Public Procurement and Non-contractible Quality: Evidence from Elderly Care

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Abstract:

Many quality dimensions are hard to contract upon and are at risk of degradation when the service is procured rather than produced in-house. On the other hand, procurement may foster performance-improving innovation. We assemble a large data set on elderly care services in Sweden for the 1990-2009 period, including survival rates, our measure of non-contractible quality, and indicators of subjectively perceived quality of service. We estimate the effects of municipalities' decision to procure rather than produce in-house on non-contractible quality using a difference-in-difference approach and controlling for a number of other potential determinants. The results indicate that procurement significantly *increases* non-contractible quality as measured by survival rate, reduces the cost per resident but does not affect subjectively perceived quality.

Keywords: incomplete contracts, privatization, procurement, quality, elderly care, mortality, outsourcing, nursing home, performance measurement.

JEL code: H57, I18, L33

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1. Introduction

Government and private firms outsource many activities to external providers. Public procurement alone accounts for an estimated 15 percent of the world GDP (Bajari and Lewis, 2011). Cost savings from increased specialization, scale economies and supplier competition can be very large (Bandera, Prat and Valletti, 2009).

However, maintaining an appropriate quality level may be a concern. For standardized products, quality degradation can be avoided by properly written and managed contracts. The risk of quality degradation is higher, however, when the procured products or services are complex and important quality dimensions are hard to verify and contract upon. In this paper we attempt to empirically identify the effects of shifting from in-house production to outside procurement on non-contractible quality dimensions - both objectively measured and subjectively perceived ones - for a common but rather hard-to-contract-upon publicly provided service: elderly (nursing home) care.

Quality degradation in non-contractible dimensions after outsourcing can occur because the cost-saving incentives of private contractors are much stronger than those of public in-house providers, and cost savings tend to affect the provision of quality (Hart et al., 1997).

Degradation of non-contractible quality can be particularly acute in public procurement also for another reason. In private transactions, where buyers have substantial discretion and can react to non-verifiable quality signals, reputation, brand names and long-term informal relations are used to support high-quality equilibrium sustained by the link between current performance and future sales (Klein and Leffler, 1981; Macaulay, 1963).

Public procurement legislation instead requires procedures to be objective and transparent for accountability reasons, limiting discretion and thereby the scope for such mechanisms (Kelman, 1987). In many countries a public procurer is in principle not allowed to discriminate in favour of strong brand names, nor of providers that performed well in the past on non-verifiable performance dimensions.

Similarly, while a public procurement contract can give the buyer an option to extend the duration of the supply contract, the exact length of the extension must typically

be specified in the original contract. Under many public procurement legislations the criteria driving the decision to award the extension must be 'objective', that is, verifiable. Even where a public procurer has the possibility of linking future sales to provided quality, e.g., via vendor rating and contract renewal schemes, existing regulations make this link very tenuous for non-contractible dimensions that cannot be audited by third parties and therefore generate accountability concerns.

In this paper we study the effect of outside procurement on non-contractible quality dimensions of publicly provided nursing home services in Sweden.[1] To do this we construct and study a panel including almost all Swedish municipalities over a period of up to 19 years.

We consider two main measures for non-contractible quality. The first one is mortality rates, a quality indicator commonly used in the literature and one that was not contracted upon (probably because it is too noisy at the single institution level and also so as not to induce screening of patients) and that is objectively measured for the whole panel.

The second indicator is a customer satisfaction index, a measure of subjectively perceived quality that was also not contracted upon but that is unfortunately only available for a cross-section of municipalities. We argue that we can estimate at least part of the effects of procurement, or outsourcing, on non-contractible quality via a statistical analysis of the impact of procurement on mortality rates and customer satisfaction indicators. In addition to this, we study the effect of procurement on the cost for provision of nursing home care for the elderly.

Using a difference-in-difference random effects approach we find a significant decrease in the mortality rates of the elderly after a regime shift from in-house provision to (partial) outsourcing. The results are consistent with a 1-3 percent decrease in mortality among residents of nursing-homes or, equivalently, with an extension by about half a month of the expected remaining 1-1.5 years of life upon entry.

[1] In Sweden the public sector - including publicly held corporations that must adhere to the Procurement Act - is estimated to procure each year for about SEK 500 billion (€ 50 billion), corresponding to 16 to 18 percent of GDP (Bergman, 2008).

