DEMAND SIDE FACTORS OF LOCAL PUBLIC SERVICES IN ESTONIA[1]

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Abstract

The goal of this paper is to quantitatively assess the relationships between the service structure and size and age structure of the population, as well as the income levels and employment structure of Estonian municipalities. The article consists of three parts. The first part deals with the relationships between the demand for local public services and the main parameters that characterize the population of a municipality based on existing theoretical and empirical studies. The second part outlines the relationship between the models of optimal public service delivery areas and population structure and income levels. In the third part an empirical analysis is carried out to assess the relationship between the structure of Estonian municipal expenditures (by service type) and population size and age structure, as well as work related income (salary) level and employment structure.

Keywords: local public services, local government budget structure, population age structure of municipalities, population employment structure and income level of municipalities

JEL Classification: H41, H44, H72, H73, J21, J31

Introduction

The role of the public sector is to provide public goods at an appropriate level. The supply of pure public goods, like the presence of state power, environmental protection, public order and security, is primarily determined at the level of the central government in accordance with the country's economic capabilities and the preferences of the population as a whole.

Besides pure public goods there are public goods and services that can be individualized (they satisfy the conditions of excludability and rivalry) and that directly increase the welfare of the population – education, leisure and culture services, economic services and public utilities. These services are provided mainly by municipalities (Reiljan, Ramcke, Ukrainski 2006: 90). To improve the effectiveness of public service provision, the supply of those goods and services has

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to be adapted as flexibly as possible to demand. The level of innovation in municipalities best reveals itself through the policies that take account of changes in public service demand.

At the municipal level, changes in public service demand are primarily caused by changes in population size and structure. A significant relationship between population age structure and the demand for local public services is generally recognised. An increase in the number of pre-school children will increase demand for kindergarten places and pre-school education. An increase in the number of school-age children will increase demand for education services, as well as school transport. At the same time, municipalities with a decreasing number of children have to solve cost inefficiency problems resulting from an infrastructure built for a larger number of children. Specific problems in the demand for public services also arise from the number and proportion of people of active working age, elderly, unemployed, disabled and other categories in the population, as well as changes in these proportions.

Therefore, population structure and changes in it affect the optimal size of different local public service delivery areas. Deciding upon the optimal area size for different local public services is a difficult challenge for municipalities that requires innovative approaches. Designing optimal service delivery areas, in turn, is made difficult by the fact that it is often necessary to organize cooperation between multiple municipalities. In Estonia, however, cooperation between municipalities is at a very modest level.

Insufficient attention has been given to other factors affecting local public service demand. For example, it can be assumed that the income levels and structure of the population has an affect on the demand for local public services, as do changes occurring within these factors. In municipalities with high income levels, demand for social services is low and more attention and resources can be allocated to leisure services. Substantial effects on demand for local public services can also be expected from the employment structure of the population. For example, workers with low qualifications usually have a lower demand for culture services than highly qualified white-collar workers. Thus, the employment structure in terms of type of economic activity has to be taken into account in public policy-making at the local level. The specific demand for local public services (e.g. social services) can also be caused by unemployment (the rate, duration). For these reasons, the remaining factors affecting the demand for local public services mentioned above (besides population age structure) are also included in the analysis.

Estonian municipalities have faced and still are facing large and controversial changes in the factors influencing demand for local public services. Municipalities in remote areas are generally losing (active working age) population. There, due to the departure of mobile young people, the proportion of older and inactive people is increasing. However, in the economic centres the demographic processes are working in the opposite direction. The income structure in terms of type of economic activity is very different among municipalities and the economic boom

and the crisis both led to significant changes in this respect, potentially resulting in a significant impact on demand for local public services. These changes must be recognised in order to improve the cost efficiency of local public services, including for example, designing optimal service delivery areas.

The goal of this paper is to quantitatively assess the relationships between the service structure of Estonian municipalities and population size and structure, as well as income levels and employment structure. We engage in the following research tasks to accomplish this goal:

- Analyse the relationships between the demand for local public services and population size and structure, as well as employment structure and income levels based on research literature;
- Present the importance of considering population size and structure, but also income levels and employment structure, based on optimal public service area models;
- Assess the relationships between the budget structure of Estonian municipalities and population size and structure, as well as income levels and employment structure.

The article consists of three parts. The first part deals with the relationships between the demand for local public services and the main parameters that characterize the population of a municipality, based on existing theoretical and empirical studies. The second part outlines the relationship between the models of optimal public service delivery areas and population structure and income levels. In the third part an empirical analysis is carried out to assess the relationship between the structure of Estonian municipal expenditures (by service type) and population size and age structure, as well as work related income (salary) levels and employment structure.

1. Factors shaping demand for local public services

The demand for public services is a much more complicated phenomenon than the demand for private services. First of all, an individual usually does not have a complete understanding of the tax price of public services (the expenditures of the taxpayer) and the budget constraints of the public sector, making his or her opinion of the amount and quality of public services needed in excess of the economic capacity of the public sector (for examples on the learning environment and teaching quality in general education, see Reiljan, Reiljan 2005). Secondly, both politicians and voters lack the information required to assess the quantity and quality of public services needed, so preferences are formed and decisions made about the structure of the public sector budget and expenditure on public services (Becker *et al.* 1992: 54). Thirdly, because the willingness of society (the tax payers) to pay for public services is very difficult or impossible to determine due to the lack of adequate empirical methods (Becker *et al*. 1992: 24-84), the demand for a particular public service and the decision to increase, maintain or reduce the share of expenditures on a certain public service in the budget is, according to Becker *et al*. (1992: 102), often evaluated based on a public opinion survey.

