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Population Changes in Swedish Municipalities. What are the Reported Economic Impacts on Fee Financed Local Technical Services?

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Abstract
Swedish local governments are responsible for providing public services to their residents. Population changes require varying considerations and responses. Population growth demands the extension of the local government service capacity, for example to provide technical services. Even a declining population is demanding because of the difficulties adjusting the size of the service capacity in an economically sustainable way. This paper seeks to clarify the economic impacts of population changes on technical services in Swedish local municipalities. Two technical sectors are compared: waste operations, and water and wastewater operations. Potential impacts are identified in existing literature. A dataset is analyzed using regression analysis. The results suggest that there are no clear reported economic impacts of population changes for waste operations. Waste operations seem to be able to adapt to existing population changes in an economically sustainable manner. On the other hand, the results show that there are clear economic impacts connected to population changes for water and wastewater operations. Costs and user fee levels are lower in municipalities with population growth, compared to municipalities with a declining population. However, the investment expenditure per connected capita increases greatly in municipalities with population growth.

Keywords: Population change, economic impact, technical service, municipality, fee

Introduction

Swedish local governments are responsible for providing different public services for their residents. All residents have the same right to services, regardless of the local municipality in which they reside. At the same time, population changes are a reality. About half of Sweden's municipalities have an increasing population, while the other half have decreasing populations. In addition, the *Local Government Act* (chapter 8, § 1) states that local governments have to manage this challenge by obtaining economic sustainability.

Local governments are often concerned with activities intended to either promote population growth or to reduce population decline (Bjørnå & Aarsæther, 2009) and there is a belief that population growth is positive (Brorström & Siverbo, 2008). Local politicians demonstrate interests in activities that intend to increase the population (Niedomysl, 2007). One reason is that a larger population makes it possible to share fixed costs. Consequently, it should be possible to take advantage of economies of scale. However, one question is how big those economies of scales are and whether they are realized.

Population growth puts great demands on the extension of the local government's service capacity, such as providing technical services including water supply, district heating, and waste disposal (Fjertorp, 2010). Technical services are often capital intensive and some require tangible assets with a long lifespan. Even a declining population is demanding because of the difficulties to adjust the size of the service capacity in an economically sustainable way. The assets are fixed and costs for depreciations and interest remain, even if people move. One

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can thus expect that population changes give rise to economic implications (Mäding, 2004), either resulting in economies of scale or cost increases. This paper seeks to clarify the economic impacts of population changes on technical services in Swedish local municipalities.

Economic Impacts Recognized in the Literature

Christoffersen & Larsen (2007) have suggested that local government expenditures per capita, in general, can be expected to decrease in municipalities with population growth and increase with a declining population. This is because the fixed costs that arise due to tangible assets need to be paid by fewer people. Thus, they note that the expected changes in costs cannot be measured, and suggest that the scale of economic effects are offset by higher quality. The authors, therefore, believe that cost levels must be studied in combination with quality levels. The results of Christoffersen & Larsen's (2007) analysis of Danish municipalities suggest that local governments provide a balance between quality and cost.

Studies of U.S. municipalities conducted by Ladd (1992, 1994) show that in growing municipalities, spending on municipal services increases faster than the population. Only in sparsely populated municipalities do expenditures per capita tend to decline upon population growth. The results also show that public spending in rapidly growing municipalities is not increasing as fast as in slow-growing municipalities. Ladd (1994) draws the conclusion that politicians are seemingly not prepared to allow spending to rise too quickly. However, in contrast to Christoffersen & Larsen (2007), Ladd (1994) states that one should be cautious in interpreting increased spending as a result of higher service quality.

Mäding (2004) also notes that population changes affect municipal costs. He argues that there are different categories of cost implications associated with population changes. First, fixed costs remain constant when the population is declining. Second, the cost per capita is likely to increase with changes in the demographic structure. Finally, politicians tend to run a resource-demanding policy in their efforts to attract and compete for the country's residents.

Another study of U.S. municipalities by Holcombe & Williams (2008) indicates that when all municipal expenditures are taken into account, a higher population density does not lead to a declining average cost per capita. An increasing density implies that there is higher public spending per capita in larger cities with more than 500,000 residents. However, they found that for some types of infrastructure, an increasing population could reduce the expenditure per capita.