Procurement is associated with a 3 percent reduction of the per-resident cost of service but there is no reduction of total cost, suggesting that there is a balancing expansion of the number of beds. We find some indication of a negative impact of procurement on subjectively perceived quality. While procuring municipalities do not differ significantly from other municipalities, there is a significant negative association between the share of homes outsourced in a municipality and customer satisfaction.

The reminder of the paper unfolds as follows. Section 2 discusses prior empirical research that can be related to the current study, as well as the theoretical background. Section 3 describes the characteristics of the elderly-care industry in Sweden followed by Section 4 that presents our database and reports some descriptive statistics. Section 5 describes our empirical approach; Section 6 presents our main results while Section 7 includes an extended empirical analysis where the main results are checked for inclusion of trend specific effects, costs and admission policy as well as to what degree the provision of nursing home care is procured. Finally, Section 8 briefly concludes.

2. Theory and prior empirical studies

Theory

With pure in-house production, there is no element of competition. Then, government may have a more direct control over the various quality dimensions of the services that are offered. However, if quality cannot be contracted on, in-house production may also suffer from poor quality. After all, government tasks must be delegated to agents – employees – that tend to be self-interested.

The analysis of Hart et al. (1997) focuses precisely on how the mode of public goods production – in-house by the government vs procured from private contractors – affects non-contractible quality provision, as well as innovation and cost efficiency. They propose an incomplete-contracts model where the producing agent can make non-verifiable investments to increase (non-verifiable) quality or to reduce cost; the latter investment will, however, be associated with a fall in quality.

The main presumed differences between internal and external production is that, first, the government can veto any investment for in-house production but not for

outsourced production; and, second, that an in-house agent (a government employee) will be given a smaller share of the rents created by these investments. The implication is that an outside agent will be more prone to making both types of investments – but will tend to invest too much in cost savings. If non-contractible cost reductions have large deleterious effects on non-contractible quality and there is little scope for efficiency-enhancing innovation, then in-house government production may be preferred. Otherwise, outside procurement should be preferred as it may lead to increased quality besides lower costs.

Abandoning the stark assumption that quality is completely non-contractible, Levin and Tadelis (2010) assume that the cost of specifying and enforcing quality for external provision varies across goods and services, and that it is convex in the required quality level. Again, the government can opt for in-house provision. With in-house production, contracting costs will be zero, but cost incentives will be weaker, so production costs will be higher. The conclusion parallels that of Hart el al. (1997): when quality is important enough, in-house production dominates outsourcing. In Levin and Tadelis' model, the reason is that saving on transaction costs more than compensates for the decrease in productive efficiency.

Putting together the results of Hart et al. (1997) with political theories of privatization emphasizing the political costs of publicly owned enterprises linked to exchanges of overemployment against vote (e.g. Boycko et al., 1996), in his influential survey Shleifer (1998) concludes that privatization dominates in-house government production unless: "1) opportunities for cost reductions that lead to non-contractible deterioration of quality are significant; 2) innovation is relatively unimportant; 3) competition is weak and consumer choice is ineffective; and 4) reputational mechanisms are also weak."

Indeed, in standard market interaction the suppliers' incentives to degrade quality are checked by their concern over reputation and brand-name value, even in the absence of repeat purchases (Bar-Isaac and Tadelis, 2008). With repeat purchases, buyers may establish long-term supply relations, supported by threats to break those relations if the suppliers degrade quality (MacLeod, 2007). In general, the main mechanism to maintain a quality level above the minimum when quality is non-

verifiable and observable only ex post is to have future sales increasing in current quality level.

In the context of public procurement, if quality is non-verifiable but observable in advance, the procurement design could give the procurer sufficient discretion to choose high-quality providers (Kelman, 1987). The disadvantage is of course that the procurer will then be less accountable (Banfield, 1975). The outcome will not be fully predictable and it will be impossible to verify ex post that the contract was awarded to the supplier with the best bid, making the process susceptible to corruption. Because of these concerns, public procurement rules generally limit the freedom of the procurer to select provider on the basis of reputation or other non-verifiable aspects. Hence, rules set up to deal with one problem (accountability) may create another (adverse selection); one that would not exist in the absence of the rules.

