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School of Economics and Management

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Population Change and its Effects on Local Spending: Cost Efficiency Behaviors of Swedish Municipalities on the Case of School Expenditures

Maria Pozder

ede13mpo@student.lu.se

Abstract: The paper investigates the relationship between population changes and public spending. The main interest is hereby whether local governments can adjust their public spending in times of population decline. A Swedish case study is conducted on all 290 municipalities in regard to their comprehensive school expenses between 2005 and 2013. The theoretical framework incorporates economies of scale and cost stickiness and the methodology includes stochastic frontier analyses and log-annual change models accounting for fixed and variable costs. The paper applies advanced efficiency estimations in order to provide a benchmark analysis of the cost efficiency scores. As a result, the analysis draws a comprehensive picture on the causal effects of growing and declining populations in Swedish municipalities and finds that rural and peripheral regions – opposed to general expectations – are not necessarily the worst performers, but are able to adjust their public services according to their demographic shifts in the medium run.

Key words: public cost behavior, public sector management, efficiency, population decline, stochastic frontier analysis, spatial analysis, cost efficiency

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Supervisor: Tommy Bengtsson
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1 Introduction

While the global debate still is concerned with population growth, more and more European countries on the local and regional level see themselves confronted with the challenges of population decline (Geys et al. 2007). Especially rural and peripheral regions remote from urban and metropolitan areas increasingly suffer from declining citizen numbers as a consequence of emigrating young adults and high death rates due to larger shares of elderly people. For decades, local entities such as municipalities were used to target their regional development towards growing populations, but with the beginning of the retirement of the baby boomers and the continuing below replacement fertility rates, they now struggle to adapt new strategies in order to deal with declining tax revenues, shifts in demands for public service provision and increasing per capita costs. More and more municipalities have difficulties providing their public goods on constant prices or cannot undertake necessary investments in order to maintain or improve local infrastructures. As a consequence, 'many Europeans view population decline and ag[e]ing as threats to national influence and the welfare state' (van der Kaa 1987, p.1).

Sweden is no exception to the process and is confronted with exactly those concerns. While the overall population is still growing, the benefiters are mostly metropolitan and urban areas. In return, peripheral and rural regions suffer from population decline and ageing. However, each municipality is obliged to fulfill their administrative and executive duties in order to provide similar living standards across the entire country (Swedish Constitution, Chapter 14). Tightening budgets and shifting demands have the consequence that municipalities are more and more required to act cost efficient as rational business firms. Monitoring and understanding the relationship between population decline and its effects on local government spending is crucial to identify affected municipalities and to support them early enough to address their changing demands according to the undergoing demographic shifts.

Therefore, this paper researches the effects of population decline on local spending in Swedish municipalities and studies their cost efficiency behaviors. The underlying question is whether those municipalities are able to adjust to their changing demographic circumstances and maintain cost efficiency by productivity increases and supply-demand adjustments or suffer from per capita cost increases in their service provision. Cost efficiency is eventually the indicator that benchmarks the performance of the municipalities.

By doing so, this study picks up and extends previous research in order gain further knowledge about the core relationship between population decline and public spending. Earlier results have shown that effects become less biased when focusing on one service provision,

because the input-output matching becomes easier (Kalb 2009; Kalb 2010). Instead of matching just overall spending with demographic indicators, it is more suitable to identify a certain public good and study the relationship between the consumer group and the explicit good's expenditures. Thus, this paper follows this approach by limiting the study to school expenditures. Swedish municipalities carry the task to provide comprehensive schooling and to finance their school system. Above that, the Swedish statistics provides excellent data on specific school cost categories that allows for a more in-depth analysis. Furthermore, scholars continuously emphasize the relevance of population size and density and suggest their disentanglements in order to avoid bias (Ladd 1992; Holcombe & Williams 2009). Consequently, the analysis accounts for this relationship as well.

The two applied base theories are economies of scales and cost stickiness. They both address the question of why population decline is connected to cost increases, but focus on different cost components – namely variable and fixed costs. The differentiation becomes one of the biggest challenges in this paper which is why it is even more important to discuss both theories in one study framework and thus justifies the extended analysis. Additionally, the study incorporates a broad set of sub-theories that adds additional value to the empirical part by accounting for a variety of socio-economic and administrative factors and increases explanatory power. The flypaper effect accounts for the profound fiscal equalization system that equalizes local budgets across the country, while Niskanen's bureaucracy model considers principal-agent dilemmas between voters, elected governors and assigned bureaucrats.

The statistical analysis applies stochastic frontier and annual log-change models that account for fixed effects. Both approaches follow the general procedures of previous research. Above that, the stochastic frontier analysis has the advantage of computing efficiency scores which makes it easy to compare performances between municipalities. In order to apprehend the results better, the data will be often displayed in form of maps. That has not just the advantage of visualizing and approaching a lot of information in an easy and quick way, but it also adds a spatial component to the overall study in order to identify potential regions across the 290 municipalities that perform explicitly well or badly.

Overall, the study is very ambitious and connects many factors that previously have just been discussed in separate manners. However, in order to receive a full picture of the effects of population decline, research needs to step up and combine all the available information to eventually gain larger external validity. The analysis itself brings already huge policy-benefits since it actually provides a very useful tool to evaluate local governments' performances and allows a very straight-forward benchmarking of municipalities. In addition, the results help to judge on

the overall questions in which extend the national government needs to provide extra financial and executive support to guide adjustment processes.

As a final remark on the research approach, it needs to be emphasized that this paper does not study quality effects of population decline on local public service provision. The question is not, whether the local schools perform well in respect of student outcomes and test scores. The focus is purely on cost effects and whether schools experience higher costs per student once student and population numbers decline. If high costs are potentially related to quality effects, it will be discussed during the analysis.

On a technical note for an easier reading process, some definitions and common expressions need to be clarified. The descriptions 'public goods' and 'public service provision' as well as 'local' and 'municipal' are used as synonyms. Likewise are the words 'public spending', 'expenditures', 'costs' and 'expanses' used interchangeably. Furthermore, the descriptions 'peripheral', 'metropolitan' and 'urban' always refer to the entire municipality. Peripheral municipalities lack any urban center with a population above 20 000 citizens in near distance, while urban indicates a bigger city within the municipality that serves as center for the entire region (such as Umeå municipality or Luleå municipality). Metropolitan municipalities cover the three biggest agglomerations Stockholm, Göteborg and Malmö. All municipality names will be kept in Swedish.

The paper is structured as follows: While chapter 2 and 3 cover the Swedish background introducing the demographic and institutional settings, chapters 4 and 5 discuss the theoretical framework and previous research. Chapter 6 completes the entire pre-analysis section by proposing the hypotheses. Data management and estimation approaches are introduced in chapter 7. Chapter 8 presents the results and lastly chapter 9 concludes.

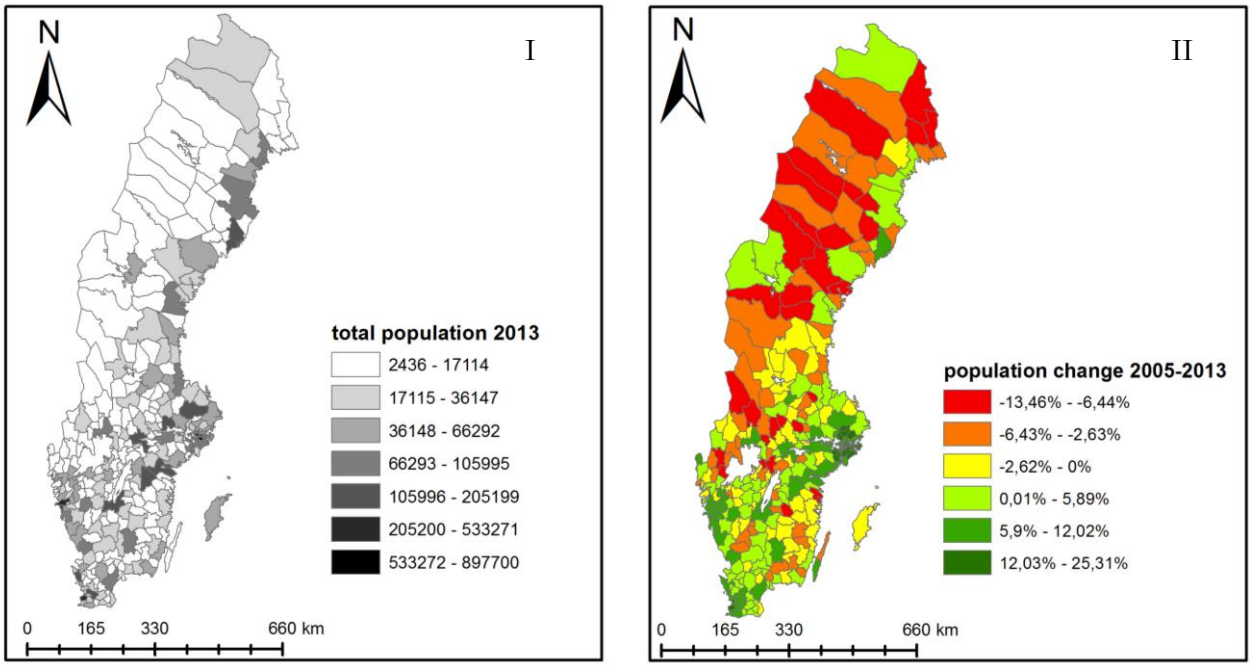
2 Historical Population Dynamics in Sweden

Sweden is the third largest country within the European Union, but with a total population of only 9,7 million inhabitants the country also holds Europe's second lowest population average density of 21 inhabitants per km^2 (Statistics Sweden 2015). In addition, the population is very unevenly distributed across the country, which in turn leads to even more distinctive figures. 39,5% of the entire Swedish population lives in the metropolitan areas of Stockholm, Göteborg and Malmö with population densities between 1 000 and 5 000 inhabitants per km^2. In contrast, only 17,6% of the Swedes are settled in northern Sweden, a region that makes up two third of the entire land area. Figure 1-I reveals a peripheral belt in northern Sweden along the Norwegian

border. Few of those northern municipalities even have population densities below 1 person/km^2 and none of them are close to any urban center with a population above 20 000 inhabitants.

Even though the total population in Sweden is continuously growing; the country is clearly not homogenous in its population structure. As it can be seen in figure 1-II, the most emerging population is in the metropolitan areas, but also coastal urban regions and university towns grow in absolute numbers. In return, rural and peripheral provinces experience population losses due to out migration and natural population decline, whereupon here some municipalities stand out as touristic countryside and leisure destinations or benefit from industries such mining that apart from their remote position undergo positive regional developments (Pettersson 2001).

Figure 1 Total Population 2013 and Population Changes 2005-2013



Source: Statistics Sweden (2015)

Sweden's population redistribution is from a theoretical perspective often analyzed in terms of dispersion and concentration (Borgegård et al. 1995; Håkansson 2000; Kupiszewski et al. 2001). By doing so, the reciprocal mobility between urban centers and rural areas are described. Historically, the Swedish population was distributed evenly across the country until the late 19th century. 80% of the population was still involved in the primary sector in the 1870s; thus, living in rural areas. With the ongoing industrialization in the following decades, urbanization slowly evolved, but did not yet take off as a primary trend. In fact, other mobility patterns occurred alongside; more than one million Swedes emigrated to the United States between 1870 and 1915, but also regional dispersion remained relevant with many workers moving towards northern Sweden following the development of the saw mill and paper industry. Despite those diverse

mobility patterns, the population remained highly dispersed on the national level, but increasingly showed concentration around urban centers on the local level (Borgegård et al. 1995).

The vast urbanization and concentration process, however, did not begin until the 1960s when the metropolitan areas grew fast and the peripheral regions underwent a substantial depopulation. The post-war period was influenced by an immense economic growth and high demand on labor. Small-scale factories in the periphery closed down, while industrial centers further expanded. Workers from stagnating regions were forced to move, while the growing cities were actively recruiting. At the same time, the social welfare system was improved and social security strengthened which made traditional social structures less important and relocation away from family less risky in case of hardships. It became more attractive for young and well-educated people to leave their protective environment within the family network and experience a new, modern and urban life-style (Borgegård et al. 1995).

The 1970s turned this development around and a suburbanization set in leading to a dispersion around the metropolitan areas. The so-called 'green wave' tried to combine urban and rural lifestyles, especially because those young people that initially moved to the cities started now to have own families and tried to preserve their old roots from when they grew up in rural areas. As a result, many families left the core urban areas and settled around the big cities in smaller villages and neighborhoods leading to a concentrated dispersion. One reason for this trend was the improved infrastructure that allowed commuting between living and working place. Another supportive factor was the extension and decentralization of the public sector that created new jobs outside the metropolitan areas and thus gave the people the opportunity to stay closer to the countryside. From the rural perspective the concentration towards local centers continued, although on a slower pace than in the 1960s. Newly founded universities such as Umeå University in 1965 or Luleå University in 1971 gave young students the opportunity to move to growing urban areas while still staying in relative proximity to their home regions (Borgegård et al. 1995; Kupiszewski et al. 2001).

The 1980s and 1990s continued to diversify the redistribution patterns: Young people preferred mobility towards urban centers, whereas families and elder generations left the city in favor of smaller towns in the countryside or in commuting distance to urban centers. International immigration became more important than net domestic migration. Since the foreign migrants had strong tendencies towards moving to big cities, a policy in 1985 was established with the aim to spread newly arrived immigrants evenly across the country. The policy did not win huge recognition and was abandoned again in 1994 in favor of free choice of settlement. The big recession of the early 1990s caused further depopulation of rural municipalities (Borgegård et al. 1995).