The overall picture from the above-described studies on the economic impacts of population change is not completely clear. However, it seems reasonable to expect that population changes would affect both costs and expenses per capita. It should also be noted that these studies refer to different countries and focus primarily on the effects on the overall municipal economy. Thus, it may be easier to see population change's economic impacts by studying the effects of a particular operation.

With regard to the technical operations providing infrastructure, there appear to be some economic effects of population change: the expenditures per capita increase upon population decline and decrease upon population growth (Holcombe & Williams, 2008). The economic benefits that may arise in the infrastructure of municipalities with population growth would be undermined by politicians' efforts to provide attractive accommodations to the new residents (Mäding, 2004). For example, lakeside lodging on the outskirts of existing settlements requires extensive resources for pump installations (Tagesson, 2002; Fjertorp, 2010).

When it comes to investments in infrastructure, Ladd (1994) finds that population growth in U.S. municipalities demands a multi-fold increase in investment expenditures. Moreover, in Sweden, it has been found that the infrastructure's scope increases faster than the population (Fjertorp, 2010). However, even if the literature gives some answers, it is still not clear what economic impact one can expect from population growth on a local municipality's technical services.

Method

Comparing Waste Disposal and Water and Wastewater Operations

Technical operations are often a basic requirement for the possibility to live in a certain area. A changing population will sooner or later imply consequences for technical operations. In Sweden, some of the most important operations connected to population changes are financed by fees. Thus, this study focuses on fee-financed technical operations.

Analyses of two operations with somewhat different characteristics can provide a more complete picture of the various impacts of population changes. Also, the operations dependent on tangible assets are relevant to understand the need for resources in order to adjust service capacity to population changes (Fjertorp, 2010). For instance, a water operation requires tangible assets to each connected property. The required assets are capital intensive and have a long lifespan. It is quite difficult to adjust the service capacity to a decreasing population, while an increasing population demands capital to expand.

Waste operations are somewhat different in character. The treatment of waste requires substantial assets, but the distribution is structured differently. Certain tangible assets required for the collection of waste, such as vehicles, can be sold relatively easily in accordance with changing needs. Therefore, it is appropriate to study water and wastewater operations together with waste operations. The choice of operations is supported by the availability of data for Swedish operations in both areas.

Swedish law stipulates that both water and wastewater operations and waste operations shall be user-financed. The cost-based principle means that revenues, which come from user fees, are not allowed to be higher than the *necessary costs*. Therefore, a consequence of changing costs is that revenues can be expected to change (see Holcombe & Williams, 2008). Local governments have a monopolistic position. The fees do not decrease automatically, even if scales of economics exist. Resources could, for example, be used for increased labor costs instead. However, fee levels are not decided by public officials, but by local politicians. In general, in Sweden there is political pressure on technical operations to keep fees low in order to create benefits for residents. These conditions should be considered when interpreting the results.

Operationalization of Variables

Population change is measured as the percentage change in the number of residents between 2004 and 2009. One reason for studying a period of several years is that delays can be expected before fees change, or before the infrastructure is adjusted for a larger population.

Measuring economic impact demands some simplification. Regulations allow local governments to decide the design of the fees. This results in some difficulties when comparing municipalities. The professional national trade associations *Swedish Water and Wastewater Association* and *Swedish Waste Management* have coordinated some common measures in order to compare economic variables within each sector. This analysis is based on some of those measures, which also corresponds to the data's availability.

Data used in this analysis consist of *reported* financial data. It is known that the compliance of accounting standards is varying (Haraldsson & Tagesson, 2014). In some municipalities, for example, investments are already reported as a cost during the first year, instead of being activated in the balance sheet. Such differences in accounting practices are unfortunately not possible to correct in the dataset, and may imply that some economic impacts are difficult to identify. It is, therefore, important to point out that the study refers to *reported* economic impacts.