In this study, we draw from the competition among different population groups over public sector budget allocations manifest in political processes, and from the political influences of different population groups in public sector budget decisions. This is the focus of mainstream scientific research analysing the formation of demand for public services. Particular attention has been given to the hypothesis of possible competition between the young and the elderly in shaping the expenditure structure in municipal budgets. Many authors (Borge, Rattsø 2008; Cattaneo, Wolter 2007; Strömberg 2006; Grob, Wolter 2005; Poterba 1997 and others) have identified an empirical relationship whereby an increase in the proportion of elderly people in society leads to a decrease in child care and education spending per child and pupil. At the same time there are authors (Brunner, Balsdon 2004; Gradstein, Kaganovich 2004; Ladd, Murray 2001; South 1991), whose studies argue against the existence of such a relationship and show positive attitudes among the elderly towards increasing expenditures on education. Of course, the attitude of different groups of people towards increasing or decreasing expenditures on certain public services and the actual effect of those attitudes on political decisions are different things.

Scott J. South (1991), in his study, shows that children and the elderly in the US are not direct competitors for public sector expenditures, because elderly welfare programs are funded by the federal government and the welfare of children is the responsibility of the states. Similar issues should be taken into consideration when analysing local public services in Estonia because expenditures on certain public services (e.g. education) do not depend on the economic opportunities and political decisions of municipalities alone.

Kempkes (2010) raises the problem of adjusting education expenditures in response to severe demographic shifts. He points out that previous empirical evidence on the relationship between public education spending and student cohort size suggests that spending is not adjusted proportionately to the size of the student cohort and that a large decrease in the number of students would thus translate into an important increase in education spending per student rather than a significant decrease in resources allocated to public education. The empirical analysis based on data from five East German schools provided contradictory results: during the period 1993–2001 expenditures on education where successfully adjusted to the decreasing number of students, but for 2002–2006 expenditures on education decreased significantly slower than the number of students. Of course, when assessing these kinds of adjustment processes we must also consider how developed the country is. For example, in Estonia the number of students is decreasing rapidly, but at the same time there is pressure to improve the quality of the study environment in many schools and bring teachers' salary levels in line with the general wage level.

Fernandez and Rogerson (2001) conduct an analysis based on a panel data set for the 48 states of continental USA for 1950–1990. They find that expenditures per student on public primary and secondary education have a strong positive correlation with the income level of the residents and a moderate negative correlation with the number of students. The proportion of elderly, however, did not have a statistically significant relationship with expenditures per student.

When naming factors affecting the demand for public services, Becker *et al.* (1991: 28) mention, in addition to age, income levels and the tax burden and people's assessment of the rationality and efficiency of the use of money in the public sector. It should also be noted that the availability of public services intended for families and children often depends to some degree upon the income level of families (Becker *et al.* 1991: 90), and this must especially be considered when determining the share of the total costs the family has to pay itself for a service.

Kalwij and Salverda (2007) show how a change in a family's demographic structure and employment changes the spending patterns of the family. Similarly, changes in the demand for local public services must be taken into account as changes in the family occur. A decrease in the number of children in families reduces the demand for kindergarten and school places. An increase in the proportion of single parent families will increase the demand for kindergarten places, so the lone money earner in the family could go to work. Children leaving the parental home will in the long run lead to increased demand for elderly care. However, increases in family income levels increase the livelihood of families and reduce the demand for social services.

The dependence of the demand for local public services on the age structure is acknowledged in practice when justifying the calculated expenditure needs of municipalities. Estonia has established different rates for municipal expenditure needs in the following age groups: 0–6 years, 7–18 years, 19–64 years, 65 years and older, as well as the elderly in need of care (Friedrich *et al*. 2010:175). The coefficients calculated for the need for municipal expenditure in Estonia for the period 2003–2012 are presented in Table 1.

Due to economic growth and inflation, but also population decline, municipal expenditure needs increased rapidly until 2009, when the economic crisis led to a reduction in the coefficients in 2009 in comparison with the initial budget. After the economic crisis, the municipal expenditure need coefficients have again slightly increased. During the period under review total costs increased at a relatively slower rate compared to the increase in the municipal expenditure need coefficients because the population, and in particular the number of children, continues to shrink.

Table 1. The municipal expenditure need coefficients in Estonia in cost factor units (euros)

Cost factor	2003	2004[3]	2007	2008	2009*	2009**	2010	2011	2012
0-6 year olds	845.42	538.26	840.18	976.70	1111.49	1032.11	1055.82	1042.05	1033.72
7-18 year olds	142.59	428.08	668.13	776.65	883.83	820.75	839.61	828.66	822.03
19-64 year olds	317.83	180.10	276.74	321.67	366.09	339.95	347.74	343.22	340.48
65 year olds and older	211.04	261.65	402.00	467.32	531.81	493.78	505.16	498.57	494.58
Elderly under care			539.67	627.36	713.89	662.89	662.89	652.63	647.41

* The cost coefficients used in the preparation of the regular state budget enacted in December 2008.