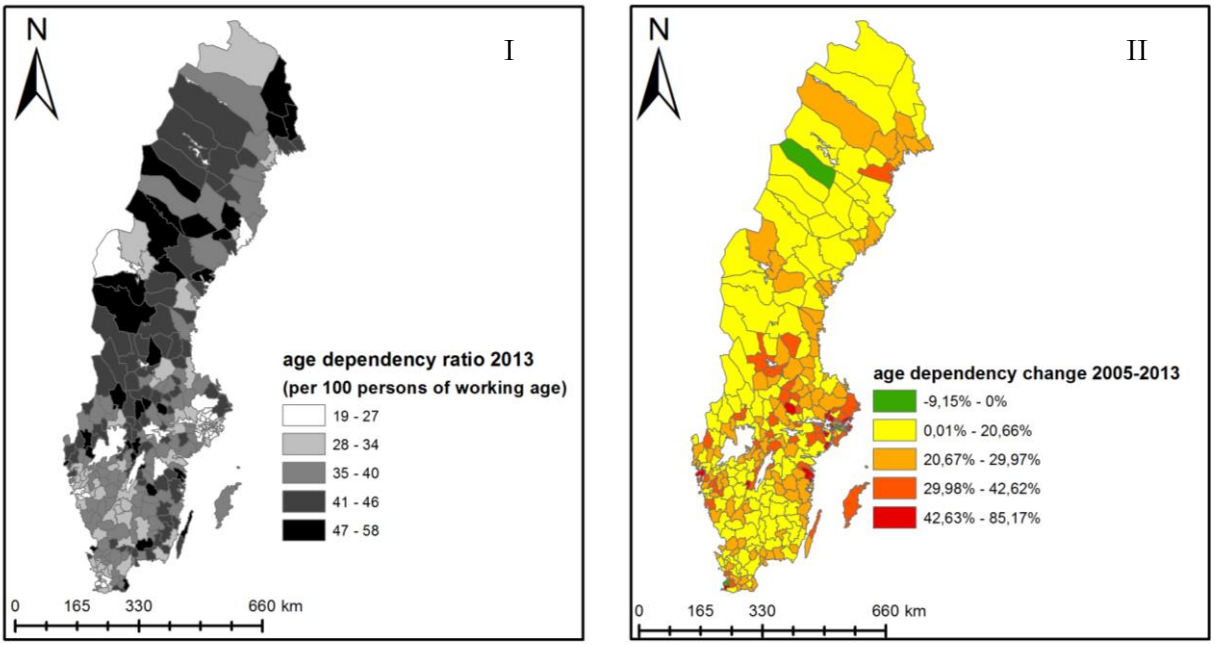
An ongoing trend in the 1990s and early 2000s was the rural growth in regions that are adjacent to metropolitan and urban centers (Westlund 2002; Westlund & Pichler 2013). Amcoff (2006) speaks of an urban 'spill over' that rather led to an expansion of the urban localities than suburbanization.

Summarizing the overall course in the 20th century, Sweden experienced a major shift from rural to urban redistribution. However, concentration and urbanization mainly occurred within the regions between surrounding settlements and local centers; whereas mobility between different parts of Sweden took place a lot less distinct (Pettersson 2001). This also applies for northern municipalities; in fact, the myth of the 'Norrland depopulation' can be rejected, because the share of the total population living in northern municipalities remained relatively stable the last hundred years (Kupiszeswski et al. 2001). Nonetheless, the concentration process is still ongoing. When looking at the six northernmost counties covering 69 municipalities, most of the population is concentrated in the coastal areas and cities along the Gulf of Bothnia forming an urban belt parallel to the peripheral belt. Those regional centers continue to grow, whereas many northern inland regions account for population losses at the same time. Population decline thus seems to be mostly a rural problem. In this regard it should be also emphasized that some southern rural municipalities are likewise affected and face similar challenges, even though they usually get less attention and are easily overlooked given their smaller sizes and physical proximity to urban areas.

Another side effect of rural depopulation led to a strongly skewed demographic profile (Pettersson 2010). The share of elderly continuously increased as a consequence of the leaving younger age groups. To make the situation even more difficult, rural areas are often characterized by distorted sex ratios, because particularly young women are more drawn to leave their childhood environment in favor of bigger, urban and especially southern Swedish regions. In the case of Sweden, the female deficiency becomes bigger, the further north the municipality is located (Kupiszewksi et al 2001). As a consequence, rural and especially peripheral regions suffer not only from population decline, but another demographic phenomenon – namely population ageing. From a historic perspective, the ageing process was driven by declining fertility during the 20th century that led subsequently to smaller birth cohorts and thus to higher concentrations of the elderly groups (Bengtsson 2010; Pettersson 2010). Additional effects of delayed births and extended life expectancies further increased the average age of the population. All those demographic distortions of the last couple of decades including decreasing fertility, aggravated partner search conditions and out migration of young fertile, mostly female, people have consequently to date obvious accelerating effects on population decline and ageing in rural areas. The problem nowadays is not just out migration anymore, but rather reflects the increasing

natural loss of an old population and the absence of succeeding generations (Kupiszewski et al. 2001). However, when looking at recent old age dependency ratios (ratio between retired and working people) and its changes 2005-2013 (figure 2-I/II), it becomes obvious that even though the peripheral areas are already more affected nowadays, the overall phenomenon of ageing population affects entire Sweden. Only Sorsele in the north improved its old age dependency ratio 2005-2013; all other municipalities in the country experienced an increase with the most severe gains in smaller municipalities in the center of Sweden.

Figure 2 Old Age Dependency Ratio 2013 and its Change 2005-2013



Source: Statistics Sweden (2015)

3 The Administrative Structure of Sweden

Sweden is by definition a unitary state in which the ultimate power emanates from the national government. Nevertheless, the national legislative has delegated a variety of competences to regional and local units. Since 1975, Sweden has been constitutionally guaranteed their autonomy resulting in a strongly decentralized three-level structure of the national government, counties (*län*) and municipalities (*kommuner*) (Levin 2009).

The municipal structures have a long history with the first local government act dating back to 1863. By that time more than 2 000 municipalities were established with many of them having less than 500 citizens (Ivarsson 1992). As a result of several amalgamation reforms between 1950 and 1977 the total number of municipalities was reduced to less than 300 in order to reach a population limit per unit of at least 5 000 inhabitants on the one hand – but also to guarantee the provision of public services otherwise. The central-place theory by Christaller served as theoretical foundation and constitutes a hierarchical spatial order. While the local centers are

supposed to provide the daily and ordinary services, the regional centers in form of major cities supply high-order and less demanded services to an entire region (Pettersson 2001).

Almost the entire service provision is executed on the regional and local levels based on the principles of self-governance. A quarter of the entire Swedish work force is employed by either the local or regional public level and the overall public sector is in relation to the private sector the biggest one in the entire world (Karlsson & Montin 2013). 21 counties handle matters that mainly involve the coordination of a larger region such as health care, public transportation, culture and regional development. The current 290 municipalities hold the responsibility for childcare and preschool, primary and secondary education, elderly care, waste and sewage systems, infrastructure, public transportation, social services as well as rescue and emergency services. Voluntary municipal tasks include cultural and leisure activities, housing, commercial and industrial services (Swedish Association of Local Authorities and Regions 2015).

Apart from the continuing importance and remaining size of the public sector, changes have been undergone in the recent past. In the 1980s, the continuously expansion ended that had started in the 1960s; while the economic crisis in the 1990s even forced the political stakeholders to cut down and reduce welfare spending on all three governance levels. At the same time it came to the break of the hegemonic social democratic, egalitarian approach through the introduction of liberal principles of privatization, outsourcing and New Public Management ideals. Sweden was a forerunner in adapting private market principles into to public service such as consumer choice and competition between service providers. Regardless of the restoration of most of the public service provisions in the 2000s, the public sector's image still suffers and the local stakeholders struggle to both retain public trust and to withstand economic pressures (Karlsson & Montin 2013).

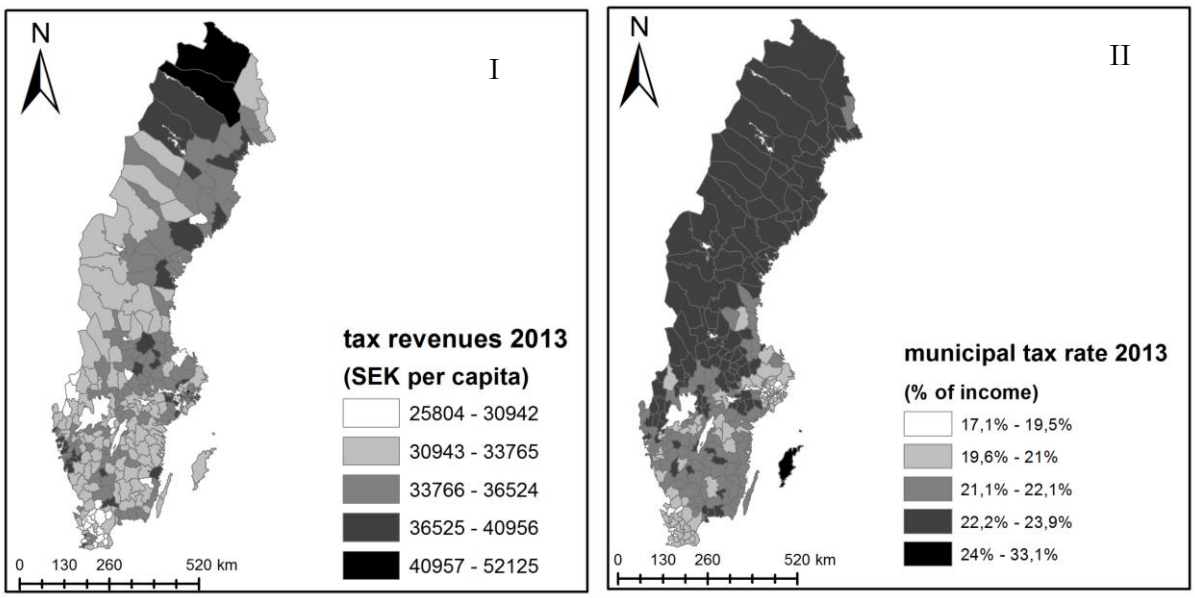
3.1 Public Finances

The self-governed local structures demand financial means in order to be able to operate and therefore, both municipalities and counties are eligible to raise taxes. The overall local tax rates including both the municipal and county fractions varied in 2013 between 28,89% and 34,52%; the municipal share respectively ranged from 17,12% to 23,9%. The majority of the municipal income with 61% was generated by tax revenues on citizens' incomes. An additional 22,6% of the total municipal income was yielded within the municipalities through operational and financial revenues (own calculations based on Statistics Sweden 2015).

Figure 3-I/II shows that the northern municipalities with the highest municipal tax rates do not necessarily generate the highest per capita tax revenues. Only the furthest northern and urban

municipalities seemed to generate above average revenues in relation to the high tax rates based on higher incomes.

Figure 3 Tax Revenues and Municipal Tax Rate 2013



Source: Statistics Sweden (2015)

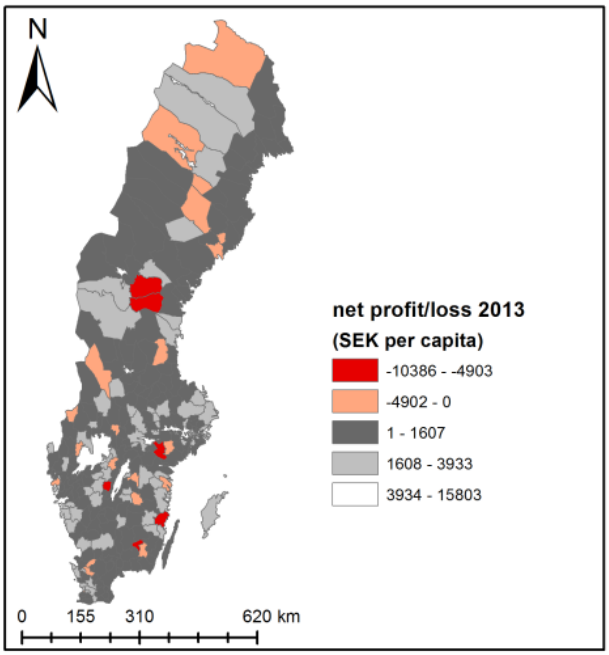
An additional considerable income proportion of the 16,4% in 2013 was, in fact, received from outside fiscal resources through a complex intergovernmental fiscal equalization and grant scheme. Swedish municipalities are obliged to fulfil their administrative responsibilities, but not all local governments face the same socio-economic conditions. Therefore, the Swedish system provides additional financial support to ensure equal living standards everywhere. Most of the money is provided by the central government, but also high income municipalities partially contribute parts of their income in order to balance the municipal income level across the country (Sunesson 2011).

The current applied equalization system was reformed in 2005 and consists of five parts: The income equalization grant is the biggest grant of the entire system and compensates for the fact that municipalities have different average taxable incomes of their citizens. The threshold hereby is 115% and all municipalities below the threshold are grant receivers and the ones above are grant contributors. Technically, this grant is intended as horizontal equalization scheme; however, the imbalance between paying and receiving municipalities requires nevertheless the central government to carry most of the contributions. The second grant is the cost equalization that focuses on the cost differences due to exogenous factors, such as, geographic location or age structure. Standard costs for all the mandatory responsibilities of each municipality are calculated and compared to the Swedish average costs. Municipalities above the average costs receive compensations and municipalities below contribute to the payments. The equalization is executed

entirely horizontally between municipalities without any additional payments from the central government. The structural grant is paid entirely by the central government and addresses the costs of business and employment promotion while accounting for the factor of population density (Gan et al. 2005). After the reform in 2005, some municipalities experienced a strong decline in their cost equalization grants; thus a few affected local governments receive so-called transitional grants as compensation for the sudden grant deduction. This grant will decline over time until it eventually vanishes. The last grant is the regulation grant that is a disposal activity that comprises the differences between assigned capital and the total sum of all grants discussed before (Ersoy & Attermo 2012). Apart from the equalization scheme, the government may also pay earmarked grants under extra frameworks when certain developments should be stimulated or political objectives demand extra financial support (Ministry of Education and Research 2008).

The overall financial transfer system impacts the municipalities' financial budget tremendously. Summing up all those grants, in 2013 only seven municipalities were net grant contributors: Lomma and Vellinge as the two municipalities from Skåne; and Danderyd, Täby, Solna, Nacka as well as Lidingö from Stockholm county. All the other municipalities received more than they contributed with the peripheral belt receiving the biggest compensation payments. Additionally, when subtracting the grants from the total income, only 14 municipalities were still able to record a net profit; all other municipalities accounted a net loss – once again with the peripheral belt experiencing the biggest per capita losses.

Figure 4 Municipal Net Profit/Loss 2013



Source: Statistics Sweden (2015)

Only with the financial transfer system, the distribution of the net profit/loss sum was properly evenly distributed across the country, as it can be seen in figure 4. After accounting for all grants and payments, only 27 municipalities still recorded a net loss with their financial deficits varying between 7 and 10 386 SEK per capita. The concerned municipalities spread evenly across the country and the highest losses with above -10 000 SEK per capita had Katrineholm and Oskarshamn – both located in the south of Sweden. All the other

municipalities generated a positive income statement with an average between 1 and 3933 SEK per capita.