A study by Holcombe & Williams (2008) suggests that the total activity cost for water per resident decreases with an increasing population. They note that the results are consistent with previous studies by Kim (1987) and Renzetti (1999), who suggest that there are economies of scale in terms of water supply. The same applies to operating costs per capita for wastewater. Holcombe & Williams (2008), however, found that the cost per capita for roads increases with population growth, making it more difficult to predict how the costs for waste operations are affected. Because waste operations are less capital-intensive than water and wastewater operations, the proportion of variable costs is higher, which allows one to expect less positive economic impacts for municipalities with a growing population.

Most of the residents in Sweden are connected to their municipal water supply system, but not all. Accordingly, it is more relevant to study the total operating cost per connected capita. Population change does not necessarily mean that the number of users change, although there is a connection. To get an accurate picture of the number of those who are connected, adjustments are made for the scope of jobs and leisure places in the municipalities, converted to correspond to a population. Even in waste operations, it is relevant to study the cost per connected capita, which is also adjusted for the scope of jobs and leisure places. The professional national trade associations *Swedish Water and Wastewater Association* and *Swedish Waste Management* provide estimates of the number of persons.

One measure used for revenues is the total revenue per connected capita in 2009. Another measure used in this study is the total annual fee for a typical single-family-house and a typical apartment building, as well as the fee for one cubic meter of water consumed in 2009. Revenues for waste operations are also measured as the total revenue per connected capita, as well as the annual fee for a typical single-family-house. The operationalization for apartment buildings, however, is somewhat different compared to water and wastewater operations. The available dataset includes data about the revenue for *one* typical apartment, not a typical apartment building. However, the variables refer to the same type of housing. An additional variable for the level of domestic waste fees in 2009 is also included in order to identify another measure that may be affected by population changes. This variable refers to the average fee per square meter in a typical housing type.

Previous studies show that population changes will result in changes in investment expenditure per capita (Ladd, 1994; Holcombe & Williams, 2008; Fjertorp, 2010). Thus, it is important to study how the investment expenditures per connected capita change. This is done by a variable of investment expenditure in 2009 per connected capita. It is also relevant to analyze changes in capital costs (depreciation and interest) per connected capita in 2009. Unfortunately, data on investment expenditure is missing for waste operations. Nevertheless, it is relevant to study the investment cost for water and wastewater operations.

Method of Analysis

The starting point is the independent variable *Population change 2004-2009*. The economic impact of population growth is studied using several dependent variables. The variables are operationalized using register data supplied by the national trade associations *Swedish Water and Wastewater Association* and *Swedish Waste Management*. Pearson's correlation analysis and single linear regression analysis are used as analytical methods.

The design is similar to a linear multiple regression analysis with one dependent and several independent variables. Thus, the layout is the reverse, namely, multiple dependent variables to be explained by one independent (*Population change* 2004-2009). Due to the interaction effects, linear multiple regression analysis is not applicable. Instead, several single linear regression analyses are made, wherein each dependent variable is analyzed in relation to the independent variable.

The results of the statistical analyses have been discussed at a meeting with: three practitioners with experience in water and wastewater operations, three practitioners with experience in waste operations, and three researchers with experience in the management of technical municipality operations. Several possible explanations for the analytical results were discussed and used as input to this paper.

Descriptive Statistics

Descriptive statistics are presented in Table 1. An examination of the minimum and maximum observations for each variable did not show any unreasonable values that could indicate erroneous input data. The mean values do not differ substantially from the trimmed means, which also suggests that outliers do not occur to an unacceptable extent.

Data about *Population change 2004-2009* are available for all the 290 Swedish municipalities. The availability of data varies considerably for the waste variables. Information about *Domestic waste fee 2009* (average per square meter) is available for 282 municipalities. However, data for the variable *Total cost 2009* is missing for a large number of municipalities. Data for the variable *Total Revenue 2009* exist only for 76 municipalities. However, a missing-value-analysis using a T-test indicates that there are no significant differences in population change ($p > .10$) between the municipalities for which data are available and missing, related to population change. This applies to all five waste variables.

The availability of data for water and wastewater operations is greater. The variables *Annual fee single-family-house 2009* and *Annual fee apartment building 2009* include data from nearly all municipalities. Information on *Capital cost 2009* is available for 190 municipalities. A missing-value analysis using a T-test indicates that available data do not completely reflect the country's municipalities as a whole. The average population change is positive for the municipalities in which data are available, while it is negative for the municipalities where data is missing. This should be considered when interpreting the results. The results for the variables with the most missing values cannot be generalized to municipalities with a declining population as much as to a local government with an increasing population.