** The cost coefficients used in the preparation of the "crisis budget" enacted in February 2009.
Source: Friedrich *et al.* 2010.

There was no actual analytical justification for the municipal expenditure need coefficients (shown in Table 1) in the first year (2003). The best evidence for this is the fact that costs related to 65 year olds and older were estimated one third and costs related to the 7–18 year olds 55% lower than the cost related to the 19–64 years old residents. In 2004, the proportions of municipal expenditure need coefficients were adjusted significantly in comparison with 2003 (see Table 2). After that the proportions of the coefficients have remained basically unchanged. The proportions of the current municipal expenditure need coefficients are certainly logically justified. Compared with municipalities in Sweden (Strömberg 2006: 2), however, the difference between costs associated with children and the elderly and the costs associated with 19–64 year olds is smaller in Estonia. In Swedish municipalities, the costs associated with 65–74 year olds were assessed two times and costs related to 75–77 year olds three times higher than the costs associated with 19–64 year olds. Then the cost ratio rose rapidly and costs associated with 90 year olds and older were assessed 14 times higher than the costs associated with 19–64 years old. The costs related to children were also assessed much higher than the costs related to 19–64 year olds. Costs related to 0–6 year olds where assessed six times and 7–18 year olds eight times higher than the costs related to 19–64 year olds.

There is no general rule for determining the proportions of municipal expenditure need coefficients. The proportions are significantly affected by the division of public

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[3] Years 2005 and 2006 were left out because the changes in these years were not very large.

sector responsibilities between central and local government. Estonian municipalities in comparison with municipalities in Sweden are more uneven in their level of economic development. Therefore, the provision of public services in Estonia is more centralized.

In Germany, the expenditure needs of municipalities are primarily determined on the basis of population size and in all of the states the expenditure needs are estimated higher for more populous municipalities. This means that the residents of each municipality have an importance multiplier, which is 1 for the smallest municipalities and can be nearly 2 for the largest municipalities in some states. In different states the extent of variation in the importance multiplier differs (settlement structure). In addition to the number of inhabitants, other factors, such as the number of inhabitants needing social care, the number of students in the municipality and the size of the area of the municipality are also considered when estimating expenditure needs. Unlike in Estonia and Sweden, the elderly are not considered when the expenditure needs of municipalities in German states are estimated. (Büttner *et al.* 2008: 83-88)

Table 2. The proportions of municipal expenditure need coefficients in Estonia by cost factor units (the municipal expenditure need coefficient of 19-64 year olds = 1)

Cost factor	2003	2004-06	2007-08	2009*	2009**	2010	2011-12
0-6 year olds	2.66	2.99	3.04	3.04	3.04	3.04	3.04
7-18 year olds	0.45	2.38	2.41	2.41	2.41	2.41	2.41
19-64 year olds	1.00	1.00	1.00	1.00	1.00	1.00	1.00
65 year olds and older	0.66	1.45	1.45	1.45	1.45	1.45	1.45
Elderly under care			1.95	1.95	1.95	1.91	1.90

Source: Friedrich *et al.* 2010, authors' calculations.

In summary, primarily population age structure has been analysed as a factor influencing demand for local public services. Other factors have not found significant attention. The reason for this probably lies in the fact that there is no systematically gathered municipal data for the other factors. This study used data from the Estonian Tax and Customs Board, which allows us to identify the employment structure of municipalities by type of economic activity. By using this data we can extend the list of factors influencing demand for local public services and test the hypothesis that the municipal budget cost structure also depends on employment structure.

Based on the purpose of this article we focus on the question of which factors determine demand for local public services; in other words, affect the opinion of individuals about changing the level and structure of public spending. The empirical analysis is carried out with the assumption that the output of political processes

reflects the average opinion of individuals (the median voter); in other words, we assume that the expenditure structure of the municipal budget is in accordance with the opinion of the median voter; or, the supply of local public services equals demand. Unlike traditional approaches, this study does not examine the opinions of individual inhabitants (usually derived from public surveys) on the need to change the expenditure structure of the municipal budget along with parameters characterizing the individual (age, income, etc.). Instead, the object of this study is the expenditure structure of each individual municipality with the parameters that characterize the population (the proportion of different age groups in the population, employment structure by type of economic activity, etc.). In some municipalities, political processes lead to an overestimation of the opinion of the median voter and in others to an underestimation, but the average estimation of a large pool of municipalities should approach the average opinion of the median voter on the optimal expenditure structure of the municipal budget.

The differences in the structure of municipal spending should therefore result from differences in the levels, structure and dynamics of demand-setting factors. The significance, direction and intensity of the potential factors can then be identified using relationship analysis methodology (correlation analysis, regression, etc.). The empirical part of this study is built upon this approach.