While the equalization scheme ensures overall service provision across the entire country and evens out imbalanced financial resources, it still can lead to different utilization and allocation of financial resources eventually resulting also in different cost performances and efficiency outcomes. Therefore, it is important to consider the Swedish structure of the public finances in the following analysis in order to avoid misjudgment of spending behaviors.

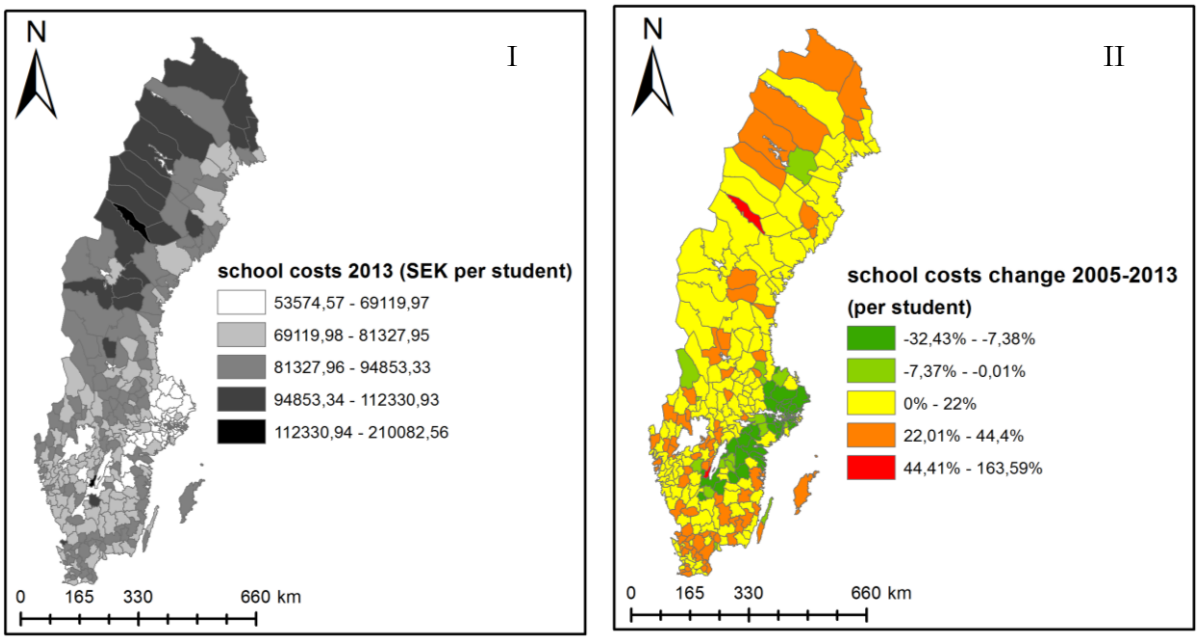
3.2 Comprehensive Schooling

School provision is one mandatory obligation of the municipalities. Swedish compulsory education covers primary and lower secondary schooling (*grundskola*) which lasts for nine years starting at the age of seven and is free of charge. Hereinafter, it will be referred as *comprehensive schooling*. Additional educational institutions such as pre-school, upper secondary or university education will not be subject to the analysis and therefore neglected in the further discussion. Nonetheless that the curriculum is determined and decided by the central government, several changes transpired in the 1990s that led to an increased decentralization and greater responsibility on the local level that are relevant for the context of this study.

In 1990, the authority of running primary and secondary schooling was transferred entirely to the municipality level, meaning that they gained full financial responsibility. The earmarked financial support by the central government for schooling was eliminated completely by 1993 and as a consequence the scope of school expenditures differences extended across municipalities (Björklund et al. 2004). Furthermore, wage-settings for teachers were decentralized resulting in individual agreements between the school management and teachers. Both aspects directly influence the financial burdens of the municipality and thus can lead to higher cost disparities between the individual local governments depending on the location factors and attractiveness. The government tries to prevent increasing gaps by releasing special earmarked grants; for example, extra school staffing and out-of-school centers (2001-2006) or the 'boost for teachers' initiative in 2007 (Ministry of Education and Research 2008), but all differences can surely not be addressed or eliminated. Given the increased decentralization and greater responsibility of each local government, it can be expected that the subsequent analysis will reveal differences in expenditure performances according to the financial and socio-economic situation of the respective municipality. In fact, figure 5 already shows spatial differences in the total school expenditures, and especially the northern municipalities seem to carry higher per capita costs. Additionally, costs rose across the country with only the Stockholm, Södermansland and Östergötland counties having managed to reduce their costs 2005-2013 (map 5-II).

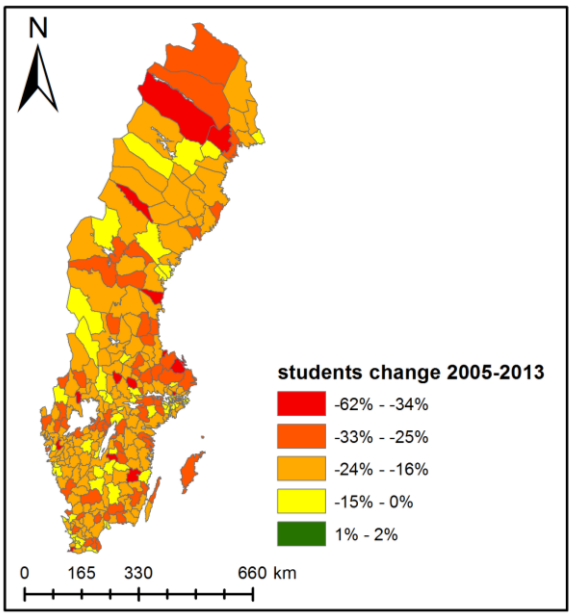
Another fundamental change happened in 1992 with the introduction of free school choice. Even though the general principal of proximity is still applied as the common practice to the present day, parents are given the opportunity to choose their children's school according to preferences. Also in 1992, it became possible to establish independent private schools linked to the condition of being freely accessible to any student – like any other public school. As a consequence, those private schools are neither allowed to charge extra tuition fees nor require admission tests.

Figure 5 School Costs 2013 and Cost Changes 2005-2013



Source: SiRiS (2015)

Figure 6 Students Change 2005-2013



Source 1: SiRiS (2015)

Both public and private schools are financed by the municipality and receive financial means from the municipality per registered student. The purpose of these changes in 1992 was meant to increase competition. At the same time schools are expected to act goal-oriented and are requested to self-evaluate their achievements in order to improve efficiency and performance. Usually this is done by the national score evaluations, but generally schools can find their own methods to benchmark their merits

(Björklund et al. 2004). Even though, the aspects of induced competition in the Swedish school system cannot be directly incorporated in this analysis later, because only data of the public schools is available, it is still worth keeping in mind when interpreting efficiency scores. Schools have incentives to act rationally and economic efficiently by competing for students since they get paid by the municipality according their enrolments.

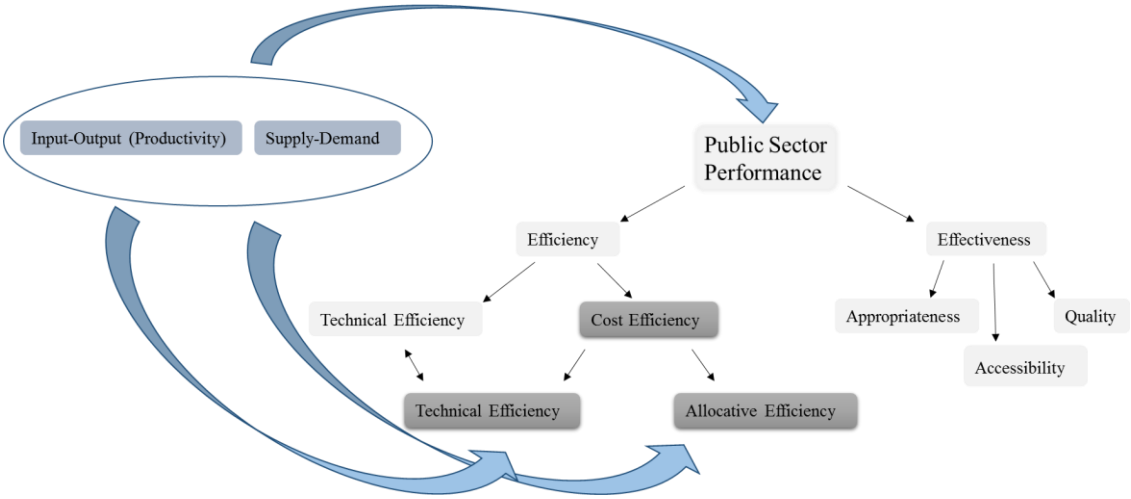
Above that, student numbers already dropped in recent years and all municipalities experienced a student population decline between 2005 and 2013 – except Lidingö in Stockholm county (map 6). The vast majority experienced a decrease of 16-24%. In general no clear pattern can be identified, both southern and northern municipalities are affected by larger declines in student numbers. Thus, it is not only the competition between schools to get students, but it is an overall principle to adjust to changing student place demands.

4 Theoretical Framework

The question of how demographic changes are affecting the public service provision can be broken down into two fundamental theoretical concepts: Supply-demand as well as productivity. Referring to the former one, population decline suggests decreasing demand in certain public goods such as schools, kindergarten, libraries, swimming pools etc., whereas population ageing endorses the assumption that certain public goods such as local public health care, elderly care or elderly-friendly infrastructure need to be more provided. The productivity consideration addresses the matter of financial resource allocations since a decreasing tax income based on a declining taxpayer group might maneuver local governments into financial difficulties beyond the common political day-to-day challenges. Eventually, the question will come up during political debates whether decreasing financial monies as input still manage to produce the same level of outputs through productivity enhancement or if the output has to be adjusted accordingly.

Both the supply-demand and input-output concerns intertwine with each other, after all the demand can be considered at the same time as the output that needs to be produced. Especially, in the context of this study with schooling being the subject of interest, the demand cannot be ignored. The numbers of students are given and every student has a right to go to school and receive free education; therefore, the municipalities have to ensure that every child gets a school placement.

Figure 7 Performance Composition (based on Kalb 2010)



Narrowing down the crucial parameter, the successful provision of public services and goods highly depends on the performance of the local governance. As Kalb (2010) states, performance is composed by efficiency and effectiveness. The latter refers to the achievements of the public stakeholders in regard to their government program and policy objectives and can be dismantled into three components: 1) accessibility, 2) appropriateness and, 3) quality. All three components can be related back to the supply-demand considerations and describe to what extent the public goods match the requirements of the consumers – if they are wanted, can be afforded, are sufficiently available and if they meet the quality standards of the public interest. However, greater concern for this study is efficiency. The simplest definition describes it as, 'how well a decision-making unit (e.g. local government) employs resources in producing (public) goods and services' (Kalb 2010, p. 2). As such it can be related back to the productivity considerations which in return depend on and vary according to differences in production technologies, scales of production, operating efficiency and the environment in which the production occurs (Fried et al. 2008).

Therefore, efficiency is not only a component of performance, but also productivity. Measuring efficiency happens through the comparison between the actual and optimal values of its output and input (Fried et al. 2008). Either it will be the input fixed and the observed to maximum potential output compared (output-orientation) or the output will be given and the ratio between the observed and minimum potential inputs (input-orientation) are observed. Both options describe purely the production combination and are thus called *technical efficiency*. Another alternative is comparing observed costs, revenues, profits, or any other goal of the decision-making unit with optimum costs. Those behavioral goals lead to *economic efficiency*, or as it is also called *cost efficiency*. The goal intentions are subject to technical constraints in regard of quantities

and prices and thus technical efficiency is also one part of the economic efficiency. In addition, economic efficiency also accounts for *allocative efficiency*, which describes an optimal distribution of goods and services by accounting for costumers' preferences at the same time. The perfect distribution is achieved when the marginal utility of the good equals the marginal cost. And here it comes eventually full circle by accounting for supply and demand again, because a technical-efficiently produced public good might be completely allocative-inefficient if it is not required by the population.

Cost efficiency is essentially the indicator that the paper is interested in – or rather the presence of inefficiency. For its identification it needs an economic framework that will be provided in the following subchapter. In addition, it can be assumed that complete efficiency is difficult to achieve due to irrational behavior and institutional limitations. Therefore, further theoretical concepts are discussed in the second subchapter to provide further explanatory power to inefficiency behavior.

4.1 Cost Efficiency from an Economic Perspective

This chapter introduces two cost behavior theories that are commonly cited in the literature of public spending. Starting point is the decomposition of total costs into fixed and variable costs (Anderson et al. 2003). The latter one depends on the units produced and is expected to behave proportionally to the production activity. As such variable costs are accordingly the sum of marginal costs and include for example the raw materials, hours worked or administrative costs. Fixed costs in contrast are expenses that are independent to the quantity of output produced and cover usually expenses such as rent or equipment that have to be paid regardless of the productivity of the firm.

4.1.1 Economies of Scale

The first theoretical concept that stands behind the negative perception of population decline is the effect of economies of scale. It is expected to achieve cost advantages by increasing the output quantity or the overall scale of operation. When more output units are produced, fixed costs can be shared by those additional produced units leading to decreasing average costs. In that case increasing economies of scale are present. Increasing average costs with increased output in contrast results in decreasing economies of scale. The neutral option is constant economies of scale with no changes in average costs regardless of output increase or decrease (Drew et al. 2014).

Applying this on the public service provision, the general assumption is that a bigger population reduces average costs since they present at the same time the consumers of the produced output (Holcombe & Williams 2009). Public goods need to be provided in any case and

an additional citizen that uses the supplied service lowers the per capita costs which equal average costs. Population decline reduces the consumption and therefore is expected to increase average costs through the reverse movement along the cost curve. At the same time a decreasing population base consequently leads to less tax revenues and thus puts constraints on public spending. The obvious resulting concern is the conflict between higher average costs of the public service provision and less financial resources to pay those. Regardless of the benefits of increasing scales in times of growth, economies of scale impose a threat in times of decline (Dalen & Henkens 2011).

4.1.2 Cost Stickiness

The second theory focuses on variable costs and questions the theoretical base assumption that variable costs behave linearly and proportionally to the units produced and thus only depend on the activity level – regardless from the direction of change or the managerial influence (Cohen et al. 2015). In fact, researchers observed considerable asymmetric cost behaviors: Costs do not decrease in the same magnitude during output decrease as they would increase during the equivalent amount of output increase. This finding led to a new theory called *cost stickiness* which was first named in the paper by Anderson et al. (2003). In the respective paper the scholars investigated sales, general and administrative costs (SG&A costs) in private firms and came to the exact conclusion that costs are sticky.