Table 1 shows that the municipalities on average had a population growth of 5.7 percent during the period 2004-2009. Waste variables show that the total cost in 2009 was on average 751 SEK per connected capita. The total revenue for 2009 was an average of 804 SEK per connected capita. The annual fee for a single-family-house in 2009 was on average 1,935 SEK, while the annual fee for an apartment was 1,167 SEK. The fee per square meter was on average 19 SEK. The waste operations are missing data for both capital costs and investment expenditures because there is no national compilation of this information.

Table 1. *Descriptive statistics*

	Waste			Water and wastewater		
Variables	**N**	**Mean**	**Std.dev.**	**N**	**Mean**	**Std.dev.**
1. Population change 2004-2009 (%)	290	+ 5.7	3.5 p.p.	290	5.7	3.5 p.p.
2. Total cost 2009 (SEK p.c.c.)	93	751	218	202	2,073	671
3. Total revenue 2009 (SEK p.c.c.)	76	804	201	201	2,109	666
4. Annual fee single-family-house 2009 (SEK)	213	1,935	454	287	5,385	1,241
5a. Annual fee apartment 2009 (SEK)	168	1,167	683	---	---	---
5b. Annual fee apartment building 2009 (SEK)	---	---	---	287	52,161	13,152
6a. Domestic waste fee, (SEK/m^2)	282	19	5	---	---	---
6b. Water consumption fee 2009 (SEK/m^3)	---	---	---	281	19	5,6
7. Capital cost 2009 (SEK p.c.c.)		(Data missing)		190	551	278
8. Investment expenditure 2009 (SEK p.c.c.)		(Data missing)		198	22,884	47,433

p.p. = percentage point, SEK = Swedish krona, p.c.c. = per connected capita

The water and wastewater variables show that the total cost in 2009 was on average 2,073 SEK per connected capita, while total revenues were on average 2,109 SEK per connected capita. The annual fee for a typical single-family-house was an average of 5,385 SEK, while the average annual fee for a typical apartment building was 52,161 SEK. The consumption fee for one cubic meter of water was on average 19 SEK. Table 1 also shows that the capital cost (depreciation and interest) per connected capita on average was 551 SEK, while the average investment expenditure was 22,884 SEK per connected capita.

Results

Correlation

Table 2 presents Pearson's correlation measure between the waste variables. *Population change 2004-2009* shows no significant correlation either with *Total cost 2009*, *Total revenue 2009,* or *Fee single-family-house* ($p > .05$). However, *Population change 2004-2009* shows a significant positive correlation ($p < .05$) with *Annual fee apartment building 2009,* and a weak positive correlation ($p < .10$) with *Domestic waste fee 2009*. The results suggest that population changes pose no strong systematic effects on waste operations' finances.

Table 2. *Correlation matrix: waste operation variables*

Variable	1.	2.	3.	4.	5a.	6a.
1. Population change 2004-2009	1.00					
2. Total cost 2009 (SEK p.c.c.)	.081	1.00				
3. Total revenue 2009 (SEK p.c.c.)	.096	.763***	1.00			
4. Annual fee single-family-house 2009 (SEK)	-.011	.414***	.530***	1.00		
5a. Annual fee apartment 2009 (SEK)	.178*	.248*	.414**	.124	1.00	
6a. Domestic waste fee (SEK/m^2)	.107ƒ	.426***	.386**	.206**	.392***	1.00

SEK = Swedish krona; p.c.c. = per connected capita; ƒ p<.10 (2-side); * p<.05 (2-side);
** p<.01 (2-side); *** p<.001 (2-side)

Table 3 presents Pearson's correlation measure between the water and wastewater variables. Unlike the waste variables, *Population change 2004-2009* shows very strong significant correlation (p <.01) with all other variables. Thus, there is a negative correlation between *Population change 2004-2009* and *Total cost 2009*, *Total revenue 2009*, *Annual fee single-family-house 2009*, *Annual fee apartment building 2009,* and *Water consumption fee 2009.* The correlation with *Investment expenditure 2009* is also positive and strongly significant. The correlation matrix indicates extensive multicollinearity between water variables, which is not surprising.