2. Relationships between optimal public service provision and population structure and income.

Optimal provision of public services is often associated with the size (number of inhabitants) of the service provider (a municipality when talking about local public services). It is a fairly common belief that larger municipalities are able to provide public services closer to the optimal level than smaller municipalities. Economic efficiency is generally regarded the main indicator of optimality. Analysing the scientific literature relevant to the topic reveals, however, that the relationship between the size of the service provision area (the size of the municipality) and cost effectiveness of service delivery is far more complex.

The scientific literature indicates that the relationship between municipal size and economic efficiency of service provision is U-shaped (an increase in municipal size is at first accompanied by unit cost reduction, but from a certain size the unit costs will start to increase again), but at the same time the service characteristics impact the relationship significantly. According to Holzer *et al.* (2009: 18-19), larger municipalities are able to provide capital intensive and highly specialized services more efficiently than small municipalities, but small municipalities are more efficient in providing labour-intensive services. A general relationship between size and economic efficiency of service provision for all public services is therefore impossible to describe.

The cost-effectiveness analysis of local public services is complicated by the fact that the main measurement used for describing the economic efficiency of service provision is usually the total cost of providing a local public service per inhabitant,

or better, per target population group member (e.g. per student). But the correspondence of service supply to service demand is often overlooked. Based on the previous chapter it can be argued that conclusions about the demand for local public services cannot be made solely on the basis of absolute population size because the demand for local public services may be significantly affected by both age and employment structure and changes in those structures. The optimal provision of public services is also influenced by quality requirements and in a number of cases by the location they are offered (such as the parish community centre) or where the provision of a service begins (e.g. fire station).

Consequently, it is clear that in order to match local public service supply with demand and thereby achieve the highest efficiency, the provision of each local public service has to be approached individually. In other words, an optimal location of supply, provision area and quality level has to be found for each local service. To achieve this, it is possible to establish three types of optimization problems:

1. Problems that involve finding the best location for providing a service when the size of the service provision area (e.g. the size of the municipality) and the required quality level are known – known as facility location models. Location models (see Klose, Drexl 2004 for different types) are used to solve facility location problems and find optimal locations or location patterns for public service providers according to objectives and constraints such as cost, transport time, accessibility, land coverage and so on. Similar problems have to be solved when searching for a suitable location for health service providers (Rahman and Smith 2000), schools (Sepp, 2007), power stations, emergency and rescue authorities (Indriasari *et al*. 2010, Sasaki *et al*. 2010) and several other public service providers.

2. Problems where, in order to achieve economic efficiency, the optimal level of quality for a public service has to be found because the location of supply and service provision area are known and for some reason it is not rational to change them. Grzybowski *et al*. (2009) developed and applied a population isolation model to define the appropriate level of maternity service for rural communities in British Columbia, Canada. The model consists of three dominant indicators that characterize each rural community:
   a. a population birth score (the average number of births in the 1-hour catchment area of a hospital over five years, and divided by 10);
   b. an adjustment for population vulnerability, which is based on the following factors: economic hardship, crime, health problems, education concerns, children at risk and youth at risk (British Columbia Regional... 2011);
   c. an isolation factor (proximity to nearest caesarean section service in surface travel time).

3. Problems where, in order to achieve economic efficiency, an optimal area size for providing a service has to be found because the location of supply is known beforehand and the required quality level is given (e.g. required by law). White and Tweeten (1973) estimated the cost of providing elementary and secondary education for rural areas of Oklahoma. Unit cost curves were derived for instruction, administration, plant operation and maintenance, buildings, equipment and transportation. They found that optimal school district size,

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derived by combining these unit cost curves, varied significantly in terms of student density, meaning that the optimal school district size was smaller in sparsely populated rural areas.

All three types of optimization problems use the size and proportions of different population groups, income levels of the population and employment figures as inputs for finding the most efficient way of providing a public service. These indicators are (as in this study) used to describe demand for public services. In addition to these indicators, the models usually also include different geographical indicators – the spatial distribution of the population or a specific population group in the service area (e.g. municipality), transportation time, existing infrastructure and several other parameters on the basis of which the optimal service supply level, place, quality and structure can be designed. In this study, characteristics of the geographic distribution of the population are ignored because it would require a separate analysis. The study also ignores possible differences in public service quality levels among municipalities because the methods for taking those differences into account in the analysis are inadequate.

3. Relationships between local public service provision in Estonian municipalities and population structure, income levels and employment structure

The population age structure and local public service levels and structure of Estonian municipalities will be analysed based on data from Statistics Estonia (ESA), and the job related income (salary) levels and employment structure (by economic activity type) will be analysed based on Estonian Tax and Customs Board (EMTA) data. The analysis focuses on 213 municipalities for three separate years: 2004 (before the economic boom), 2008 (peak of the economic boom in Estonian municipalities), and 2010. Municipalities with less than 500 inhabitants where left out of the analysis because the expenditure structure of their budgets might be significantly affected by special state programs, and therefore, differ from other municipalities with more autonomous budgets. The analysis also did not include municipalities for which some data was not available.