Reasons for sticky costs are that existing structures cannot be reduced at the same speed and extend as the declining demand would request it, creating a delay effect. These delay adjustments are usually based on deliberate managerial decisions: Demand changes can be misinterpreted as temporary slumps suggesting that it is easier to manage short-term economic downturns through 'wait and see' attitude instead of temporary resource adjustments. In addition, actual adjustment costs – both monetary and psychological – might be more costly than running on under-worked capacities leading to the managerial decision to maintain current production levels (Pervan & Pervan 2012; Cohen et al. 2015). The time effect of the delayed adjustment is indicating that the concept is primarily addressing immediate or medium run effects of demand decline and after a certain period due to managerial reassessment cost stickiness should decline. Anderson et al. (2003) tested for this hypothesis and found statistical support that cost stickiness in case of SG&A costs decline over longer aggregated time periods.

The concept of cost stickiness is primarily addressed in the private sector and adaptations to the public sector are done in little amount. Dobroschke et al. (2014) defined cost stickiness as the cost fraction within one public service provision that arises when the population group consuming that service is declining faster than the local government's viable infrastructural, legal

or organizational adjustment takes place. The disadvantage of this definition is, however, the lack of a clear conceptual differentiation between variable and fixed costs. In fact, some research contributions neglect a clear distinction and associate cost stickiness with fixed costs as well.

Gutsche (2006), for example, addresses in his research the concept of cost stickiness and argues that cost adjustments depend on the characteristics of the public good. He differentiates between *technical* and *social infrastructures* that possess different adjustment abilities. *Technical infrastructures* describe all services related to basic settlement requirements such as roads, street lightning, water, waste and sewage systems. Those infrastructures are usually related to high fixed costs and therefore carry a low flexibility for cost adjustments. Additionally, they are seen as a principal necessity and thus partial disconnection or closure is generally considered as unbearable. *Social infrastructures*, in contrast, are not physically connected to the place of residence and hold a greater flexibility in the network arrangement, such as schools, kindergartens, libraries or recreational facilities. Those public goods are usually subject to political discussions when it comes to budget cuttings, especially because they create less fixed and more personnel costs which are expected to be easier adjustable. Additionally, closing or scaling down one social facility can be easier compensated through others, providing that similar services are available within proximity.

As the classification according to Gutsche shows, cost stickiness is referred to both variable and fixed costs as he argues that technical infrastructures suffer from fixed costs and hence are also affected by stickiness. That makes a clear identification between economies of scale and cost stickiness difficult. In addition, variable costs in relation to social infrastructures as such may also have partially fixed character as they are often paid in lump sums, are subject to contract agreements with other suppliers or possess only little flexibility through legal restrictions such as dismissal protection laws.

The conclusion that can be drawn from this theoretical inconsistency is that the empirical analysis demands considerable caution of what kind of costs are examined. It is important to identify expenditures according specific cost categories to allow for proper judgement of the driving cost factors. Both theoretical concepts come to the same conclusion that reduced demand increases costs, but they affect efficiency differently. While economies of scale and underused capacities due to rigid fixed costs affect allocative efficiency, cost stickiness and managerial misjudgment on variable costs may impact technical efficiency. Thus, both theories do not oppose each other, but lead to different inefficiency behaviors. The remaining challenge will be to disentangle both components in the data in order to get meaningful results that lead eventually to beneficial policy recommendations.

4.2 Cost Efficiency from an Institutional Perspective

From the economics perspective, decision-making processes are usually assumed to be based on rational behavior and stable preferences aiming for utility maximization. However, given the special circumstances of the public sector, evaluating cost efficiency is not as simple and straightforward. Blank and Lovell (2000) identified five attributes that separate the public sector from the private one and which make it comparatively hard to measure and judge upon efficiency.

First, the public sector as a bureaucratic institution in itself tends to continuously grow and extend by creating constantly new tasks. Second, the ownership of the public sector lies by definition in the hands of the public which makes it difficult to monitor and control the efficiency of the public management. Above that civil servants earn considerably lower salaries and have fewer career opportunities than in the private sector which leads to certain extend to self-selection of less ambitious and innovative-aversive employees.

Thirdly and partially related to low ambition is the monopolistic nature of the public sector that prevents competition to act as an economic incentive to perform well. Since there is no obvious threat compared to open markets, the local governance is not facing any punishment in case of low performance; de facto the lack of competitors makes it even difficult to detect low efficiency. Fourthly, the public sector follows not the general economic objectives of profit maximization and cost minimization. Market prices of many public goods are often not even measurable in monetary values and thus barely comparable in regard of cost efficiency. The fifth and final attribute regards to the overall difficulty of measurability. When prices for public services are not available, the alternative is to substitute the price with the produced amounts. However, assessing the quality of one unit produced public good or service and then determining whether it is efficient or not, is difficult to undertake and one of the biggest challenges in public economics research. Generally, defining appropriate input and output variables and to find available data and suitable indicators that describe closely as possible the intended production function are crucial to understand underlying patterns and behavioral economics in the public sector.

4.2.1 Niskanen's bureaucracy model

Give these five distinguished attributes; the institutional setting of the public sector often creates a principal-agent dilemma that offers further potential for inefficient behavior. The population, acting as principals, demands as many as possible public goods for the available budget, but the elected political officials as agents might have a higher interest in being less efficient or productive in order to earn higher salaries, suffer from less stress and benefit from more free

time. Since the agents tend to be better informed about the true costs and production possibilities, they have higher incentives to act according to their advantage by investing in less productive activities and thus perform less efficient (Kalb 2010).

Niskanen (1975) extended this institutional flaw by adding another principal-agent relationship within the public sector structure. The main focus lies hereby at the bilateral monopoly between a sponsor and a bureaucrat agency. The sponsor is presented by the local elected government and presenting the interests of the median voter. The executing bureaucrat might be any kind of executing public service agency such as the road traffic license department, the planning office or even the school authority. The total budget for each public sector department needs to be approved by the sponsor and the agency provides the services equal or below budget constraints. The true costs can be only known by the bureaucrat; in fact, he or she has a high discretion on the use of its financial and staff resources. Many tasks are unique to the agency and monitoring as subject to the public comes with high costs on the tax payers' side resulting in the neglect of the supervision. As a consequence, it creates a free-rider problem and each agency is interested in maximizing their budget in order to gain benefits in regard of personnel, income, and prestige or leisure time.

The intention is to increase the difference between the total budget and the minimum amount of costs (Niskanen 1975). The literature uses several terms for this definition, such as *fiscal residuum*, *organizational slack* or *discretionary profit* (Kalb 2010). However, the outcome is always the same meaning that the utility function of the bureaucrat will influence both productivity and output leading to both allocative and technical inefficiency.

The two-stage principal-agent dilemma has two implications for the empirical analysis. First, the voter's participation might influence the budgetary slack: First, a high political concentration might increase inefficiency due to a weaker political opposition and thus less monitoring. Additionally, the different ideologies are usually related to different spending behaviors as it is for example often anticipated that left wing governments are expected to spend more monies than liberal and conservative parties. Secondly, increasing agency expenditures might not be based on actual higher costs or increased demand, but reflect the interest of the bureaucrats to gain benefits for their agencies through pressuring the sponsor to increase their share of the allocated public monies (Kalb 2010).

4.2.2 Flypaper Effect

It has been discussed before that the Swedish local governments are subject to an extensive equalization scheme that distributes financial resources across the municipalities in order to balance the local budgets. The general intuition is that money is money and thus the different

income resources are treated equally and effect expenditures identically. Indeed, empirical studies by Henderson (1968) and Gramlich (1969) have shown that a one dollar increase in governmental lump-sum grants increases public spending by far more than a one dollar increase in tax income. Arthur Okun called this phenomenon the so-called flypaper effect noting that the 'money seems to hit were it sticks'. Government grants thus tend to stay in the public sector instead of being redistributed to the people through tax reduction. In fact, grants stimulate public spending and therefore both income resources cannot be seen as bare substitution among each other.

The label given by Okun persists as well as the question why different fiscal incomes lead to different spending behaviors. Initially, it was considered as an anomaly created through data problems and specification errors in the modelling process (Hines & Thaler 1995; Inman 2008); however, neither potential miss-classification of matched grants as exogenous aid nor the correction for omitted variable bias solved the effect. Therefore, the flypaper effect emerged as a real phenomenon and explanations were requested beyond the scientific specification concerns. Recently, potential misperceptions from the voters' perspective are considered: Possibly, citizens request more public spending, because they mistake grants as an option to decrease marginal costs, when in fact they only reduce average costs. Another alternative explanation is that they realize the budgetary effects, but allocate public monies through separate channels and therefore fail to see the interchangeability between grants and tax revenues. In practice it means that a new received grant rather leads to the question of how to spend the money instead of considering whether spending the grant or cutting taxes (Hines & Thaler 1995). A last potential explanation is the strategic behavior of politics. Since fiscal transfers are subject to a contract between receivers and donators the incentive of receiving municipalities clearly resides in increasing the valuation of public services in order to request higher aid in form of more grants in the subsequent years (Inman 2008).

Even though the true cause is not ultimately specified, the consequences of the flypaper effect are nevertheless obvious. Spending behaviors depend on whether a municipality is a net contributor or receiver as well as on how much money the receiving municipality obtains. Understanding that monies are spent differently according to their source, the local income distribution needs to be considered accordingly in the analysis. Studies by Dahlberg et al. (2008) and Sunesson (2011) confirm a flypaper effect in the Swedish context on the municipal level and therefore affirm the theoretical and empirical inclusion of equalization grants in this paper.

5 Previous Research

There has been more and more research published on efficiency performance in the public sector across the world – often specifically focusing on regional case studies. Although, demographic factors such as population size, change or ageing are usually considered as control variables, the actual relationship is rarely directly addressed. Repeatedly, points of departure are either political debates of municipality amalgamations and the therewith connected question of what constitutes the 'perfect size' of a municipality, or the question regarding which socio-economic or political factors drive inefficiency. Economic theory is usually the foundation, whereas the incorporation of socio-economic and political indicators are intended to increase explanatory power by accounting for political majorities, institutional settings, public grants in order to explain non-rational behavior. Consequently, it also leads to different empirical setups including studies on overall cost expenditures or on specific service provisions such as schooling, road maintenance or police. That makes overall comparisons difficult and the external validity of the results even more uncertain. Nevertheless, some studies will be introduced at this point in order to outline the general research field and to sketch some tendencies in the empirical findings. In order to limit the amount of papers, the attention is directed towards those studies that focus mainly on the core economic assumptions of economies of scale or cost stickiness. The institutional concepts of Niskanen's bureaucracy model and the flypaper effect have been considered in several papers and important results will be pointed out, but explicit papers that exclusively study either one of the concepts will not be discussed at this point.

5.1 Studies with Demographics as Control Variables

The Finnish study by Loikkanen & Susiluoto (2005) looks at basic municipal service provision including basic health, social services, education and cultural services in the period between 1994 and 2002. Efficiency scores where regressed on control variables finding that big populations, peripheral location, high income levels, high unemployment, diverse service structure, big proportion of services bought from other municipalities as well as high share of cost covered by state grants have decreased municipal efficiency. In contrast, higher shares of working population, urban structures and high educational attainments tend to improve efficiency. The spatial distribution shows that the overall ten best municipal performers with the highest efficiency score are all located in the south of Finland, whereas the ten worst cases are situated in northern Finland. While the study gives interesting insights, the results need to be interpreted carefully, because the authors use a two-step procedure first estimating efficiency scores and then regressing them on control variables. It leads to violation of statistical assumptions and therefore

is in the methodology literature not considered as the preferred estimation procedure (Battese & Coelli 1995; Kumbhakar et al. 2015).

Geys & Moesen (2009) examine technical inefficiencies in Flemish Belgium and find negative effects of larger and more densely populated municipalities on Flemish municipal efficiency. Differences across the socio-economic classification of agricultural, residential, industrial, touristic or urbanized municipalities are, however, not significant in regard to the core municipal obligations. Long-term debt decreases efficiency, but interestingly grants are significantly related to higher efficiency throughout all estimations. The authors contradict with these findings another Belgian study by De Borger et al. (1994) that finds a negative relationship between efficiency and grants in Belgium based on data from 1985. Geys & Moesen explain the divergence due to a reformed grant system in the late 1980s that led to higher regional responsibility and thus potentially also to better supervision of public monies spending.

The Danish study by Christoffersen & Larsen (2007) find in contrast to the Flemish and Finnish studies that municipalities with a smaller population are exposed to higher inefficiency and carry higher per unit costs as well as face a quality trade-off due to lower budgets and resources. The Danish context reveals strong competition among municipalities due to higher national regulations as well as increased numbers of commuters. As a result, smaller municipalities face higher financial pressures since they risk further population loss when diverging too much with their public expenditures compared to bigger municipalities. Therefore, the authors see economies of scale mostly benefiting quality effects and argue that municipality amalgamations may not reduce budget plans, but can improve the overall quality of service provision. By focusing on quality effects, the paper is very innovative in its approach, although it still needs further considerations on how to overcome measurement deficiencies of quality variables. The relevance can be easily applied in Southern Sweden where the size of the municipalities allows citizens more flexibility in their residential choice while still being able to keep their workplace in close distance through commuting.

Despite the discussion of efficiency advantages between small and big municipalities, a broad variety of the literature supports the idea of a U-shaped cost curve implying that there is a certain threshold when big municipalities face again diseconomies of scale. Southwick (2012) finds for cities and towns in New York State, USA that minimized costs for core municipality services are reached with a population of roughly 4 600 - 25 000 citizens. Next to average costs, inefficiency scores also increase with higher population numbers. Consequently, the authors discourage amalgamations that result in population numbers above 25 000 and conclude that mergers will not reduce overall costs. Drake & Simper (2002) found similar cost effects in the

English and Welsh police force units with staff groups above 4 500 employees experiencing diseconomies of scale after stratifying the sample into different staff size groups.