Table 3. *Correlation matrix: water and wastewater operation variables*

Variable	1.	2.	3.	4.	5b.	6b.	7.
1. Population change 2004-2009	1.00						
2. Total cost 2009 (SEK p.c.c.)	-.446***	1.00					
3. Total revenue 2009 (SEK p.c.c.)	-.443***	.952***	1.00				
4. Annual fee single-family-house 2009 (SEK)	-.398***	.689***	.686***	1.00			
5b. Annual fee apart mentbuilding 2009 (SEK)	-.406***	.707***	.694***	.808***	1.00		
6b. Water consumption fee 2009 (SEK/m^3)	-.313***	.438***	.430***	.604***	.573***	1.00	
7. Capital cost 2009 (SEK p.c.c.)	-.492***	.749***	.751***	.594***	.556***	.445***	1.00
8. Investment expenditure 2009 (SEK p.c.c.)	.329***	-.223**	-.221**	-.258***	-.253***	-.229**	-.143

SEK = Swedish krona; p.c.c. = per connected capita; ** p <.01 (2-side); *** p <.001 (2-side)

Regression

Table 4 presents the results from the regression analysis of waste variables. Regression models A-C do not indicate any significant relationships. Regression model D, however, is significant (p <.05) and regression model E indicates a weak but significant (p <.10) relationship. The result corresponds to the results provided by the correlation matrix in Table 2.

Table 4. *Regression models for waste (single linear regression, independent variable = Population change 2004-2009)*

Regr. model	Dependent variable	Constant	ß- coeff.	R^2-value	p-value	Residual K-S-test, p-value
A	2. Total cost 2009 (SEK p.c.c.)	748***	5.123	0.01	.439	.084 ′
B	3. Total revenue 2009 (SEK p.c.c.)	802***	5.603	0.01	.408	.347
C	4. Annual fee single-family-house 2009 (SEK)	1,935***	- 1.468	0.00	.871	.767
D	5a. Annual fee apartment 2009 (SEK)	1,147***	35.165*	0.03	.021*	.020*
E	6a. Domestic waste fee (SEK/m^2)	19***	0.156′	0.01	.072 ′	.080 ′

p <.10 (2-side); * p <.05 (2-side); *** p <.05 (2-side); K-S-test = Kolmogorov-Smirnovs test, p.c.c. = per connected capita; SEK = Swedish krona

Table 5. *Regression models for water and wastewater (single linear regression, independent variable = Population change 2004-2009)*

Regr. model	Dependent variable	Constant	ß- coeff.	R^2-value	p-value	Residual K-S-test, p-value
F	2. Total cost 2009 (SEK p.c.c.)	2,122***	- 86***	0.20	.000***	.056
G	3. Total revenue 2009 (SEK p.c.c.)	2,157***	- 85***	0.20	.000***	.010*
H	4. Annual fee single-family-house 2009 (SEK)	5,467***	- 142***	0.16	.000***	.748
I	5b. Annual fee apartment building 2009 (SEK)	53,041***	- 1,539***	0.17	.000***	.535
J	6b. Water consumption fee 2009 (SEK/m^3)	19.48***	- 0.51***	0.10	.000***	.877
K	7. Capital cost 2009 (SEK p.c.c.)	574***	- 39***	0.24	.000***	.226
L	8. Investment expenditure 2009 (SEK p.c.c.)	20,309***	4,504***	0.11	.000***	.000***

′ p <.10 (2-side); * p <.05 (2-side); *** p <.05 (2-side); K-S-test = Kolmogorov-Smirnovs test, p.c.c. = per connected capita; SEK = Swedish krona

Table 5 compiles the results from the regression analysis of water and wastewater variables. The result shows that all regression models are very strongly significant ($p < .001$). It corresponds to the results indicated by the correlation analysis presented in Table 3. The Kolmogorov-Smirnov test indicates that the residual for the regression models E, G, and L differs from the normal distribution. Thus, the test is considered to be too sensitive for large samples (Djurfeldt & Barmark, 2009:119), which is the case here. Therefore, the results cannot be dismissed.