The indicators used in the analysis for describing the municipalities can be divided into three groups:
1. Indicators describing the supply of local public services: the share of expenditures on different public services (education, leisure, culture, public utilities, economic services, social assistance) in the municipal budget; local public service expenditures per inhabitant or per certain group member (e.g. education expenditures per child under age 19).
2. Demographic indicators that shape the demand for local public services: population size, population age structure, dependency ratio and demographic labour pressure index, percentage of unemployed in the population.
3. Income levels and employment structure: job related income (salary) level per inhabitant and per tax payer, job related income (salary) structure by economic

activity type (NACE classification), employment structure by economic activity type (NACE classification).

The content and names of the indicators used in the analysis are presented in Appendix 1.

Our hypothesis is that the development of the structure and level of expenditures on local public services is significantly affected by population structure, income levels and employment structure in the municipality. To test the hypothesis, a correlation analysis between cost indicators characterizing the supply of local public services and indicators characterizing demand for local public services was carried out using data analysis and the statistical software STATA. The results of the correlation analysis for 2010 are presented in Appendix 2. The same analysis is conducted for 2004 and 2008.

The analysis reveals many interesting correlations between local public service supply indicators and indicators describing population age structure, income level and employment level:

- The proportion of 6 year olds and younger had no statistically significant correlations with local public service supply indicators in 2004, but in 2008 some statistically significant correlations where found and in 2010 the proportion of 6 year olds and younger had statistically significant positive correlations with all the education expenditure indicators. It seems that a larger proportion of pre-school aged children in the population encourage municipalities to increase expenditures on education both as a share of the municipal budget as well as expenditures per inhabitant and per child under 19 years of age.
- The proportion of young people (ages 7−18) in the population had a positive correlation with the share of education expenditures in the municipal budget in all three years and negative correlations with housing and utility expenditures (both as a share of the municipal budget and per inhabitant) in 2004 and 2010.
- The proportion of working age people (ages 19−64) had the largest number of statistically significant correlations with local public service supply indicators. However, the correlations were very inconsistent and unstable: correlations with education expenditures were mostly positive in 2008, but negative in 2004 and 2010; correlations with housing and utility expenditures were positive in 2004, absent in 2008 and negative in 2010; correlation with the share of social care expenditures in the municipal budget was negative in all three years, but in 2008 (the peak of the economic boom) there was a positive correlation with social care expenditures per inhabitant. An interesting finding is that in contrast to 2004 and 2008, all the statistically significant correlations were negative in 2010. It seems that for some reason municipalities with a high proportion of working age people have put together more conservative municipal budgets after the economic crises than municipalities on average.
- The proportion of elderly (age 65 and older) had many different but often non-recurrent correlations with local public service supply indicators during the

years under observation: negative correlations with education expenditures that strengthened during the economic boom; a statistically significant positive correlation with eldercare expenditures was found only in 2004; a statistically significant positive correlation with leisure and culture expenditures was found in 2008, but not in 2004 and 2010; a statistically significant positive correlation with housing and utility expenditures was found in 2010 but not in 2004 and 2008.

- The demographic labour pressure index (calculated by dividing the number of 5–14 year olds with the number of 55–64 year olds) has a stable positive correlation with the share of education expenditures in the municipal budget in all observed years. Correlations with other local public service supply indicators are unstable and seem random.
- The dependency ratio has positive correlations with social care and eldercare expenditures. A negative correlation with the share of education spending in the municipal budget occurs in 2008.
- The percentage of unemployed in the population has positive correlations with social care expenditures and negative correlations with the share of education expenditures in the municipal budget in all observed years. The percentage of unemployed also had a positive correlation with eldercare expenditures per inhabitant in 2010 but not in 2004 and 2008.
- The job related income level (both per inhabitant and per tax payer) also has a few statistically significant correlations with local public service supply indicators: positive correlations with education expenditures that were relatively weak in 2004, but strengthened significantly during the economic crisis and have maintained average strength after the crisis; negative correlations with the share of social care expenditures in the municipal budget in all three observed years; a negative correlation was also found with social care expenditures per inhabitant in 2004 but not in 2008 and 2010.

It turns out that population age structure factors have many logically justified correlative relationships with the municipal budget expenditure structure and local public service expenditures per capita. It can therefore be concluded that some level of adapting local public service supply to demand is taking place in Estonian municipalities. At the same time, unstable relationships between indicators describing income level and employment level and indicators describing local public service supply suggest that the economic boom, which rapidly increased the incomes of both municipalities and their inhabitants, and the subsequent sharp decline in income in the economic crisis, somewhat destabilized relationships between local public service supply and demand. To understand more precisely how income and employment among inhabitants affect demand for local public services, we have looked at the relationships between income and employment structure indicators and local public service supply indicators.