5.2 Studies Disentangling Population Size and Population Density

Within the discussion of the functional form of the cost curve, a more demographic perspective is put forward with the considerations of the relationship between population size and population density. Both variables are highly correlated in regard that bigger municipalities also have usually higher densities. Ladd (1992) discusses the potential correlation between both variables from the population growth perspective and finds for 247 large U.S. counties in 1985 a U-shape curve for both costs and population density. Ladd also considers population growth effects that entail both surge and population-density effects. While an increasing density increases more demand that requests more spending, the surge effect generates a temporary shortage of service provision leading to decreased per capita costs. Sparsely populated areas, in contrast, can financially benefit from higher densities, because their provisions' average costs decrease.

Holcombe & Williams (2009) further disentangle the relationship between population size and density. The scholars look at approximately 500 U.S cities with populations above 50 000 based on Census data from 1990 and 2000. Their preliminary estimation that includes density only as control variable supports as well diseconomies of scale. However, when stratifying the sample into different density sub-categories, the authors actually report constant returns to scale for almost all service sectors. Similar to Ladd (1992), they control for population growth, but find no significant effects. Accordingly, Holcombe & Williams also conclude that amalgamations or subdivisions of local governments are not leading to minimized per capita costs.

Drew et al. (2014) support the empirical findings by Holcombe & Williams (2009) when looking at 152 New South Wales councils in Australia between 2006 and 2010. Estimations for the sample mean reveal a U-shape cost curve and a population threshold of 155 000 beyond which diseconomies of scale occur. However, when stratifying the sample according subdivided density groups, economies of scale largely disappear and no consistent evidence can be found anymore. Especially 'regional', 'very large agricultural' and 'agricultural and remote' councils lose their previous diseconomies of scale effects, whereas 'metropolitan' councils seem to be sensitive to model specifications and only show scale diseconomies for environmental and health service expenditures.

5.3 Studies with Focus on Population Decline

After having highlighted more general public efficiency studies, the focus will now finally move towards explicit studies that focus on effects of population decline on public sector performance. Felmingham et al. (2002) research the effects of depopulation and the associated population

ageing in Tasmania with projecting future population trends. While the ageing process is equal to all government units (LGA), the predicted natural decline will affect 20 out of their 29 local government areas setting in between 2016 and 2026. Only few local rural government units adjacent to urban centers will gain from a continuing suburbanization process. The authors predict for the time period 2000-2017 increasing scale efficiency losses of 22-26% in declining LGA. Furthermore, the projection calculations reveal a reduction of the production's value in entire Tasmania by $33,911 million per year, an annual gross state product decline by $25,63 million and 618 job losses. The political challenge is the expected adjustment costs that collide with smaller financial capacities due to lower grants in absolute values and increasing tax burdens. Unlikely many other researchers, Felmingham et al. (2002) propose cooperation between rural/urban neighboring governments and suggest potential amalgamations in order to achieve economies of scale.

The Australian study reveals interesting insights in the future developments based on population changes and ageing, but sticks out in a way that it uses projection estimations that make the results interesting for policymakers, but also leads to the question of reliability concerning future events. Other studies approach the impact of population decline in a more traditional manner using recent historical data with the help of cross-sections and panels. A Swedish study by Fjertorp (2014) looks at the effects of population changes from 2004 until 2009 on fee-financed local services such as water, wastewater and waste operations and finds that waste operations seem to be able to adjust according to population changes, while water and wastewater operations are higher in costs and have greater fees per capita for municipalities with population decline. As regressions showed, one percent increase in population can decrease the waste and wastewater annual fees for a single-family house by 142 SEK and 1 539 SEK for an apartment building. The analysis is based on single linear regressions and no control variables are included. Therefore, the results should be taken as a first contribution and not as final truth to the issue. Efficiency is not a part of the study, but Fjertorp refers insofar to other studies that he connects the insignificant waste operation effects to both relatively easily adjustment possibilities. He sees also the potential that a quality trade-off between smaller and bigger municipalities exists as it was suggested in the Danish study by Christoffersen & Larsen (2007).

As a last study in this subchapter the analysis by Geys et al. (2007) is worth mentioning. Based on a stochastic frontier analysis, the study predicts severe financial burdens for the municipalities of the federal state Baden-Württemberg in a cross-sectional dataset of 2001. Currently most of those municipalities produce their services with costs 12%-14% higher than the most efficient municipalities in the sample. The authors conclude that especially smaller municipalities with populations up to 10 000 citizens have higher unexploited economies of scale

effects which will lead to higher cost pressures when population decline sets in. Similarly to the Tanzanian case, one suggested solution to overcome these financial vulnerabilities is to cooperate with bigger, more financially stable municipalities as well.

5.4 Preliminary Summary

The introduced literature on cost behaviors in regard of economies of scale are at this point not fully exploited, but from the given summary, it can be concluded that scientific research results are neither conclusive nor certain whether economies of scale exist and in which functional form spending behaviors appears. The literature review on the Australian case by Byrnes & Dollery (2002) points out further analytical weaknesses of the overall research. First of all, population as a proxy for output can raise problems, because it never actually describes correctly the exact amount of produced output. Furthermore, similar populations in different municipalities can nevertheless lead to different demands given different preferences, age structures or exogenous demands through tourism, commuters or shoppers. Also, the measurement of cost is questionable when considering total costs. Local preferences as well as different quality levels influence total costs and the head costs can be barely assigned to the actual economic activity given that municipalities allocate their monies differently. Therefore, specific cost assignments are thought to be a favored option. As a third mentionable criticism is the observed time. As a matter of fact, many studies use cross-sectional data or short panels which barely give any hint on long run economies of scale. Thus, Byrnes & Dollery even question whether the results can be referred as economies of scale, but rather describe short run costs adjustments.

Especially, the last point by Byrnes & Dollery is taken into consideration in this paper by extending the theoretical framework. In fact, it can be argued that most of the studies could have been also conducted under the concept of cost stickiness. Already several researchers such as Christoffersen & Larsen (2007), Geys et al. (2007), Fjertorp (2014) or Felmingham et al. (2002) move indirectly towards it by mentioning quality trade-offs or adjustment costs and propose cooperations across local governments which all demand managerial reconsiderations and affect variable costs more than fixed costs. So far, no paper has explored both aspects within one study framework, but few studies address cost stickiness for the public sector and therefore will be considered in the following subchapter.

5.5 …and Cost Stickiness?

The literature on cost stickiness regarding public service provisions is less advanced than the scales literature. However, based on the estimation approach by Anderson et al. (2013), the theory gains more and more attention – also in regard to the public sector. All the following papers apply this methodology and the respective findings will be discussed below.

Marques et al. (2014) study a panel of 669 public companies located in nine Latin American countries between 1995 and 2012 and observe cost stickiness in SG&A costs in relation to sale revenues. Sales revenues by 1% increase lead to SG&A costs increase by 0,56%, while a 1% sales decrease only reduces the same costs by 0,45%. Similar to Anderson et al., the hypothesis of decreased cost stickiness and mitigated effects over longer aggregated time periods were also confirmed for the Latin American context.

Cohen et al. (2015) study the case of Greece looking at Greek municipalities for the period 2002-2008. Interestingly, they find anti-cost stickiness for administrative and public relation costs indicating that municipalities do indeed adjust resources according to revenues decreases – even in a higher extend than increasing expenditures in times of revenue increases. However, the study showed also that it does not apply for core services such as health care, police or infrastructure and that here once again cost stickiness behavior drives up costs in time of revenue decreases. Furthermore, the extent of cost stickiness increases with higher assets intensity and bigger populations and therefore the effects are larger in bigger municipalities. In this context, it reveals contradictive findings to the empirical results of economy of scale studies where usually smaller municipalities are challenged by larger negative cost developments in case of population decline and revenue decreases. Two explanations given by the authors are higher adjustment costs in bigger municipalities as well as bigger attempts to reduce financial cuts in order to get re-elected. However, it needs to be added that the authors do not discuss the potential that especially core services combine usually higher fixed additional to variable costs. Thus the strong theoretical assumptions of only considering variable costs are softened up and once more it becomes visible that a clear separation of both cost indicators is difficult to perform.

Another perspective on cost behavior is added in the study by Bradbury & Scott (2014) as they study the case of New Zealand local councils in the period 2008-2012. Not only do they find that operating costs (employee costs; current grant, subsidies and donation expenditures; purchases; other operating expenditures) are sticky, but they also increase when revenues decrease. Two possible explanations are that the local governance has poor cost controls or that they rather focus on the service production instead of opting for an operation surplus. Furthermore, Bradbury & Scott (2014) support the hypothesis by Anderson et al. of a lagged adjustment process that leads to less cost stickiness when controlling for the second previous year.

In a second part, the scholars focus on forecast relationships that are based on mandatory disaggregated Long Term Council community plans that have to be published every third year. The results reveal that forecast operating costs are also said to increase when forecast revenues are suspected to decrease. The implication of the result is that government managers are aware of

asymmetric behaviors. Again, poor cost controls can be one possible explanation, more likely are, however, incentives to maintain increasing costs. The control variable of election year supports this explanation as it leads to less cost increases in a year with elections regardless of increasing or decreasing revenues – indicating an interest of the politicians to appear more efficient in order to be re-elected. Likewise the variable influenced the forecast by having a slight decrease in cost when revenues increase.

These three emphasized studies from three different regions emphasize that sticky cost behavior does seem to be a concern in public management. Whereas, the studies on economies of scale lack consistency and comparable methods that make it difficult to conclude, the Anderson et al. approach allowed a consistent application making it easier to compare empirical results and to rely on outcomes. Nevertheless, the weakness lies clearly in the weak separation of fixed and variable costs in some of the studies that demand further model specification and careful considerations of the results. Additionally, none of these studies explicitly address the problem of population decline, although it can be easily connected by also accounting for changes in population. Thus, it should gain more attention in further studies and stay on the agenda of current research.

6 Hypotheses

After having elaborated the theoretical framework and summarized the – sometimes contradictive – empirical results of previous research, it becomes obvious that straightforward hypotheses will be somewhat complicated to derive. For example, one obvious contradiction can be identified with the theoretical assumption of increasing economies of scale and the empirical finding of a U-shape curve that questions that very theory.

It is also important to understand that expectations and statistical outcomes often profoundly depend on the regional socio-economic and political context of each case study and the respective statistical model applied. That could explain why Finnish and Flemish studies reveal higher inefficiencies for bigger municipalities while the Danish case explicitly identifies smaller municipalities as inefficiency drivers.

Therefore, it was important to first outline theory and then to discuss previous research in order to be able to consider both aspects in the hypotheses proposal. Hence, based on these adjustments and having in mind the Swedish context, the following hypotheses are derived:

(H1) Based on economies of scale, municipalities with bigger populations and also bigger student numbers are more efficient and have lower per capita costs.

(H2) Based on empirical findings, economies of scale will have different effects in municipalities with high or small densities that is implied by a U-shape of cost elasticities.

(H3) Based on economies of scale, municipalities that experience population decline are less efficient and have higher per capita costs.

(H4) Based on cost stickiness behavior, core expenses will suffer from asymmetric cost behaviors.

In addition, the following hypotheses are tested in regard of control variables and their influences on public spending:

(H5) Population Ageing has negative impacts on cost behaviors, because it shifts public preferences within the political agenda and leads to negligence of school-related matters.

(H6) Cost efficiencies decreases with the amount of equalization and government grants received (flypaper effect).

(H7) Higher unemployment rates and a higher total local tax rate decreases costs and thus increases efficiency, because less financial income for the municipality enforces constraints in spending.

(H8) Based on Niskanen's bureaucracy model, higher disposable income of the citizens and higher municipal tax rates decrease cost efficiency since it increases fiscal capacity, endorses public spending and helps increasing the bureaucrats' budgets in their respective agency.

7 Data Management

Sweden collects and publishes very detailed data on all governmental levels in terms of demographic and public finance statistics. The entire dataset for this analysis is publicly available and provided by Statistics Sweden (*Statistiska Centralbyrån*), the database of the Swedish Association of Local Authorities and Regions (*Kommun- och Landstingsdatabasen Kolada*) and the National Agency for Education (*Jämförelsetal* and *Skolverkets internetbaserade resultat- och kvalitetsinformationssystem SiRiS*). The following chapter introduces the dataset in detail and discusses the models used for the empirical analysis.

7.1 Data Description

The dataset covers the Swedish local level and includes all 290 municipalities between 2005 and 2013. The strongly balanced panel dataset counts overall 2610 observations; merely the *municipal*

tax revenues variable is missing one observation. During the analysis, the data will be used in its logged form; however table 1 summarizes all the variables prior logging. The cost-related variables are adjusted to the Harmonized Consumer Price Index (HCPI) and relate to the base year 2005.

School expenditures are representing the dependent variables. *Total school costs* include all comprehensive school-related costs per student in each municipality. In order to identify cost adjustments in a more detailed manner, *total school costs* are categorized into different cost categories. Included are *teaching costs* which covers mainly salaries for teachers and other employees in school, but also involves class-related activities. *Premises* cover housing-related costs such as rents, facility management and inventory. *Meal costs* relate to all meal-related costs such as food, transport, cafeteria staff and administrative costs. *Material costs* include the entire teaching material such as copies, but also computers, printers, the library with the related costs of newspaper subscriptions, book orders and librarian salaries. *Other costs* contain all other costs such as study guides, on-the-job trainings or general administrative costs. Those categorized costs do not add up to total school costs, because child health costs were excluded from the analysis. These costs would have covered medical care such as school doctors or nurses, psychologists and additional specialized staff. In general, it can be expected that those costs are the least predictable and highly depend on the medical demand in each year. Above that, health care is subject to the counties and schools pay fees to the county for the services provided. Therefore, it is difficult to compare expenditures in case of different offers or arrangements between the counties and municipalities. Indirectly they are nevertheless included in total school costs.

The demographic variables cover the total population in absolute numbers and population density per km^2. The latter one allows controlling for the size of each municipality, because in relation to land area some municipalities are very sparsely populated, even though they exhibit large absolute numbers. Students per 1 000 inhabitants and number of schools control for changes in the student population and refer to enrolled students and provided schools in public comprehensive schooling in the respective year. The old age dependency ratio is the proxy for an ageing population indicating whether the ratio between the retired population above 64 years of age and the working population between 15-64 years of age shifts towards a higher proportion of elderly people. The population change respective to 2004 controls for the continuous population development between the respective year and the base year 2004. The population change respective to previous year reports population changes of subsequent years. Both variables are annual log-changes.