Discussion

Costs

Regression model A suggests that the total cost per connected capita in waste operations is not affected by population changes. Population changes can, however, explain the total cost per connected capita within water and wastewater operations (regression model F). A population growth of one percent means that the total annual cost per connected capita decreases by 86 SEK. Similarly, a population decrease of one percent implies an increased total annual cost per connected capita by 86 SEK. The correlation is very highly significant ($p < .001$).

The results confirm Holcombe & Williams's (2008) findings, where they noted that the overall operating cost per resident for water decreases with population growth. The results are further evidence that some economic benefits are generated within water and wastewater operations with population growth (*cf.* Kim, 1987; Renzetti, 1999). These benefits do not arise for waste operations, at least not as found in the data analyzed. On the other hand, there does not turn out to be any immediate negative economic impact of waste operations with population growth either.

Revenues

The current cost-based principle stipulated by law means that revenues could be expected to follow the same pattern as costs. The total revenue per connected capita is indeed the same result as the total cost. In waste operations, there is no systematic relationship between population changes and total revenues (regression model B). Within water and wastewater operations, there is a very strong significant relationship between population change and revenues ($p < .001$). The coefficient of the regression model G is almost the same as for the regression model F. This means that population changes imply a change in revenue per connected capita, which is almost as large as the change in total cost per connected capita. A population growth of one percent between 2004-2009 means that the total revenue is reduced by 85 SEK per connected capita, while a declining population means that the revenue will increase by the same amount.

The revenue is derived from various fees. Regression model C suggests that the level of the annual fee for a single-family-house for waste operations is not affected in any systematic way by population changes. In contrast, regression model D suggests that there is a tendency that an apartment's annual waste operations' fee is slightly enhanced by population growth ($p < .05$). The result of the regression model E suggests that the domestic waste fee (SEK/m^2) is slightly higher in municipalities with population growth compared to municipalities with a declining population. The results, however, are vague on this point ($p < .10$).

The results show that the total fees for an apartment are higher in municipalities with a population that is increasing compared with decreasing. The reason that the annual fee for an apartment can be affected by population growth, although revenue per connected not is affected, could be explained by population density. In municipalities with population growth, the availability of apartments tends to be lower than the demand and accordingly more densely populated.

Unlike waste operations, the relationship between population changes and fee levels are very highly significant ($p < .001$) within the waste and wastewater operations. One percent population growth implies that the annual fee for a single-family-house decreases by 142 SEK (regression model H). An apartment building's annual fee is reduced by 1,539 SEK when the population increases by one percent (regression model I). The water consumption fee is reduced by 0.51 SEK per cubic meter when the population increases by one percent. Similarly, the fee levels increase by the same amount in municipalities with a decreasing population.

Capital Investments

Due to a shortage of data, it is not possible to compare the two different technical operations when it comes to the impact on capital investments. Regression model K shows a very strongly significant negative correlation between population change and capital costs per connected capita ($p < .001$) for water and wastewater operations. The capital cost per connected capita decreases by 39 SEK when the population increases by one percent. At the same time, the annual investment expenditure per connected capita increases by 4,504 SEK. The results correspond with previous studies, which show that population growth implies that local government investment expenditure per capita increases (see Ladd, 1994; Fjertorp, 2010).

The combination of declining capital costs and increasing investment expenditure is somewhat contradictory, since higher investment expenditures reasonably lead to higher capital costs. One explanation could be that the investments are self-financed. However, the results of the regression models F and G do not indicate that water and wastewater operations generate any positive results that could be used to self-finance investments. Furthermore, according to legislative restrictions, water and wastewater operations are not allowed to self-finance investments. Self-financing is not a likely explanation.

Increasing investment expenditure per connected capita and decreasing capital cost per connected capita may also mean that the investments are lagging behind and not keeping up with population growth. It is not surprising that population decline implies higher capital cost per connected capita. Those who remain will share the former capital costs. Nor is it surprising that the investment expenditure per connected decreases, as there is excess capacity in the assets.

However, some adjustments and renewal will still need to be made (Fjertorp, 2010).