If quality is non-verifiable and observable only ex post, the situation is even more difficult. The buyer must now give the seller incentives to provide quality. Bonuses (monetary or in terms of contract renewal) or penalties that depend directly on ex-post observed quality cannot help, unless the buyer can a) discretionally decide bonuses and penalties and b) make it credible that it will fairly reward high quality and punish low quality (Calzolari and Spagnolo, 2009; Iossa and Rey, 2010). Although a public entity may conceivably be able to commit to such a scheme, it may not be possible or desirable to give the procurer such discretion – due to the risk of corruption.

Alternatively, an element of consumer choice may link current quality and future sales also in a public procurement setting. This can be done without post-award competition, as is typical of the procurement of public transport services. The contract may be structured so that the seller retains the ticket revenues – and these revenues will tend to increase in the quality level. In a traditional consumer-choice model, however, there will generally be competition ex post between two or more selected providers. This ex-post competition for customers gives incentives for providing high quality also after the selection stage, and also on non-contractible

quality, as providers can 'steal' customers from each other by offering better services.[2]

In the absence of consumer choice and with reputational forces constrained by accountability regulation competition on price is likely to induce even lower quality when contracts are incomplete and non-contractible qualitative aspects are crucial (e.g. Spulber, 1990; Manelli and Vincent, 1995), possibly contributing to further weaken reputational forces (Calzolari and Spagnolo, 2009). Clearly, if the procurer only looks at the price when awarding contracts, then evaluation of past performance becomes ineffective. Also, to the extent that intense price competition makes future sales less profitable, the prospect of future sales will be a weaker incentive to provide quality today. Competition in other dimensions than price may also dissipate profit and, hence, may also make future sales a less attractive carrot for current quality.

Cost-sharing can possibly tilt the balance in the direction of higher quality (Laffont and Tirole, 1993; Bajari and Tadelis, 2001). If the procurer reimburses a fraction of the supplier's cost, it will be less costly to produce higher quality. For a given return in terms of future sales, the producer will have stronger incentives to raise current quality. Hence, cost-sharing schemes can boost the effectiveness of the other mechanisms for encouraging high quality.[3]

Lindqvist (2008) develops a theory of privatization and quality related to this argument based on the multitask framework by Holmstrom and Milgrom (1991). In his model, an agent can put effort into increasing the quality of a service or reducing costs. Being residual claimants, private owners have stronger incentives to cut costs than public employees. However, if quality cannot be perfectly measured, providing a private firm with incentives to improve quality forces the owner of the firm to bear risk. As a result, private firms will always be cheaper for low levels of quality but may be more expensive for high levels of quality.

[2] This benefit comes, as usual, at a cost: with consumer-choice models the quantity sold by each of the provider is uncertain and, with more than one supplier, smaller than in single-provider procurements; and the higher risk and smaller quantities is typically reflected in higher prices, together with the higher quality.
[3] Laffont and Tirole (1993).

Prior empirical research

Although the effect of privatization or outsourcing on non-contractible quality is of fundamental importance for the efficient organization of government, this issue has attracted few empirical studies, presumably because it is difficult to subject non-contractible and subjectively perceived quality to quantitative analysis.[4] Levin and Tadelis (2010), for example, report that outsourcing is indeed less common when quality matters, but do not investigate the effect of outsourcing on quality.

Precisely because the importance of non-contractible quality and the scope for quality degradation varies across services, the effect of outsourcing must also be expected to vary across services. The quality effect of outsourcing cannot be determined once and for all, so that an effective procurement policy seems to require that the impact of procurement is explored in different contexts.

A field that has generated a relatively large empirical literature is school voucher programs' effect on pupil performance (e.g. Hsieh and Urquiola, 2006, and Angrist et al., 2006) and choice of school (Angrist et al., 2002). Here, outsourcing goes hand in hand with intensified competition through consumer choice based on voucher systems; the typical finding seems to be that there is no significant effect on average pupil performance.

A small number of studies have focused on prison services.[5] After outsourcing of the medical staff at prisons, according to Bédard and Frech (2009), inmate mortality increased by about 10 percent. While their empirical strategy was similar to our (they too rely on difference-in-difference analysis), they do not seem to have information on costs. They cannot, therefore, evaluate whether the reduction in quality measured by the increased mortality was accompanied by strong cost savings, or even determined by a deliberate switch towards (possibly efficient) cost saving policies. Bayer and Pozen's (2005) study of juvenile offenders is also related to our, as they find that recidivism is larger among those released from privately operated correction facilities, relative to publicly operated facilities. Their data, however, does not allow for robust causal inference of the kind a difference-in-difference analysis permits.