Table 1 Descriptive Statistics

VARIABLES	description	N	mean	sd	min	max
		Dependent variables				
total school costs	SEK per student	2 610	76 242	10 638	53 575	210 083
teaching costs	SEK per student	2 610	38 960	5 733	26 172	93 272
premises	SEK per student	2 610	14 617	3 494	6 060	41 279
meal costs	SEK per student	2 610	4 948	1 248	375.1	20 2
material costs	SEK per student	2 610	2 897	1 046	735.8	9 283
other costs	SEK per student	2 610	12 781	4 154	400	47 866
		Independent Variables Demographics				
population	absolute	2 610	32 199	63 782	2 421	897 700
population density	per km²	2 610	135,0	464,7	0,200	4 917
old age dependency ratio	ratio between retired persons (>64 years) & workers (15-64 years	2 610	33,59	7,398	14,57	57,98
population change respective to base year 2004	percent	2610	0,6821	4,764	-14,82	26,05
Population change respective to previous year	percent	2610	0,1418	0,9379	-3,00	4,55
students	per 1000 inhabitants	2 610	97,04	14,17	39,54	150,5
schools	absolute	2610	14,0613	16,0438	1	165
		Control Variables				
political majority	categorical	2 610	1,872	0,901	1	3
municipal tax revenues	SEK per capita / annual	2 609	32 569	2 908	23 55	52 125
total tax rate	percent	2 610	32,12	1,042	28,89	34,52
municipal tax rate	percent	2 610	21,50	1,331	17,12	33,25
unemployment rate	percent	2 610	6,271	2,436	1,100	17,20
median net income	SEK per capita / annual	2 610	179 914	23 638	130 159	310 954
total government grants	categorical	2 610	2,784	0,786	1	5
municipal net profit/loss with grants	categorical	2 610	3,929	0,450	1	6
		Annual Change Variables				
annual total cost changes	logged percentage	2320	0,00122	0,00903	-0,0469	0,0981
annual teaching cost changes	logged percentage	2320	0,00113	0,01072	-0,0644	0,0832
annual material cost changes	logged percentage	2320	0,00338	0,03530	-0,1959	0,2666
annual meal cost changes	logged percentage	2320	0,00248	0,02389	-0,2782	0,4772
annual premises cost changes	logged percentage	2320	0,00207	0,01770	-0,0896	0,1500
annual other cost changes	logged percentage	2320	0,00121	0,03558	-0,2461	0,4799
annual revenue changes	logged percentage	2320	0,00293	0,00183	-0,0070	0,0122
annual population changes	logged percentage	2320	0,00011	0,00098	-0,00378	0,00424
annual student changes	logged percentage	2320	-0,00398	0,01742	-0,7954	0,0780

Control variables include the *political majority* in the local parliament (liberal-conservative/ no majority /left wing majority). *Unemployment rate* and *median net income* of the inhabitants have both implications on tax revenues of the municipality, but also indirectly control for preferences and willingness of the people in how much to invest in public goods such as school quality (Kalb 2010). Furthermore, municipal income controls contain the *total local tax rate* and the *local municipal tax rate*. Comparing both the total tax rate and the municipal fraction of it can give different indications on welfare spending of each municipality. An increase in the local total tax rate does not necessarily mean that the municipality receives more tax revenues, because the fraction for the county level could have been just raised that pressures in contrast stricter austerity on the municipal level. In the contrary, an increase in the local municipal tax rate means that the respective municipality also receives higher tax revenues. National taxes are excluded from the analysis, because it is only levied from incomes above 420 800 SEK. The *municipal tax revenues* cover the biggest municipal income source and are therefore listed as municipal income variable.

The variable total *government grants* is another municipal income variable and sums up the entire equalization scheme (including income equalization, cost equalization, structural grant and regulation grant) per capita. The variable *net profit/loss with grants* is the final income statement of the year describing whether a municipality is making a surplus or a loss after adding all income and expenditure items. In order to test for the significance of the equalization scheme grants, another variable is constructed describing the annual *net profit/loss without grants*. The data reveals that 2478 out of 2610 observations have a net loss in the final income statement when economic grants are deducted. This implies that roughly 275 observations are not able to achieve a balanced income statement without receiving grants. On the contrary, after accounting for government grants, only 83 observations still expose a negative income statement. The equalization scheme therefore is a strong financial instrument that influences immensely the financial power of a municipality. By including both variables it can be tested whether municipalities with higher or lower grants and net receivers or payers behave differently in their own expenditure performances in relation to comprehensive school expenditures. All three last mentioned variables are categorical variables in order to account for the presence of negative and positive values within one variable without running into difficult adjustment procedures when logging the data.

The model for the cost stickiness requires slightly different data which is presented in the last part of table 1. The data covers the annual changes of all *cost categories* as well as *student numbers*, *population* and *municipal revenues*. The data has been first logged and then the differences were calculated – again to bypass the impossibility of logging negative numbers. The *revenue changes* include tax, grant and financial incomes of each municipality. The time period had to be

shortened to 2006-2013 due to the reformed government grant system in 2005 that did not allow using change rates between 2004 and 2005. Therefore, the variables cover in total only 2320 observations.

7.2 Estimation Approach

The aim is to explain the relationship between demographic changes and public expenditures on the local level. It is important to understand first the impact of population decline and ageing and second the response of local governments, commonly called decision-making units (DMU). Only that way cost behavior can be fully explained and, in case of mismanagement, later adjusted. The analysis focuses on both economic theories: First it follows the economies of scale-literature applying a stochastic frontier approach that allows to benchmark best practice municipalities in regard of their efficiency performance. Second, it accounts for cost stickiness by applying a second shorter analysis of the Anderson et al (2003) approach in order to test for variable cost behavior.

7.2.1 Stochastic Frontier Analysis

Efficiency is one option that links population changes and cost pressures through the DMU's actions, because they are required to react and adjust the public service provisions accordingly to the given demographic circumstances (Kalb 2010). A common approach to test for efficiency is creating an input-output-equation in order to calculate frontiers which constitute best practices representing the most efficient DMU. The deviation from the frontier hence describes economic inefficiency of the other DMU. This dataset focuses on cost functions instead of production functions with school costs being the input variable, thus the result will be also called a cost frontier. Cost efficiency and cost frontiers can be modelled in a very simplistic and straightforward way (Kalb 2010):

$$C_i \geq c(y_i, x_i, \beta) * exp\{v_i\}, \qquad i=1,\ldots, n \qquad (1)$$

C_i describes the actual costs of DMU and $c(y_i.x.\beta)$ is representing the cost frontier with y_i being a vector of inputs. X_i is a vector of output prices and β a set of parameters to be estimated. The subscript *i* stands for DMU, which are in fact the individual municipalities. It can be expected that external factors such as random shocks or measurement errors affect the actual costs and therefore the $exp\{v_i\}$-term accounts for stochastic influences. The actual cost efficiency is a ratio of the minimum achievable costs and actual costs:

$$CE_i = \frac{c(y_i,x_i,\beta)*exp\{v_i\}}{C_i} \qquad (2)$$

In order to estimate cost efficiency a log-linear Cobb Douglass cost function is assumed:

$$\ln c_{i,t} = \beta_0 + \sum_p \beta_p lny_{p,i,t} + \sum_r \alpha_r lnx_{r,i,t} + \upsilon_{i,t} \quad (3)$$

Given the context of this study an input-oriented efficiency is estimated with costs being the dependent variable. As a result, it can be noted that $\ln c_{i.t} = lny_{i.t}$, because school costs are actual costs and input at the same time. Additionally – and that is where the advantage of the stochastic frontier analysis becomes obvious – the error term $\varepsilon_{i.t}$ is not only assumed to consist of the random noise $\upsilon_{i.t}$, but also has an inefficiency tem u_i. The independent statistical noise $v_{i.t}$ is not correlated with the regressors, whereas the non-negative u_i may be correlated with both the regressors and $v_{i.t.}$ (Kalb 2010).

Different approaches are available in order to define and estimate the inefficiency term. For this paper the term will be time-invariant for each DMU, meaning u_i does not change over time. Therefore, it will be tested which municipalities are the most and least efficient for the entire time period. By assuming a constant inefficiency term, the estimation procedure follows standard fixed effects panel estimation methods and no assumptions about the distribution of the inefficiency term need to be made (Kumbhakar et al. 2015). As a result the functional form can be rewritten accordingly:

$$\begin{aligned} \ln y_{i,t} &= \beta_{0,t} + \sum_p \beta_p lnx_{p,i,t} + v_{i,t} + u_i \quad (4) \\ &= \beta_{i,t} + \sum_p \beta_p lnx_{p,i,t} + v_{i,t} \end{aligned}$$

The intercept $\beta_{0,t}$ is equal for all DMU in period *t* and the individual intercept presenting fixed and unobserved individual effects for each municipality *i* can be derived through

$$\beta_{i,t} = \beta_{0,t} + u_{i,t}, \quad (5)$$

The $\beta_{i,t}$ –parameter is first eliminated through the transformations by the within estimation during the fixed effects application, but can be recovered from the mean of the residuals for each DMU:

$$u_i = \max_i\{\beta_i\} - \beta_i \geq 0\ , \quad (6)$$

From this composition it can be derived that the most efficient municipality constitutes 100% and that all other DMU efficiency scores are relative to the best practice (Kumbhakar et al, 2015). This implies that the best practice is not necessarily the most efficient DMU in absolute terms and the actual absolute efficiency might be higher.

The final efficiency scores are obtained by calculating:

$$CE = exp\{-u_{i,t}\}, \quad (7)$$

Looking back to equation (4), the parameter $y_{i,t}$ is – as it has been mentioned before – the input variable school costs of each DMU i in a specific time period t = T, T+1, ,… and the parameter x denotes a vector of output variables, which is in this case the number of students and schools. However, so far explanatory variables are not included. The common procedure suggested by Battese and Coelli (1995) is to assume that all explanatory variables influence the inefficiency term and therefore should be incorporated in a second functional form:

$$u_{i,t} = \delta_0 + \sum_r \delta_r z_{r,i,t} + w_{i,t} \quad (8)$$

The vector $z_{i,t}$ covers all the desired control variables and $w_{i,t}$ is random noise. The extension requires several assumptions and complex statistical modelling which are not subject to this paper and will not be explained in detail at this point.

In fact, it can be argued that environmental factors not only influence efficiency performance, but directly shift the cost function. For example economic controls such as income and tax revenues could also influence local preferences for higher quality leading to higher costs. Demographic indicators in contrast might induce certain extra costs or impose financial burdens that also demand adaptations in the cost function. For those reasons and in order to simplify the econometric analysis, it will be assumed that the vector $z_{i,t}$ directly influences input considerations and therefore will be incorporated straight into the log-linear Cobb Douglas equation. The final functional form applied in the fixed effects estimation therefore looks as follows:

$$\ln y_{i,t} = \beta_{0,t} + \sum_p \beta_p ln x_{p,i,t} + \sum_r \delta_{r,p} ln z_{r,i,t} + v_{i,t} + u_i \quad (9)$$

The outlined methodology has two benefits: First the impact of demographic indicators on public school expenditures can be interpreted straightforwardly as elasticities with the outcomes of the linearized fixed effects estimations. In a second step, efficiency scores are computed and can be benchmarked in order to identify potential spatial patterns and draw conclusions of efficiency deficits based on demographic challenges. Additionally, the fixed effects have the benefit of controlling for omitted variable bias by removing all time-invariant municipality-specific characteristics.

7.2.2 Anderson et al. (2003) Approach for Cost Stickiness

Most studies that study cost stickiness follow the Anderson et al. (2003) approach that measures the variation in sales, general & administrative costs in relation to sales revenues. The model is simple to apply, but since it was originally intended for testing cost stickiness in private firms, it needs some adjustments in order to be applicable in the public sector.

Sale revenues are substituted with the annual log-changes of either population or student changes or municipal revenue income. A dummy variable $d_{i,t}$ is introduced that equals one when the independent variables decline and zero otherwise. The SG&A costs will be replaced by the annual log-change school expenditures of total, teaching, materials, meal and other costs respectively and are for now summarized in equation (10)-(12) as $EXP_{i,t}$. Premises will be tested for model robustness; however, are not considered in the model by theory due to its characteristics of fixed rather than variable costs.

The models for municipality *i* in year *t* follows the simply structure by Anderson et al. (2003) by not using any control variables. However, fixed effects are added in order to control for omitted variable bias in form of unobserved factors that do not vary over time.

$$\log\left(\frac{EXP_{i,t}}{EXP_{i-t}}\right) = \beta_0 + \beta_1 \log\left(\frac{POP_{i,t}}{POP_{i-t}}\right) + \beta_2 d_{i,t}\left(\frac{POP_{i,t}}{POP_{i-t}}\right) + n_i + \varepsilon_{i,t} \tag{10}$$

$$\log\left(\frac{EXP_{i,t}}{EXP_{i-t}}\right) = \beta_0 + \beta_1 \log\left(\frac{Students_{i,t}}{Students_{i-t}}\right) + \beta_2 d_{i,t}\left(\frac{Students_{i,t}}{Students_{i-t}}\right) + n_i + \varepsilon_{i,t} \tag{11}$$

$$\log\left(\frac{EXP_{i,t}}{EXP_{i-t}}\right) = \beta_0 + \beta_1 \log\left(\frac{Revenues_{i,t}}{Revenues_{i-t}}\right) + \beta_2 d_{i,t}\left(\frac{Revenues_{i,t}}{Revenus_{i-t}}\right) + n_i + \varepsilon_{i,t} \tag{12}$$

The interpretation of the results is very straightforward: The coefficient β_1 reflects the percentage increase of school expenditures when population/ students/revenues increase by 1%, while the sum $\beta_1 + \beta_2$ measures the school cost decrease for 1% population/students/revenues decrease. The empirical hypothesis for cost stickiness is found to be confirmed when $\beta_1 > 0$ and $\beta_2 < 0$ leading to $\beta_1 > \beta_1 + \beta_2$ (Cohen 2015).

8 Results and Discussion

The following chapter discusses the results separately according to each model approach and hypothesis test conducted. Contradicting or supporting results between the sections will be nevertheless highlighted and discussed in order to comprehend the results fully.

8.1 Fixed Effects Frontier Regression

The fixed effects regressions are displayed in three models that successively add more variables. While model (1) and (2) rather serve to test the robustness of the most important coefficients, model (3) actually presents the fully developed specification.

Looking first at the variables that directly influence the Cobb Douglas cost function, namely number of students and schools, it reveals the expected results. In all three models, a 1% increase in students has a positive effect by reducing school costs between -0,3% and -0,4%. In contrast, an extra 1% more school adds 0,036% to 0,055% more costs. It supports the theoretical assumptions considering that students have increasing scale effects on the existing school capacities while an entire extra school adds an extra fixed costs lump sum that needs to be carried by the public budget.