The correlation coefficients between income and employment structure indicators (according to NACE economic activity type) and local public service supply indicators highlight the following:

- Education expenditures in the municipality, particularly in 2008 and 2010, had a positive correlation with the proportion of tax payers in the population. This means that municipalities with a larger proportion of occupationally active inhabitants make larger education expenditures than municipalities with a smaller proportion of occupationally active inhabitants. At the same time, however, the ratio of taxable income earned in public administration to total taxable income has a negative correlation with the share of education expenditures in the municipal budget. This is an interesting relationship, which must be explored in greater depth. Public administration employees are more familiar with the mechanisms and procedures of the public sector and have therefore a greater influence on municipal policy decisions. If the income of the people working in public administration comes from working for the municipality, the question arises whether education expenditures compete not with eldercare expenditures but with the personnel costs of the municipality.
- The share of social care expenditures showed negative correlations with the proportion of tax payers in the population in all three years. In addition, social care expenditures per inhabitant had a negative correlation with the proportion of tax payers in 2004. At the same time, a positive correlation was found between social care and eldercare expenditures and the proportion of inhabitants working in the public sector. It seems that a high proportion of tax payers in the population suggests municipalities with an active and strong private sector, where the demand for social care services is low. At the same time, the public sector has a higher than average role as an employer and income provider in regressing municipalities with a decreasing proportion of tax payers, where the need for social care services is greater than average.
- Social care expenditures directed at unemployed did not have statistically significant correlations with the population age structure indicators and even with the percentage of unemployed in the population. However, the social care expenditures directed at the unemployed did have interesting relationships with the job related income structure (according to NACE economic activity type): negative correlations with the proportion of tax payers in the population and the ratio of taxable income earned in the private sector to total taxable income, and at the same time, positive correlations with the ratio of taxable income earned in the public sector (especially in public administration) to total taxable income. These relationships are probably also based on the fact that a large proportion of people working in the private sector characterize developing municipalities with low unemployment rates, while the public sector, including public administration, has a greater importance as an employer in regressing municipalities with larger unemployment rates. Such relationships did not occur in 2008 and 2010. The reason for this may lie in the fact that the national unemployment insurance system was launched in 2008. This meant that the majority of unemployed no longer needed to apply for social assistance from the municipality. This in turn means that the demand for local public services depends substantially on the socio-economic policies of the central government.
- Housing and utility expenditures and also leisure and culture expenditures had only a few statistically significant correlations with the indicators characterizing

the income and employment structure of the inhabitants. No clear general rules can be found from those relationships. It can be assumed that the sample used in the study, consisting almost exclusively of similar Estonian municipalities, is too heterogeneous, meaning that the supply of both housing and utility services and leisure and culture services differ significantly in urban, semi-rural (working in towns, but living in the country) and rural municipalities. A different scope of private sector involvement can also be observed in these service areas, which certainly has an impact on the level and structure of local public service expenditures.

In general, it should be noted that quite a number of statistically significant relationships were found, but the coefficients of determination (the squared correlation coefficient) were mostly small, and only in single cases were they greater that 10% of the entire variance.

The results of this analysis show that the income and employment structure of the population of a municipality, which have been neglected in previous empirical studies, have statistically significant correlations with both the share of different public service expenditures in the municipal budget and with local public service expenditures per inhabitant or per certain group member. Therefore, the structure of employment and income may significantly shape the demand for local public services. Analysis of these demand side factors will provide a better understanding of problems matching local public services supply and demand.

Conclusion

Dissatisfaction with the provision of local public services among municipalities has been a frequent topic in Estonia for more than ten years. Undoubtedly, at least part of the dissatisfaction stems from real problems. A variety of solutions have been offered over the years in which the main emphasis has been on strengthening the ability of municipalities to supply local public services. The solutions offered have overlooked the fact that in addition to supply capability, how well a municipality is able to match its supply to the demand for local public services and how quickly it can adapt its supply to demand changes is also important. However, in order to quickly change the supply of local public services, it is necessary to know what factors affect demand.

Based on existing theoretical and empirical studies and optimal public service area models, it is clear that the main factors affecting demand for public services are population age structure and to a lesser extent the employment and income structure of the population. Given the large changes taking place in the population of Estonian municipalities and changes in employment and income resulting from the economic situation, it is important to know whether and how the provision of local public services in Estonian municipalities has adapted to the differences in demand factors.

The correlation analysis conducted here confirms the existence of relationships between indicators characterizing the supply and demand of local public services,

meaning that population structure as well as employment and income levels and the structure of the population have statistically significant correlative relationships with the expenditure structure of the municipal budget and local public service expenditures per inhabitant. The direction of the relationships is usually logical and the dense network of relationships reveals a system in these relationships.

As a new aspect, the study analysed the income and employment structures of the population (according to NACE economic activity type) as possible local public service demand factors. The result of the empirical analysis revealed that these factors have statistically significant correlations with the expenditure structure of municipal budgets and with local public service expenditures per inhabitant.

As a whole, the results of the analysis in this study show that differences in local public service supply factors (the share of expenditures in the municipal budget and expenditures per inhabitant) in Estonian municipalities can be associated with statistically significant differences in demand side factors (population structure, employment and income levels, employment and income structure by economic activity).

However, the sample used in the study was rather non-homogeneous, which could have obscured and distorted the results of the correlation analysis, because the economic boom and crisis affected the budgets and socio-economic development of different types of municipalities differently. In future studies, we plan to analyse qualitatively more homogenous groups of municipalities (e.g. urban, semi-rural and rural). In a more homogenous sample the relationships between local public service demand and supply side factors should reveal themselves more clearly and precisely.