[4] An important exception is education – the determinants of educational outcomes, including the impact of voucher systems, have been studied extensively as will be discussed shortly.
[5] Possibly inspired by the lively UK debate and following the influential paper by Hart et al. (1997) cited above, which used prisons as an archetypical example.

Lindqvist (2008) study residential youth care. He develops a model where the supplied service is a credence good – the producer has private information whether a certain treatment is needed or not – so that privatization may increase costs due to overtreatment. He then tests the model on a data set of Swedish residential youth care facilities and finds that total cost is indeed twice as high in private facilities due to much longer treatment spells.

Quantitative studies of quality in the US elderly care (nursing home) industry have mainly focused on the effect of ownership, i.e., on the difference between non-profit and for profit facilities. Anderson et al. (2003), for example, reports lower quality in for-profit care. Similarly, Amirkhanyan et al. (2008) finds that for-profit providers violate quality standards more often than non-profit providers. The latter study is based on a large institution-level sample, with numerous controls for client composition and similar measures. In a study based on more than 1000 individuals, Chou (2002) addresses the effect of asymmetric information and finds that for-profit homes provide lower quality than non-profit rivals when the client's position is weak, i.e., when the client has no living close relatives or is dement, but not otherwise. In common with the current study, Chou uses mortality as the main indicator of quality.

A concern is that the estimated effect of ownership status on quality may be affected by sample selection bias. To address this concern, Grabowski and Stevenson (2008) focus on quality changes following changes in ownership status among US nursery homes. They find no such effect, while finding that homes that change from for-profit to non-profit status tend to have higher quality than homes that make the opposite transition. They conclude that the negative impact of for-profit status found in earlier studies is due to selection effects, rather than a causal effect of ownership status.

Broadening the perspective to the choice of contractual form in other markets, there exists a small but growing empirical literature, including, e.g., Bajari et al. (2009) (complex construction projects) and Ménard and Saussier (2000) (comparison of the performance of in-house and outsourced water utilities). The latter study finds no significant differences between in-house and outsourced water utilities but it also focuses on quality characteristics that appear relatively easy to contract on.

From Jensen and Stonecash (2005) survey of the literature on public-sector outsourcing, it is apparent that while a relatively large number of studies have addressed the size of the cost savings from outsourcing, few have tried to evaluate the effect of outsourcing on quality. The only cited article finds, based on a case study, that quality falls (Cope, 1995).

3. The Swedish market for provision of nursing home for the elderly

Since 1992 elderly care in Sweden is the responsibility of the municipalities. Close to 100,000 persons live permanently in elderly care units (or nursing homes), while more than 150,000 receive assistance in their homes. The provision of elderly care is an important part of the welfare system and it consumes a relative large part of the resources of the Swedish public sector. The cost of elderly care, home care as well as care in nursing homes, was approximately SEK 90 billion in 2008, or close to 3 percent of GDP. Of this, SEK 56 billion was for elderly care units.[6]

There are about 2,600 nursing homes in Sweden, of which about 10 percent were privately operated in 2008.[7] Almost all of these are owned by for-profit corporations; many of the owners are private-equity firms. However, the admittance decision is made by the municipality. A private provider cannot decide whom to accept and nor does it have the right to decline, given that it has capacity (free beds). Income-dependent fees cover on averages 4 percent of the cost, with the municipalities paying the rest. Although a unit is privately operated, the facility itself is often owned by the municipality.

During the period we studied the legal status of voucher systems for elderly care remained unclear, so only a tiny fraction of the private provision have been organized as a consumer-choice system. Hence it is unlikely that consumer choice contributed significantly to the quality of provision we measure.