The next variable to discuss is population. Here again, bigger populations have significant lower school spending costs. The elasticities even get larger, the more control variables are included and model (3) eventually accounts for a total cost reduction of -2,67%. Both the increasing economies of scale for students and population lead to the confirmation of hypothesis (1) that proposed that very effect.

Of bigger interest in this study is, however, how population change affects school expenditures. The annual change reveals a short-term positive impact on costs, meaning that a 1% population change leads to cost reductions by -6,57% up to -10,27%. In the medium run this relationship reverses and municipalities that experience a population change by 1% compared to the base year 2004 will have cost increases by 18,75% to 23,44%. The results imply, that population decline induces short-term pressures and increases costs, while in the medium run it facilitates cost savings. That suggests that municipalities suffer mainly from short term adjustment distresses and are able to adjust their cost behaviors in the medium run. The conclusion to be made is that hypothesis (4) at this point partially needs to be rejected. Apart that the short-term negative effects of population decline is confirmed, it reveals a more positive estimate that over time those negative impacts turn into cost saving potentials and influence cost behavior positively.

As last demographic variable the old age dependency ratio accounts for population ageing. The results contradict hypothesis (5) and finds in fact that an increase in the ratio reduces school costs. The underlying assumption was that public preferences shift to other public services as the cohorts of older generations increase. That leads to negligence of school-related improvements and cost adjustments. In fact, this logic can easily be turned around in order to explain the now found positive effects: While the preferences shift to other services such as elderly care, the budgets for schools are tightened and the school management needs to increase technical efficiency to produce same services on lower costs. The reduced tax income due to larger retired pensioners adds to this budget problem that demands cost decreases. Thus, even though hypothesis (5) is at this point rejected, it does not contradict with the theoretical relationship.

Table 2 Results of the Frontier Fixed Effects Regressions

VARIABLES	(1) Ln (total school costs)	(2) Ln (total school costs)	(3) Ln (total school costs)
Ln (students)	-0,399***	-0,318***	-0,300***
	(0,0180)	(0,0442)	(0,0440)
Ln (schools)	0,0552***	0,0328**	0,0361**
	(0,0148)	(0,0150)	(0,0149)
Ln (population)	-0,737***	-3,307***	-2,671***
	(0,0720)	(0,681)	(0,702)
Ln (population density)		0,188	0,222*
		(0,134)	(0,133)
Ln (annual population change)		-10,27***	-6,570**
		(3,014)	(3,182)
Ln (population change respective to 2004)		23,44***	18,75***
		(6,588)	(6,703)
Ln (old age dependency ratio)		-0,319***	-0,333***
		(0,0525)	(0,0531)
Ln (total tax rate)			-0,959***
			(0,287)
Ln (municipal tax rate)			0,533**
			(0,246)
Ln (unemployment rate)			-0,0441***
			(0,0137)
Ln (median net income)			-0,628***
			(0,159)
Ln (tax revenues)			0,329***
			(0,105)
equalization grants total (reference: <0 SEK)			
1 - 6 000 SEK			-0,0504***
			(0,0187)
6 001 - 12 000 SEK			-0,0684***
			(0,0209)
12 001 - 18 000 SEK			-0,0612**
			(0,0252)
18 001 - 22 508 SEK			-0,0717*
			(0,0388)
municipial net profit/loss (reference: < -6000 SEK)			
-6000 - -3000 SEK			-0,110**
			(0,0438)
-2 999 - 0 SEK			-0,119***
			(0,0457)
1 - 3000 SEK			-0,116**
			(0,0463)
3001 - 6000 SEK			-0,114**
			(0,0482)
>6000 SEK			-0,0983**
			(0,0500)
political indicator (reference: liberal-conservative majority)			
no majority			-0,0143**
			(0,00660)
left wing majority			-0,0293***
			(0,00656)
Year effects	NO	YES***	YES***
Constant	20,16***	45,52***	45,17***
	(0,715)	(6,686)	(7,167)
Observations	2,610	2,610	2,609
R-squared	0,210	0,236	0,261
Number of code	290	290	290

Standard errors in parentheses
*** p<0,01; ** p<0,05; * p<0,1

Apart from the explicit relationship between costs and the demographic variables, the effects of additional socio-economic variables are considered that influence the public budget. Hypothesis (7) states that higher unemployment and total tax rates have cost improvement effects. As a matter of fact, both assumptions are confirmed in model (3): A 1% unemployment increase reduces costs by -0,044% and a tax increase leads to -0,96% savings. Furthermore, hypothesis (8) stating that higher median net incomes and higher municipal tax rates encourage cost inefficiency finds only partially support. While higher municipal tax rates indeed increase costs, higher median net incomes actually lead to decreased costs by -0,68%. At this point only speculations for the reason can be made, but potentially higher incomes generate higher demand on school quality and leads to preferences for private schools. Therefore, if parents send their children to private schools, public ones receive less funding and face smaller budgets that forces them to be more cost efficient. As a consequence, competition between schools might decrease the bureaucrats' abilities to extend its agency and the effects outlined by the Niskanen's bureaucracy model are weakened. However, since private schools are not included in this study, a final answer cannot be given.

Regarding the flypaper hypothesis (6), it was proposed that cost inefficiency increased with an increasing allocation of government grants within the equalization scheme. Yet, the categorical variable equalization grants total reveals a different pattern: Compared to the reference category that covers only net contributors, every other class of net receivers has lower school costs. Above that, there is even a positive trend indicating that the higher the net receiving becomes, the lower the school costs become. All the coefficients are significant and therefore the hypothesis is clearly rejected. This finding contradicts previous studies that have found a flypaper effect in Sweden. Even though, the overall presence of the flypaper effect cannot be questioned based on this analysis; the case of school expenditures suggests that municipalities that receive additional equalization support do indeed work more thoughtful with their financial resources.

The picture slightly alters when looking at the final net loss/profit statements. Those municipalities that have the highest per capita net loss with more than -6000 SEK (displayed as reference group) also have the highest school expenditures. The second highest costs are carried by those municipalities that have the highest per capita net profit with more than 6000 SEK. Eventually that means that the least efficient municipalities are those that have the highest net loss followed by those ones that have the highest profits. The other classes have in contrast very similar values around 11,5%. There are two explanations for those two outlier classes. First, the high costs in the reference category either indicate structural problems that impede cost efficient behavior or mismanagement of their local governors leading to higher costs. In contrast, the high costs in the net profit group most likely result from preferences of the local public that demand

higher quality in their school service provisions given that the financial resources allow extra spending. That means that high costs are not necessarily the result of cost inefficiencies, but rather additional services that are provided beyond the basic requirements.

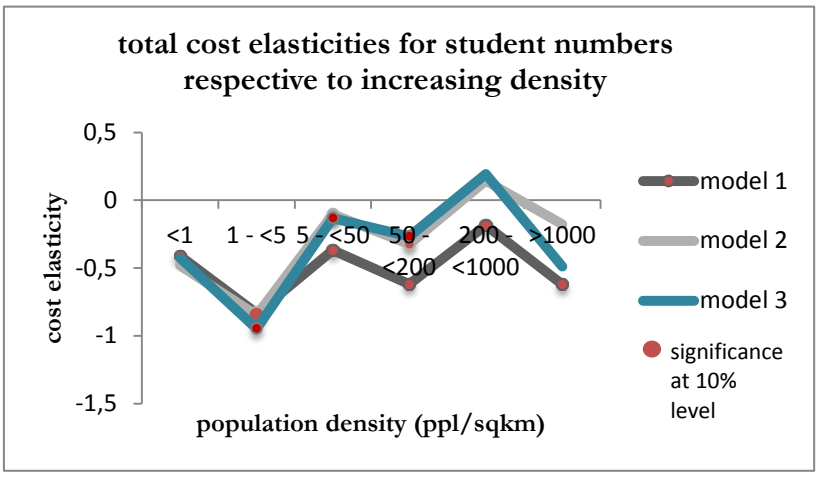
As last control variable the political indicator reveals interestingly that municipalities with left-wing majorities have lower total school costs than the liberal-conservative parties. That contradicts common perceptions that left-oriented parties are assumed to spend more. In the Swedish case, however, the political indicator could also be biased by the distribution of majorities: While the Northern municipalities by trend tend to vote more for left, the Southern and especially the metropolitan municipalities more often vote for liberal-conservative parties. Thus, the Northern peripheral regions that have the tighter budgets and face the declining population challenges are naturally also the ones that have to be more cost saving.

8.1 Density Check

Model (2) and (3) also accounted for density and found increasing cost effects with increasing density. However, hypotheses (2) suggested that economies of scale within a density class appear to have different elasticities and that those effects are concealed when just simply controlling for it with a control variable. Therefore, the regressions of model (1), (2) and (3) were estimated for six different density classes in a so-called rolling regression. By doing so, the changes in cost elasticities in respect to student numbers as the important consumer group can be observed.

Figure 9 illustrates that almost all classes have increasing economies of scale, saying that a positive increase leads to decreasing costs. Only for municipalities between 200-1000 people/km^2 for model (2) and (3) diseconomies of scales can be observed. There is a no tendency of a U-shape visible, but it becomes obvious that different density classes influence cost elasticities. Therefore, hypothesis (2) is only partially confirmed and the presence of a U-shape is rejected.

Figure 8 Total Cost Elasticities for Student Numbers according to Density



Surprisingly the biggest economies of scale can be observed in the municipality group of 1-5 person/km^2. These density sizes cover still considerable scarcely populated municipalities and cannot be related to urban centers where the biggest

scale effects would be presumed. However, what the results also indicate is that a declining population threatens specifically those municipalities with densities below 5persons/km^2, because in reverse they also face the highest cost increases when student numbers go down. Apart from the crisscross pattern, municipalities with densities above 5ppl/km^2 seem to have an overall positive trend and cost pressures continue to decline along with a density increase. The underlying policy implication is that less densely populated areas need most likely financially support in case student numbers further decline.

In contrast to the common assumption of previous research that specifically peripheral and metropolitan areas are most vulnerable to cost pressures, the here presented results find no unconditional support. While it is confirmed that peripheral municipalities suffer from higher cost pressures when population further declines, the metropolitan areas still manage to expose increasing economies of scale with growing populations. In fact, metropolitan areas are better prepared than their urban counterparts of only 200-1000 ppl/km^2 which face decreasing economies of scale with an increasing population.

8.2 Efficiency Scores

After just analyzing the results in regard to total school costs, the distinction between the separate cost categories becomes now relevant. The efficiency scores were calculated from the stochastic frontier model (3) for each school cost category separately and are displayed in figure 8. The best practice municipalities with efficiency scores of 1 are highlighted by their names in order to be identified easily. The score of 1 means 100% efficiency in relative terms to the other municipalities and consequently, all scores below 1 refer to the best practice and describe the efficiency performance level in relation to the top score. The efficiency score classifications in the maps are divided by Jenks natural breaks that intend to minimize the variance within each class and to maximize variance between classes. It is specifically useful for uneven distributed data in order to be still able to observe spatial patterns.

Looking first at total costs, it stands out that the overall eleven best practices are all urban municipalities with Göteborg scoring 100%. Stockholm follows second with an efficiency score of 90% and Uppsala 69%. Also cities from the northern urban belt are represented in the top performers with Umeå, Skellefteå and Sundsvall. It was discussed earlier that most urban municipalities are still growing, so it seems that an already existent bigger population scale and the potential of further growth benefits the cost efficiency in regard to school expenditures. In comparison, the worst performers are mostly smaller rural municipalities in central and Southern Sweden that have substantial less population. Surprisingly, extremely low population densities do not lead to worst total cost efficiency scores as most of the Northern municipalities range in the

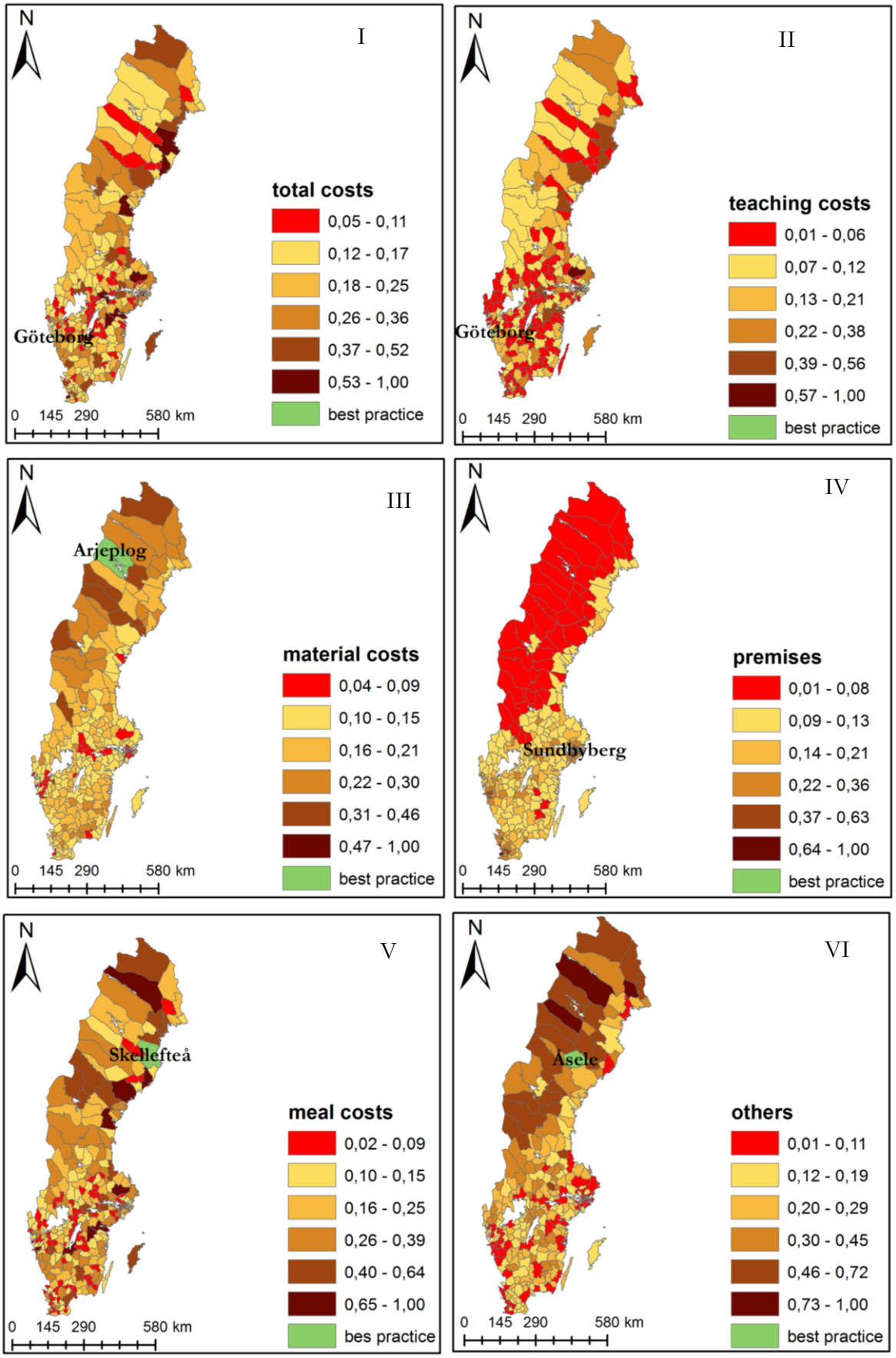
center field and do – apart from few exceptions – not stand out as the least efficient region. That stands in contrast to the just identified worse cost elasticities for little densely populated municipalities in the density check. Apart from their higher risks, they nevertheless seem to handle their cost pressures quite well.