Because the set of local public service demand side factors is quite large, and different factors could have statistical relationships between them, the correlation coefficients between demand and supply side factors might be false and misleading and thus complicate our understanding of the nature of the relationships. In future studies we will therefore systematically analyse the internal relationships of the demand side factors and indentify the independent components that characterize local public service demand using principal component analysis. In doing so, we will be able to use multiple regression models that provide a complex description of the effects of demand side factors instead of correlation coefficients that describe only fragments of the relationships.

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Appendix 1. Indicators used in the analysis and their names

Name [4]	Indicator used in the analysis
har10	Share of education expenditures in the municipal budget in 2010 (%)
kult10	Share of leisure, culture and religious expenditures in the municipal budget in 2010 (%)
komm10	Share of housing and utility expenditures in the municipal budget in 2010 (%)
sots10	Share of social care expenditures in the municipal budget in 2010 (%)
vana10	Share of eldercare expenditures in the municipal budget in 2010 (%)
ttu10	Share of social care expenditures directed at unemployed in the municipal budget in 2010 (%)
har10_in	Education expenditures per inhabitant in 2010 (euro)
kult10_in	Leisure, culture and religious expenditures per inhabitant in 2010 (euros)
komm10_in	Housing and utility expenditures per inhabitant in 2010 (euro)
sots10_in	Social care expenditures per inhabitant in 2010 (euro)
vana10_in	Eldercare expenditures per inhabitant in 2010 (euro)
ttu10_in	Social care expenditures directed at unemployed per inhabitant in 2010 (euros)
har1810	Education expenditures per child under age 19 in 2010 (euro)
ralot10	Proportion of 6 year olds and younger in the population in 2010 (%)
ranot10	Proportion of 7 to 18 year olds in the population in 2010 (%)
ratot10	Proportion of 19 to 64 year olds in the population in 2010 (%)
ravot10	Proportion of 65 year olds and older in the population in 2010 (%)
tts10	Demographic labour pressure index in 2010
ylal10	Dependency ratio in 2010 (%)
ttuot10	Proportion of unemployed in the population in 2010 (%)
vms10_in	Total taxable income per inhabitant in 2010 (euro)
vms10_mm	Total taxable income per tax payer in 2010 (euro)
mm_ra10	Proportion of tax payers in the population in 2010 (%)
amm_arv10	Proportion of tax payers working in the agriculture, forestry and fishing industries (NACE classification) in the population in 2010 (%)
avms10	Ratio of taxable income earned in the agriculture, forestry and fishing industry (NACE classification) to total taxable income in 2010 (%)
cmm_arv10	Proportion of tax payers working in the manufacturing industry (NACE classification) in the population in 2010 (%)

[4] The indicators for 2004 and 2008 are similar, ending with either 04 or 08.

Name [4]	Indicator used in the analysis
cvms10	Ratio of taxable income earned in the manufacturing industry (NACE classification) to total taxable income in 2010 (%)
fmm_arv10	Proportion of tax payers working in the construction industry (NACE classification) in the population in 2010 (%)
fvms10	Ratio of taxable income earned in the construction industry (NACE classification) to total taxable income in 2010 (%)
lmm_arv10	Proportion of tax payers working in the real-estate industry (NACE classification) in the population in 2010 (%)
lvms10	Ratio of taxable income earned in the real-estate industry (NACE classification) to total taxable income in 2010 (%)
fl_arv10	Proportion of tax payers working in the construction and real-estate industries (NACE classification) in the population in 2010 (%)
fl10	Ratio of taxable income earned in the construction and real-estate industries (NACE classification) to total taxable income in 2010 (%)
gmm_arv10	Proportion of tax payers working in the wholesale and retail trade and motor vehicle and motorcycle repair industries (NACE classification) in the population in 2010 (%)
gvms10	Ratio of taxable income earned in the wholesale and retail trade and motor vehicle and motorcycle repair industries (NACE classification) to total taxable income in 2010 (%)
omm_arv10	Proportion of tax payers working in the fields of public administration, national defence and compulsory social security (NACE classification) in the population in 2010 (%)
ovms10	Ratio of taxable income earned in the fields of public administration, national defence and compulsory social security (NACE classification) to total taxable income in 2010 (%)
pmm_arv10	Proportion of tax payers working in education (NACE classification) in the population in 2010 (%)
pvms10	Ratio of taxable income earned in education (NACE classification) to total taxable income in 2010 (%)
qmm_arv10	Proportion of tax payers working in the health care and social care industries (NACE classification) in the population in 2010 (%)
qvms10	Ratio of taxable income earned in the health care and social care industries (NACE classification) to total taxable income in 2010 (%)
opq_arv10	Proportion of tax payers working in the public sector (activities O, P and Q according to the NACE classification) in the population in 2010 (%)
opq10	Ratio of taxable income earned in the public sector (activities O, P and Q according to the NACE classification) to total taxable income in 2010 (%)
koguopq_arv10	Proportion of tax payers working in the private sector (total tax payers-tax payers working in the public sector) in the population in 2010 (%)
koguopq10	Ratio of taxable income earned in the private sector (total taxable income-taxable income earned in the public sector) to total taxable income in 2010 (%)

Source: compiled by the authors.