Concluding Remarks

Does Population Change Imply Economic Impacts for waste operations?

The results suggest that there are no clear reported economic impacts of population changes for municipal waste operations, as waste operations are able to adapt to existing population changes.. These results are in contradiction with Mäding (2004), who noted that population changes do affect municipal costs. This is obviously not the case for Swedish municipalities' waste operations. Thus, there is neither any obvious negative or positive reported economic impact of population changes related to waste activities.

The results related to the waste operations, however, do support Christoffersen & Larsen (2007), who did not find any systematic differences in the total cost connected to differences in municipalities' population. Christoffersen & Larsen (2007) point out that it does not necessarily mean that there are no impacts, but that this is compensated by differences in quality. The Swedish local government monopoly, and the use of a cost-based principle, makes it difficult to conclude for sure that population changes have no systematic economic impact on waste operations. At the same time, it seems reasonable to conclude that waste operations are relatively easily adaptable, because politicians in Swedish municipalities are motivated to keep fee levels down (Fjertorp, 2010). Waste operations have even undergone a restructuring process during the period analyzed. Those structural changes may have facilitated an adaptation to population changes in an economically sustainable way.

Does Population Change Imply Economic Impacts for water and wastewater operations?

The results show that there are clear economic impacts connected to population changes when it comes to water and wastewater operations. It should be noted that the study's findings should not be interpreted as an indication that the levels of costs and fees are lower in municipalities with a relatively large population compared to municipalities with a relatively small population. A correct interpretation is that the levels of costs and fees are lower in municipalities with population growth, compared to municipalities with a declining population.

The results for the water and wastewater operations are consistent with conclusions drawn by Mäding (2004). Contrary to what one would expect from the results of Ladd (1992), the present study shows that the cost of water and wastewater services is not growing as fast as the population. In a study of U.S. municipalities, Holcombe & Williams (2008) noted that when all expenses are taken into account, a higher population density does not mean that the average expenditure per capita is reduced. However, they point out that individual municipal operations can reduce the cost. The results of this study demonstrate that the water and wastewater operations in Swedish municipalities are one such business, where population growth tends to generate economic benefits. The reported economic benefits that arise within the water and wastewater operations do not apply to investment expenditure per connected capita, which instead increases greatly in municipalities with population growth. On this point, the result is consistent with both Ladd (1994) and Fjertorp (2010).

One explanation to the clear economic impact is that many assets used in water and wastewater operations were built during the 1960s and 1970s. The forecasts pointed to a sharp increase in water use, and facilities were designed based on those forecasts. Subsequently, the forecasts were not met, which led to overcapacity in many municipalities. Municipalities with population growth have had the opportunity to use this capacity. This could also be a contributing explanation as to why the cost per connected is lower in municipalities with a growing population, compared with a declining population.

However, results indicate that future population growth requires a substantial amount of investments in tangible assets. Those assets will affect the future costs for operation, maintenance, depreciation, and interest, which often have a very long period of use. While making it possible to push the level of fees down for the current residents, population growth also puts a financial burden on future residents. It should also be noted that the results indicate that municipalities have difficulties adjusting the service capacity for water and wastewater to a decreasing population without increasing the remaining residents' fees.

Are Population Changes Desirable?

There is a great interest in issues related to population growth among Swedish municipal politicians (Niedomysl, 2007). Municipalities with a decreasing population are considered to have a problematic situation. This paper seeks to clarify the economic impacts of population changes on technical services in Swedish local municipalities. The study concludes that waste operations tend to be able to adapt to current population trends without any direct economic impact on the residents. On the other hand, population growth seems to be desirable in order to create economic benefits within water and wastewater operations. Population growth makes it possible to offer water and wastewater services at lower costs and user-fees, even if investment expenditures increase. One important reason as to the difference between the two technical services is that water and wastewater operations are highly more tangible asset-intensive compared to waste operations.

The results of this study posit answers to what economic impact population changes have on two fee-financed technical services. To offer a complete picture, similar studies should be done for other sectors within municipal public operations. However, this study contributes with a puzzle piece to the overall picture of the economic impact of population changes in Swedish local municipalities.

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