Elderly living at nursing homes constitute 7 percent of the population aged 65 or more – less than in Norway and the Netherlands, more than in Germany and about the same as in France (Larsson et al., 2008). People aged 80 or more make up 80

[6] NBHW, 2009.
[7] NBHW, 2008. In addition, there are about 150 transitory (short-stay) nursing homes, with another 11 000 residents. The fraction of private provision has risen rapidly since, to almost 20 percent in 2011.

percent of the residents; in this age group 16 percent of the population lives permanently in care units. For those above 95 years of age, the fraction rises to about 50 percent. More than two thirds of the residents are women and around three quarters of the residents are demented.[8]

Variation within Sweden is large; the ratio between the municipality with the highest and the lowest fraction of its population in nursing homes is about four. Northern and rural municipalities tend to have a high fraction of their population in nursing homes, mainly due to a more elderly population. Larsson et al. (2008) report that among people aged 80 or more, the fraction living in permanent care fell by about a quarter between 1995 and 2004, due to better health and because of a policy shift towards providing more assistance at home in order to delay entry into nursing homes.

From the age of 40 at least until the age of 90, the logarithm of mortality in general rises more or less linearly with age. For example, the annual mortality rate is 1 percent approximately at the age of 63 (68) and 10 percent approximately at the age 84 (87) for Swedish men (women).[9] Admittance to a nursery home is a strong indicator of increased mortality rates (Larsson et al., 2008). Also, they report that while about 10 percent of the population aged 75 or more live in elderly care units five years before their death, the fraction rises to about 50 percent in the months prior to death. The average age when admitted to a care unit is about 84 years. After about one years in a care unit, half of the individuals will have deceased.[10]

Procurement has become an important mechanism for organizing elderly care in Sweden since the 1990s. The contract is awarded after a tendering procedure where the winner is nominated on the basis of lowest price, highest price/contractible quality score or, more unusually, highest contractible quality for a given price. Once a winner has been nominated, the contract is basically a per-resident fixed-fee contract with an average duration of close to four years. Often the procurer has an option to extend the contract once or twice, with an average total extension period of more than two years.[11] Following the EU directives (2004/17/EC and 2004/18/EC) any qualitative criteria that will be considered when public contracts are allocated

[8] SALAR, 2007; NBHW, 2009.
[9] SCB, see ://www.scb.se/statistik/_publikationer/BE0701_1986I03_BR_BE51ST0404.pdf
[10] Personal communication with experts at SALAR.
[11] Bergman and Lundberg, (2011).

must be listed in the so-called contract notice (a document published by the procuring authority that contains the information on which the bidders base their bids). Contract performance clauses are also to be specified in the same document.

4. The Data

All of our data is by municipality, rather than by elderly-care home. Although this increases noise in our data, it also has the advantage of reducing problems of sample selection. Focusing on individual homes, we would be concerned that private providers could select (or would be selected by) a non-representative group of clients and that this would bias our results. However, if we use municipal-level mortality rates selection would not be a cause of problem. We know that less than one percent of nursing-home residents live outside of their own municipality, so we are confident that selection across municipal borders will not be a large concern. Selection within the municipality may still occur, but given that we are interested in the total effect this is not a problem either.

The data is drawn from four main sources. First, we have panel data on 290 Swedish municipalities with an average population of approximately 30,000 inhabitants. This data is mainly taken from Statistics Sweden (SCB), covers the 1990 to 2009 period and includes the number of elderly citizens by five-year age groups (60 to 64, 65 to 69, 70 to 74 and so forth, with the oldest age group covering 95-plus-year-olds), mortality by age group, as well as a number of municipality characteristics, such as population density, educational level, employment rate, immigrants' share of population etcetera. For the period 2000 to 2009 we also have municipal-level data on the average cost per person in sheltered permanent accommodation (nursing homes), total expenditures for nursing homes and, by age group, the number of residents.

Second, we have cross-sectional data at the nursing-home level that is related to contractible input quality and that is collected by the National Board of Health and Welfare (NBHW), including whether there is a choice of meals, whether there is more than one person in each room and the educational level of the staff; all in all seven main categories or variables (see Table A1 in the Appendix). These data have

been collected by the NBHW since 2007.[12] All quality parameters are reported on a one-to-five scale, where a five reflects the highest quality level. Out of the 290 municipalities, 287 responded and 2,584 of Sweden's 2,596 nursing homes are included. We use the 2008 data. Descriptive statistics and variable s are found in Table A1 in the Appendix.

