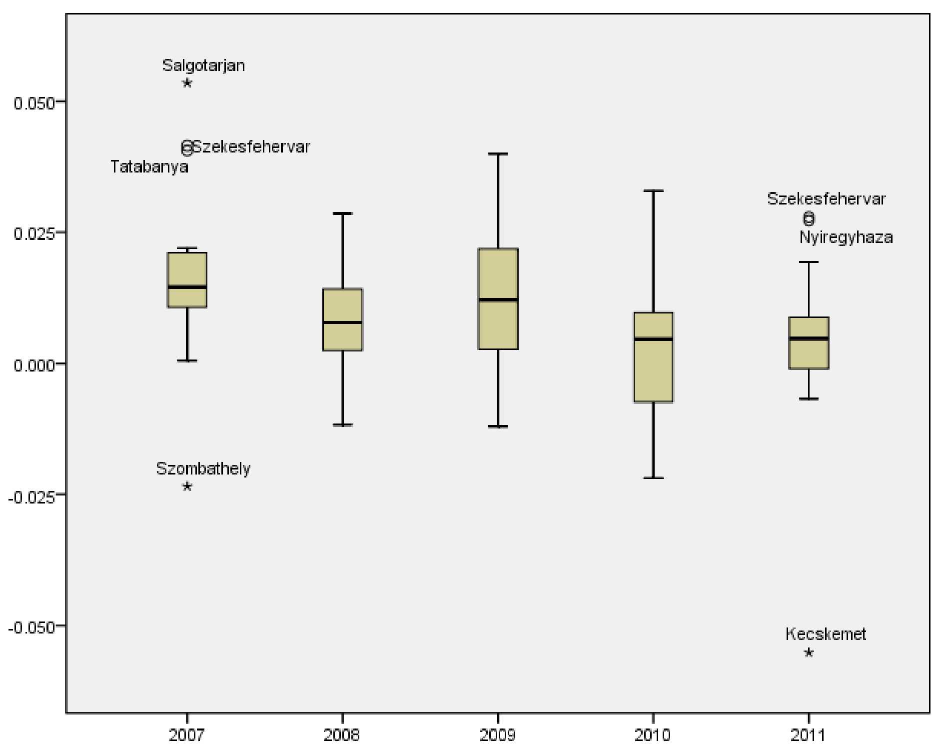


Table Multivariate regression model independent variable statistics

Cities	Adjusted R^2	Intecept			Number of companies (th.)			Population (th.)			HICP inflation rate (%)			GDP growth (%)		
		β	t value	p value	β	t value	p value	β	t value	p value	β	t value	p value	β	t value	p value
Bekescsaba	88.51%	463,732	1.28	0.26	370	1.23	0.27	421	1.36	0.23	25,794	0.90	0.41	-29,908	-1.89	0.12
Debrecen	74.29%	2,431,448	1.35	0.24	-37	-0.02	0.98	3,578	2.08	0.09	17,915	0.12	0.91	-104,439	-1.26	0.26
Dunaujvaros	61.39%	-798,025	-0.65	0.54	1,310	1.17	0.30	1,082	0.93	0.39	170,666	1.68	0.15	21,350	0.38	0.72
Erd	90.29%	213,723	1.03	0.35	224	1.50	0.19	80	0.53	0.62	4,237	0.22	0.83	-9,629	-0.80	0.46
Eger	77.47%	649,484	1.48	0.20	402	1.04	0.34	230	0.57	0.59	40,327	1.19	0.29	-14,152	-0.71	0.51
Gyor	50.37%	-2,050,782	-0.25	0.81	1,777	0.67	0.53	404	0.15	0.89	173,208	0.27	0.80	-426,555	-1.16	0.30
Hodemzovasarhely	54.44%	997,900	5.36	0.00	-89	-0.27	0.80	268	0.87	0.42	-8,855	-0.61	0.57	-15,238	-1.80	0.13
Kaposvar	77.05%	1,214,048	3.28	0.02	-130	-0.45	0.67	506	1.72	0.15	-10,573	-0.34	0.75	-40,406	-2.33	0.07
Kecskemet	84.33%	-48,190	-0.04	0.97	686	1.39	0.22	245	0.49	0.65	62,846	0.73	0.50	-25,677	-0.50	0.64
Miskolc	86.05%	1,320,813	1.08	0.33	197	0.58	0.59	459	1.32	0.25	39,294	0.39	0.71	-149,368	-2.53	0.05
Nagykanizsa	82.55%	202,801	0.25	0.81	1,126	1.01	0.36	651	0.54	0.62	44,471	0.66	0.54	-82,896	-2.26	0.07
Nyiregyhaza	90.51%	879,323	1.12	0.31	556	2.78	0.04	33	0.14	0.89	104,829	1.78	0.14	-126,519	-4.30	0.01
Pecs	88.90%	-28,727	-0.02	0.98	156	0.53	0.62	696	2.36	0.06	63,431	0.67	0.53	-99,452	-1.79	0.13
Salgotarjan	75.51%	174,160	0.83	0.45	451	1.27	0.26	400	1.18	0.29	17,096	1.09	0.33	4,191	0.44	0.68
Sopron	88.70%	761,865	1.88	0.12	163	0.39	0.71	537	1.26	0.26	38,897	1.27	0.26	-53,135	-2.92	0.03
Szeged	92.76%	876,679	0.88	0.42	597	1.91	0.11	215	0.70	0.52	150,149	1.81	0.13	-131,091	-2.81	0.04
Szekszard	57.87%	-1,141,344	-0.29	0.79	2,595	1.65	0.16	-964	-0.59	0.58	578,936	1.84	0.12	-135,433	-0.76	0.48
Szekesfehervar	86.61%	53,909	0.19	0.86	363	1.21	0.28	427	1.43	0.21	24,906	1.19	0.29	-24,131	-1.99	0.10
Szolnok	80.86%	487,275	0.83	0.44	878	2.12	0.09	-72	-0.16	0.88	77,933	1.78	0.14	-13,929	-0.58	0.59
Szombathely	73.75%	-933,678	-0.68	0.53	996	0.92	0.40	507	0.46	0.67	75,752	0.77	0.47	13,409	0.24	0.82
Tatabanya	89.13%	-1,131,598	-1.38	0.23	941	1.08	0.33	696	0.77	0.47	124,737	1.84	0.13	-75,376	-1.95	0.11
Veszprem	88.11%	-759,229	-1.05	0.34	936	1.44	0.21	603	0.87	0.43	46,271	0.90	0.41	24,400	0.81	0.46
Zalaegerszeg	85.76%	1,710,043	2.64	0.05	431	0.78	0.47	317	0.53	0.62	-57,616	-1.03	0.35	-66,902	-2.26	0.07
Average	**79.36%**	**241,114**	**0.83**	**0.44**	**648**	**1.04**	**0.39**	**492**	**0.85**	**0.47**	**78,463**	**0.83**	**0.42**	**-67,865**	**-1.42**	**0.30**