Teaching costs follows similar patterns as total costs with Göteborg once more being the most efficient followed by Stockholm and Uppsala. Yet there exists a huge disparity between low and high efficiency performance and 274 out of 290 municipalities perform below 33%. Teaching costs seem to be an overall Swedish efficiency problem. Reason for this is most likely the overall teacher shortage and the huge competition between schools to find qualified personnel. As a consequence, smaller and peripheral regions try to attract potential teachers by offering higher salaries which of course affects expenditures negatively. In this context, it should be carefully weighted if that means an actual inefficiency on the side of the municipalities, because expensive teachers are still better than none. The political intention in the early 1990s reform was to explicitly hand over the responsibility of wage negotiations to the local level and national programs try to support the teaching financing in order to compensate for the financial burden. It is not subject to this paper to analysis the advantage and disadvantages of this system, but the consequence is a careful interpretation of the results in order to avoid a wrong judgement of cost behaviors when neglecting the background circumstances.

Material and other costs can be analyzed at the same time, because they reveal both similar results. In both cases the best practice can be found in the northern peripheral belt – Arjeplog for material costs and Åsele regarding other costs. Furthermore, it stands out that the entire region has cost efficiency advantages compared to the rest of the country. Again, the gap between best practice and the rest of the municipalities is fairly big, but it seems that on average the peripheral schools are more efficient in their material and other expenditures. Both cost categories involve mainly variable costs that are relatively easily adjustable and one potential reason for the efficiency might be tighter budgets that force a more efficient performance.

Meal costs do not reveal a certain pattern regarding their best performers. Next to the best practice Skellefteå, few more small and medium urban municipalities scattered across the country have higher efficiency scores. Gällivare as one of the biggest Northern peripheral municipalities stands out with a considerable high score of 78%. However looking at the bottom range, it is in evidence that the least efficient municipalities scoring below 15%, are almost entirely located in Southern Sweden. This group covers 176 municipalities and only 18 of them are found in Northern Sweden. It indicates once more that the peripheral region performs on average better. Apart from that, the difference between Skellefteå and the other municipalities is quite substantial suggesting a lot of room for efficiency improvement.

Figure 9 Efficiency Scores according to Cost Classifications



Premises as the last cost category is an interesting case that reveals a strong cost efficiency disadvantage for the peripheral belt. The entire region except Östersund is affected- small and big municipalities likewise. They all just reach 8% of the efficiency level of Sundbyberg as the best performer. Yet the rest of the country is not necessarily far better off, the general efficiency performance is very low with 225 out of 290 municipalities producing on efficiency levels below 22%. Only the metropolitan areas manage their school premises cost efficiently as the overall ten best practices are all located either around Stockholm or Göteborg or Malmö. The results support strongly the assumption that fixed costs in relation with reversing increasing economies of scale burden high costs on municipalities. Premises are the least flexible cost category when it comes to adjustments because school buildings need to be provided.

To answer hypotheses (1) and (3), it needs to be accounted that peripheral and declining regions do not necessarily suffer higher inefficiencies. In fact, the empirical data has shown that those Swedish municipalities with demographic challenges and smaller populations can perform within or even above average. This is especially the case for expenditures of materials, meals and other costs. However, in terms of premises those municipalities do suffer from higher cost inefficiencies and perform a lot worse. In return, metropolitan and urban municipalities benefit from their economies of scale in regard of premises as well as in total costs, while they perform worse in variable costs – most likely due to less budget constraints and potentially higher demands of urban parents. Thus, the theoretical significance of fixed and variable costs are also found in the empirical data.

Teaching costs as an outlier in this context are somewhat different to judge given the circumstances of local salary negotiations and recruitment competition between municipalities. It partially impedes scale effects and cost efficiency considerations and needs an adjusted study with a more suitable theoretical approach in order to understand spatial salary developments better.

As a last note, the often found huge disparities between best performer and the majority of municipalities need to be re-emphasized – suggesting two potential scenarios (Geys et al. 2007). The optimistic thinking is that it discloses unused improvement potential in order to cushion future population decline and decreasing revenues. In other words by orientating themselves on the high performers, there is great potential for productivity improvement for the low performers. The more pessimistic approach is, however, that low performance is rather due to adverse structural socio-economic factors that are barely adjustable. Further economic challenges would only impose further burdens to those municipalities making their situation even worse. Public stakeholders need to keep that in mind by analyzing regularly which path most of the municipalities go in order to provide support if needed.

8.3 Cost Stickiness

In order to address hypothesis (4) in regard of cost stickiness, three models according to the Anderson et al. (2003) approach were estimated. The first and second specification address population changes directly by regressing the dependent variables of the annual log cost changes in each cost category according to the independent variables annual log changes of the population and student numbers. The third model follows the original method by using annual log revenue changes as the independent variable in order to check for robustness. Only the β_1 and β_2 – coefficients are reported in table 3. Control variables were not included in the regression, but further tests were conducted during the analysis and were found to have no influence on the directions of coefficients.

Table 3 Cost Stickiness Coefficients

	(1) population			(2) students			(3) revenues		
	β_1	β_2	$\beta_1+\beta_2$	β_1	β_2	$\beta_1+\beta_2$	β_1	β_2	$\beta_1+\beta_2$
(a) total costs	**0,17**	**-0,61**	**-0,44**	-0,08	0,01	-0,06	**0,08**	**-0,78**	**-0,70**
(b) teaching	**0,86**	**-1,29**	**-0,43**	-0,06	0,00	-0,06	-0,19	-0,38	-0,57
(c) materials	-1,22	3,60	2,38	**0,49**	**-0,53**	**-0,03**	-0,31	3,26	2,96
(d) meals	-1,19	0,62	-0,57	-0,17	0,11	-0,06	0,38	0,28	0,66
(e) others	-3,25	1,78	-1,47	-0,32	0,20	-0,12	**0,87**	**-3,00**	**-2,13**
(f) premises	**0,18**	**-0,87**	**-0,68**	**0,11**	**-0,19**	**-0,08**	**0,28**	**-1,57**	**-1,29**

First it can be stated, that the results are not completely conclusive; in fact, each specification identifies different potential cost categories as sticky: While the population-specification highlights total costs and teaching as sticky, model (2) only finds sticky behavior for material costs. The control model (3) on municipal revenues, in contrast, discovers total costs and other costs as sticky. Thus, there is no consistent proof whether cost stickiness is present; beyond that, none of the results are significant suggesting that the phenomenon might not be as decisive as assumed.

Apart from the uncertainty about the presence and significance, a second peculiarity needs to be emphasized. As a reminder, the β_1–coefficient measures the percentage increase when population/students/revenues increase by 1%, while the sum of $\beta_1+\beta_2$ measures the percentage decrease of costs when population/students/revenues decrease by 1%. When $\beta_1 > 0$ and $\beta_2 < 0$ ($\beta_1 > \beta_1+\beta_2$), the presence of sticky behavior is confirmed. When looking at all specifications that identify some sort of stickiness, it is remarkable that not only the sum of $\beta_1 + \beta_2$ are all smaller than β_1, but also negative. That implies that if cost stickiness is present, it would not just mean that population, student or revenue declines lead to costs decreases slower than the equivalent increase, but that they actually lead to cost increases. As an example, 1% increase in population means a total school cost increases by 0,17%, while a 1% decline of the population leads to a cost

increase by 0,44% (model 1a). It is also in line with the earlier done fixed effects analysis, where annual log-change was found to have increasing cost effects.

It implicates that there is something to demographic and financial decreases that impacts cost behaviors beyond cost stickiness. One potential explanation are hidden fixed costs within each cost category that lead – based on reversing increasing economies of scale – to increased costs in times of declines. In order to test for this possibility, the models were regressed on the annual log changes of premises from which it is already known that they are characterized by high fixed costs (models 1-3f). As a matter of fact, all three specifications confirm the same pattern and support the presence of bias through fixed costs. However, once more again all results are insignificant leaving a certain doubt about the validity of the results.

At this point, it can be concluded that the separation of variable and fixed costs is a very delicate undertaking and that the methodological approach lacks precision leading to biased results. Whether cost stickiness is present cannot fully be answered within this paper, but surely demands further research in a more accurate and detailed setting.

9 Conclusion and Perspectives

The aim of this study has been to examine the relationship between population decline and local public spending. After elaborating on the demographic background and the administrative structure with a focus on the strongly decentralized public service provision it became apparent that Sweden is both experiencing population growth and decline and faces different challenges in metropolitan and peripheral regions respectively. Merely population ageing is a process that affects the entire country.

Apart from the national importance to provide all basic public services across Sweden and the therewith connected fiscal transfer that ensures the fulfillment of all obligations, the variance in the data shows that local governments still end up with different public expenditures. Given the different cost behaviors, the assumption was made that municipalities produce on different efficiency levels and that an econometric analysis could help understand which factors influence increasing costs. School expenditures as one public service provided by municipalities seemed the appropriate case study, because the financial responsibility solely lies on the local level. It excluded a great potential of data distortion through the theoretical absence of shared stewardship between administrative levels. In reality, of course, national earmarked grants still bias slightly the analysis. Beyond that, another advantage is the easier matching of input and output variables in order to detect direct causal relationships. Additionally, the rich data enabled the differentiation between different cost categories, which allowed a more precise distinction

between variable and fixed costs and made it possible to apply the economic theories in a more precise manner.

In combination of previous applied statistical methods and previous research, the hypotheses were derived and tested during the analysis. The results brought interesting insights regarding the current efficiency and cost situation of Swedish municipalities on comprehensive school expenditures. Not all hypotheses are confirmed, but overall few conclusions can be drawn from this analysis: First, it is essential to distinguish between variable and fixed costs. Theory showed why fixed costs are less adjustable and the econometric testing confirmed that municipalities more often suffer from high fixed costs that impede cost improvements.

Second, larger population and student numbers meant cost saving potential, the efficiency benchmarking supported that finding by identifying several times metropolitan areas as most efficient public service producers. The density check confirmed this finding by highlighting that metropolitan areas with big densities still impose increasing economies of scale, while municipalities with low densities face bigger cost pressures.

Third, the fixed effects regressions revealed that the impact of population change is more nuanced than the initial threat summarized by van de Kaa. As a matter of fact, population decline has short-term negative cost consequences, but over the medium run of nine years this relationship turns into a positive one and leads to cost saving potential. The efficiency scores support this finding as well, because those peripheral municipalities that are identified as declining regions are not necessarily the least efficient in their school expenses, but often show within or even above average scores –twice even ranking most efficient. It suggests that local governments are aware of their challenges and adjust their budgets accordingly. Affected municipalities manage to identify resources where they can adjust costs in order to balance out other cost categories where they have little influence in – mostly fixed costs in form of teaching contracts and premises. These results hint for the presence of cost stickiness, but unfortunately could not be confirmed by the second analysis. The lack of coherent and significant results still leaves some doubt and demands further research.

Other aspects of the study stood out less distinct. The flypaper effect was rejected and Niskanen's bureaucracy model only found little support. However, even though the informational value of these variables is not exhausted, it was nevertheless important to control for those in order to reduce bias and specify the model as precise as possible. As a matter of fact, the adjustments over time observed in the regressions could even indicate that the bureaucrats' self-interests are less pronounced than theory assumes.

As an overall summary it can be concluded that metropolitan and urban centers are the general benefiters from population changes. As they are the ones still growing, they also profit

from increasing economies of scale. Yet, they do not outperform peripheral regions on all levels. In fact, the rural and remote municipalities confront their challenges and improve their cost behaviors and efficiencies. The general perception that the peripheral belt is a persistent bad performer cannot be confirmed.

The benchmark analysis, however, also has shown that huge gaps exist between best and worst performers that either speak for potential of efficiency improvement or are a witness of structural problems that are hard to overcome. For this purpose, the methodology needs to be further specified and standardized to receive comparable results over time. The scope of this paper limited this study, but also the applied models have their boundaries that need to be improved in the future. For example, changing efficiency scores over time would have served the panel dataset better, but the alternative model alternatives were insufficient since they estimated only one direction of changes identically for all municipalities. Thus, observing improvements for some and deterioration for others would not have been possible; instead, all municipality efficiency scores would have either improved or worsened. This, however, is a very unlikely observation to be made in reality and therefore not applicable. Furthermore, it is necessary to identify methods that combine economies of scale and cost stickiness at the same time. Both concepts are relevant, but estimating the effects in two different models is impractical and insufficient. Scholars need to be more open to extend research and methodology in order to get consistent and coherent frameworks. This paper contributes to the scientific literature by taking the results of previous research and combining them within one study. In this regard, it is a first step to show that a more holistic approach is needed instead of smaller studies that focus only on one theory.

After all, the scientific contribution benefits the policy-makers in the respective countries that need to address the consequences of population decline. Decreasing public budgets and limited finance options in the final sector will most likely demand further liberalization inducing higher competition and more New Public Management tactics. Benchmarking will gain in this context more importance and relevance. This paper has shown that scientific methodology can be used as strong evaluation tool to provide practitioners with useful insights that guide them in their political decision-making process. Consequently, the next step is to extend the analysis to other public services in order to identify cost behaviors for each public good provided.

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