Third, the NBWH has asked clients and their relatives how satisfied they are overall with the quality of the service provided in elderly care homes, as well as their views on particular aspects of the care they receive. The survey generates a customer satisfaction index (*CSI*) capturing subjectively perceived quality of service. Of the close to 60,000 surveyed individuals, more than 35,000 (61 percent) responded. The survey was undertaken between August and October 2008.[13] Recipients of elderly care were asked to grade, on a ten-graded scale, the quality of the services provided concerning information, staff's attitude, user influence, safety, extent of care, food quality, cleaning and hygiene, health care, social interaction and activities and the standard of the room and the facility. Finally, the respondents were asked to give an overall evaluation of the care they received. In 62 percent of the cases a relative, associated person or legal representative answered the questionnaire on behalf of the recipient of care. The data are available on the municipality level, not for individual nursing homes.[14]

Fourth, we have surveyed all municipalities about what method they use to organize elderly care: in-house production, traditional procurement, a voucher scheme – or a combination thereof. We asked what fraction of the beds was under in-house operation and when procurement was first introduced for this service in the municipality. Also, we asked if there had been a shift in the method organizing

[12] NBHW, 2008. The number of quality indicators has increased in the 2009 report.
[13] NBHW (2009).
[14] Since we do not have access to the original data we can only make a partial analysis of non-responses. Across municipalities, the response rate is positively correlated with the decision to procure and with the fraction of beds that are procured. A possible explanation is that better educated clients have a higher response rate. This is not likely to introduce bias, since we control for education. Alternatively, it may be perceived as more important to respond when there are multiple providers and that, therefore, a larger fraction of the responses are not from the residents themselves. Only four out of a thousand surveys were answered – on behalf of a resident – by someone from staff, versus more 500 from relatives. When relatives answer on behalf of the resident, they report, on average, less satisfaction with the services that when someone from the staff helped the resident. Yet if all additional responses on procuring municipalities – about 2.5 percentage points higher response rate on average – are from relatives, we expect the reduction of the *CSI* to be only about 0.15 units.

elderly care, other than the initial decision to procure. The survey was undertaken during 2009 and we obtained answers from all but six municipalities.

Descriptive statistics

Table 1 provides summary statistics of socio-economic factors that will be controlled for in the empirical analysis. The summary statistics is also reported by type of provision; external (shift = 1) or in-house (shift = 0). In addition, Table 1 includes summary statistics for the total cost for nursing home care and the cost per person. The inclusion of socio-economic factors is motivated by e.g. Gallo et al. (2000) and Shkolnikov et al. (2011). Gallo et al. find the job market situation to have a negative and significant effect on physical and mental health, after controlling for other socio-economic factors, while Shkolnikov et al. find evidence of increased differences in mortality between population groups with different levels of education.

In total, 276 out of 290 municipalities are included in the data. Eight municipalities are excluded from the panel due to them participating in a split or fusion of municipalities and six municipalities did not respond to our survey.

Population density is defined as the total population per square kilometer. Education is defined as the share of the total population with more than three years of university studies. The employment rate is the employed population aged 16 and above divided by the total adult population. Immigrants 1 and 2 are the share of immigrants aged 55 to 64 and the share of immigrants aged 65 and above, respectively. Total cost (in million SEK) and annual cost per resident (in 1000s) are measured at 1990 prices in Swedish kronor (SEK). Statistics for total population and average income are presented although these variables will not be included as controls in the regressions.

Municipalities that procure elderly care are larger, have higher average income, and are more densely populated than those who have never procured. The difference in population between municipalities is notable. The largest municipality (Stockholm) has a population almost 322 times larger than that of the smallest and 27 times larger than the average municipality.

The distribution of cost per resident is wide. The average annual cost per person in a nursing home is 359,150 SEK (at 1990 prices; close to € 60,000 at 2011 prices). The

lowest observed value is about half the average, while the maximum value is about four times higher than the mean.

Table 1. Descriptive statistics for municipal control variables and elderly care costs (averages for all years)