Figure Comparison of forecasting techniques aggregate local business tax revenue data

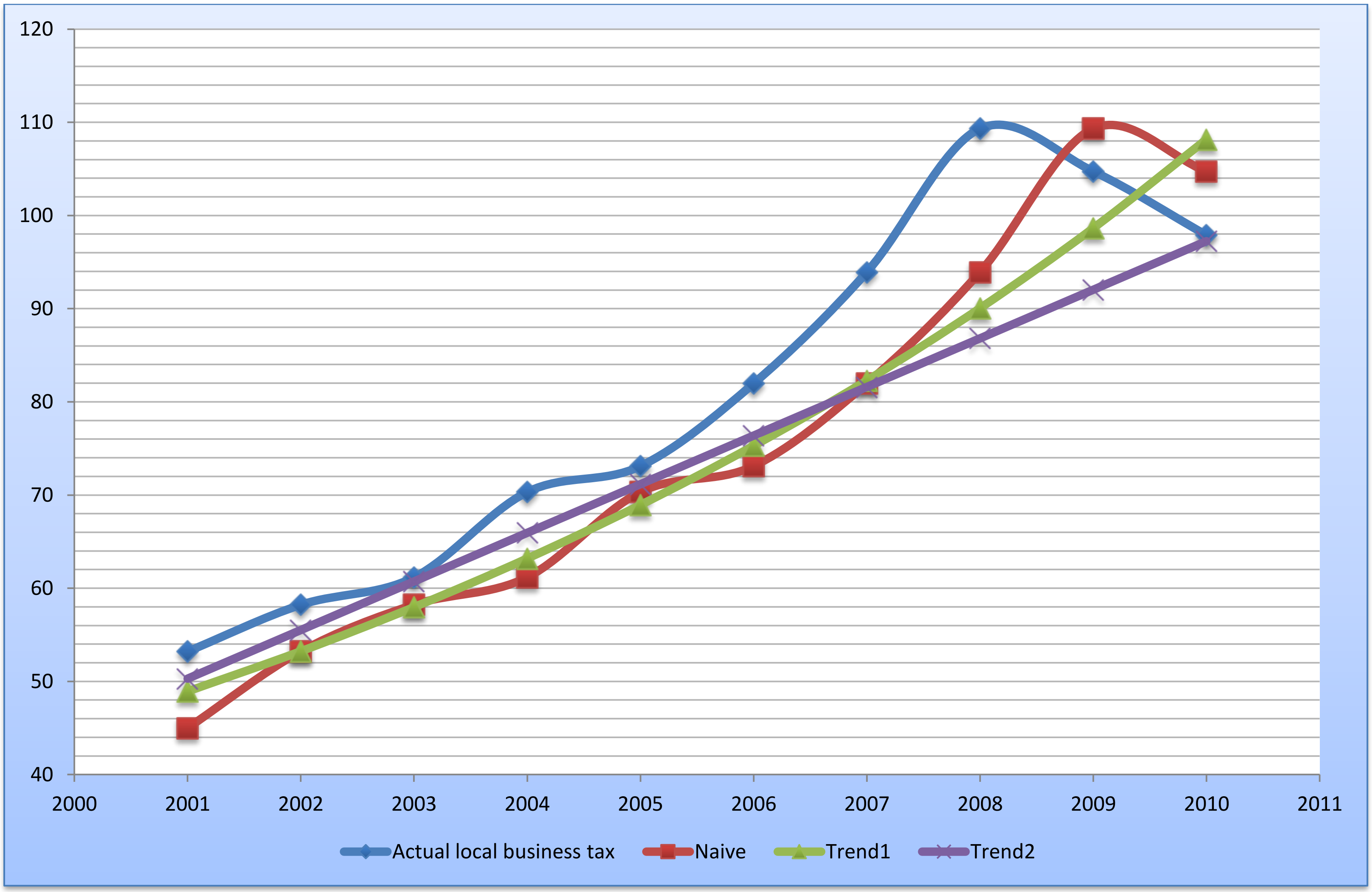


Figure Comparison of forecasting techniques aggregate local business tax revenue data