Appendix 2. The correlation coefficients between local public service cost indicators and demand indicators in 2010

	har10	kult10	komm10	sots10	vana10	har10_in	kult10_in	komm10_in	sots10_in	vana10_in	har1810
ralot10	0.21*	-0.08	-0.12	-0.14*	-0.10	0.48*	0.05	-0.02	0.06	0.03	0.27*
ranot10	0.28*	-0.09	-0.18*	0.02	0.11	0.11	-0.09	-0.16*	-0.02	0.02	-0.06
ratot10	0.13	-0.03	-0.02	-0.20*	-0.20*	-0.14*	-0.16*	-0.14*	-0.19*	-0.14*	-0.10
ravot10	-0.34*	0.11	0.16*	0.24*	0.18*	-0.14*	0.16*	0.20*	0.15*	0.10	-0.01
tts10	0.32*	-0.12	-0.15*	-0.04	-0.01	0.31*	-0.05	-0.10	0.03	0.02	0.13
ylal10	-0.17*	0.08	0.11	0.19*	0.20*	-0.03	0.14*	0.19*	0.15*	0.13	0.01
ttuot10	-0.24*	0.06	0.02	0.18*	0.04	0.03	0.08	0.07	0.24*	0.16*	-0.06
vms10_in	0.19*	-0.03	-0.05	-0.19*	-0.14*	0.54*	0.09	0.06	0.00	-0.03	0.34*
vms10_mm	0.14*	-0.02	0.00	-0.17*	-0.14*	0.38*	0.07	0.08	-0.04	-0.06	0.28*
mm_ra10	0.18*	-0.08	-0.07	-0.18*	-0.12	0.52*	0.11	0.05	0.05	0.02	0.28*
amm_arv10	0.15*	-0.20*	-0.10	0.01	0.09	-0.01	-0.19*	-0.10	-0.05	0.00	-0.08
avms10	0.15*	-0.23*	-0.06	0.04	0.11	-0.03	-0.21*	-0.08	-0.04	0.01	-0.06
cmm_arv10	0.06	0.09	0.07	-0.17*	-0.12	0.06	0.02	0.06	-0.12	-0.10	-0.09
cvms10	-0.09	0.10	0.08	-0.05	-0.04	-0.20*	-0.03	0.02	-0.12	-0.09	-0.25*
fmm_arv10	0.21*	-0.02	-0.10	-0.19*	-0.14*	0.33*	0.02	-0.04	-0.04	-0.05	0.16*
fvms10	0.13	-0.06	-0.01	-0.15*	-0.14*	-0.01	-0.12	-0.05	-0.13	-0.11	0.00
lmm_arv10	0.03	-0.02	-0.03	-0.07	-0.12	0.21*	-0.02	0.00	-0.04	-0.06	0.12
lvms10	0.03	-0.04	-0.04	-0.08	-0.09	0.04	-0.07	-0.07	-0.11	-0.10	0.04
fl_arv 10	0.18*	-0.03	-0.09	-0.18*	-0.16*	0.35*	0.01	-0.03	-0.05	-0.06	0.17*
fl10	0.14*	-0.07	-0.02	-0.16*	-0.16*	0.00	-0.14*	-0.07	-0.15*	-0.13	0.01
gmm_arv10	0.23*	-0.06	-0.05	-0.21*	-0.18*	0.45*	0.03	0.04	-0.05	-0.07	0.26*
gvms 10	0.25*	-0.12	-0.05	-0.18*	-0.17*	0.22*	-0.07	-0.02	-0.14*	-0.15*	0.15*

	har10	kult10	komm 10	sots10	vana 10	har10_in	kult10_in	komm 10_in	sots10_in	vana 10_in	har 1810
omm_arv10	0.04	0.03	-0.03	-0.06	0.00	0.49*	0.21*	0.12	0.20*	0.16*	0.27*
ovms 10	-0.19*	0.03	-0.01	0.21*	0.25*	0.05	0.20*	0.06	0.24*	0.23*	0.14*
pmm_arv10	0.16*	0.02	-0.04	-0.17*	-0.18*	0.34*	0.08	0.03	-0.03	-0.07	0.27*
pvms 10	0.13	0.00	-0.01	-0.12	-0.13*	0.06	0.00	0.00	-0.07	-0.09	0.10
qmm_arv10	0.20*	0.01	-0.07	-0.08	-0.11	0.21*	0.01	-0.04	0.00	-0.03	0.15*
qvms 10	0.10	0.03	-0.04	-0.02	-0.06	-0.04	-0.02	-0.07	-0.05	-0.06	-0.01
opq_arv10	0.12	0.03	-0.05	-0.11	-0.07	0.52*	0.19*	0.10	0.15*	0.11	0.32*
opq10	-0.09	0.04	-0.03	0.14*	0.15*	0.06	0.18*	0.03	0.18*	0.15*	0.18*
kogu opq_arv10	0.22*	-0.04	-0.08	-0.21*	-0.16*	0.42*	0.01	-0.01	-0.07	-0.07	0.19*
kogu opq10	0.09	-0.04	0.03	-0.14*	-0.15*	-0.06	-0.18*	-0.03	-0.18*	-0.15*	-0.18*

* Correlation coefficient is statistically significant at 0.95 confidence level.
Source: authors' calculations.