Variable	Sample[15]	Mean	Std. Dev.	Min	Max	N
Population	All	125.00	414.78	0.20	4 307.80	5356
density (inhabitants	Shift=1	399.25	822.33	0.90	4 307.80	804
per km2)	Shift=0	77.87	262.94	0.20	3 756.90	4438
Population	All	29 759.34	56 755.28	2 516.00	810 120.00	5356
(inhabitants)	Shift=1	63 384.60	102 497.30	7 220.00	810 120.00	804
	Shift=0	23 920.79	41 659.82	2 516.00	703 627.00	4438
Higher education,	All	0.06	0.03	0.02	0.27	5356
share of adult	Shift=1	0.10	0.05	0.02	0.27	804
population	Shift=0	0.05	0.02	0.02	0.22	4438
Share of left	All	0.51	0.13	0.09	0.88	5343
wing seats	Shift=1	0.44	0.11	0.09	0.78	804
	Shift=0	0.52	0.13	0.14	0.88	4425
Immigrants 1	All	0.03	0.03	0.00	0.34	5356
	Shift=1	0.04	0.02	0.01	0.33	804
	Shift=0	0.03	0.03	0.00	0.34	4438
Immigrants 2	All	0.02	0.02	0.00	0.26	5356
	Shift=1	0.03	0.02	0.00	0.25	804
	Shift=0	0.02	0.02	0.00	0.26	4438
Employment	All	0.44	0.04	0.29	0.54	4512
rate	Shift=1	0.46	0.03	0.37	0.54	786
	Shift=0	0.44	0.03	0.29	0.54	3630
Average income (1000	All	128.95	21.43	90.33	292.57	5076
SEK/year)	Shift=1	148.05	28.45	96.71	292.57	801
	Shift=0	125.41	17.74	90.33	223.96	4167
Total cost for elderly	All	125.22	244.40	9.51	3 947.15	2454
care (MSEK/year)	Shift=1	229.43	424.99	24.41	3 947.15	573
	Shift=0	93.27	137.81	9.51	1 948.85	1827
Cost per nursing	All	360.53	73.28	168.57	1 385.95	2757
home resident	Shift=1	362.33	71.04	168.57	950.56	664
(1000 SEK/year)	Shift=0	359.80	73.79	16911	1 385.95	2034

Among the 284 responding municipalities approximately two thirds still rely solely on nursing homes operated in-house and report that they have never procured this

[15] Shift = 1 for municipalities that have procured elderly care.

service. In the group that does procure, there is a notable dispersion in the extent of privately provided care. Figure 1 plots the fraction of procured nursing homes against the year of shift from in-house production to procurement. About half of the municipalities that have procured elderly care began doing so during the 1990s; the other half introduced competition after the year of 2000, as shown in Figure 1.

Note that Figure 1 only reports external provision, not beds won by the in-house unit in procurement. There is no clear correlation between the year of shift and the proportion of the nursing homes procured. This is verified by a simple regression of the number of years from the regime shift on the share of privately provided nursing home beds (not reported). Among procuring municipalities, the average share of beds that are managed by private firms is 28.6 percent (see Table A1 in the Appendix for descriptive statistics).

Hence, close to 10 percent of all nursing homes were managed by private providers in 2008. This value corresponds well with institution-level data from the NBHW, according to which about 10 percent of all units are privately managed.

Figure 1. Starting year for procurement of elderly care and share of beds procured in 2008.

The NBHW has transformed the results of its consumer satisfaction survey into a consumer satisfaction index, *CSI*, on a scale from 0 to 100. The average value for all municipalities is 70, with a slightly higher value for municipalities that have in-house

production only than for procuring municipalities. The difference is, however, not statistically significant (the *t*-value is 1.2).[16]

Figure 2 shows the development of annual mortality rate for the eight five-year age groups we are primarily interested in. Generally, mortality rates have fallen between 1990 and 2009. Also, for all age groups, mortality rates tend to be markedly higher in municipalities that have in-house production than in procuring municipalities (external). However, the graphs do not reveal whether this is because procurement results in lower mortality (a causal effect) or whether municipalities with low mortality tend to procure (a selection effect). A municipality that begins procurement during the 1990 to 2009 period will contribute to the "in-house" average for the first few years, before the first procurement, and to the "external" average for the subsequent years. Hence, the curve representing mortality in municipalities with external provision is based on very few observations initially, rising to about a third of the whole sample in 2009.

Figure 3 displays the mortality rate for only those municipalities that shift from in-house to private regime. The solid line represents the municipalities before they shift to procurement and the dashed line represents them after they have shifted. One (1) municipality had shifted to procurement already in 1990. By 2008 all municipalities in our sample that eventually introduced procurement had done so; hence the line representing as yet pre-reform municipalities disappears after 2007. Visual inspection of the graphs suggests that procurement is associated with lower mortality rates.

[16] We treat each municipality as an observation, independently drawn from an infinitely large population.

Figure 2. Mortality rate by age group, all, before (in-house) and after shift to private provision (external).

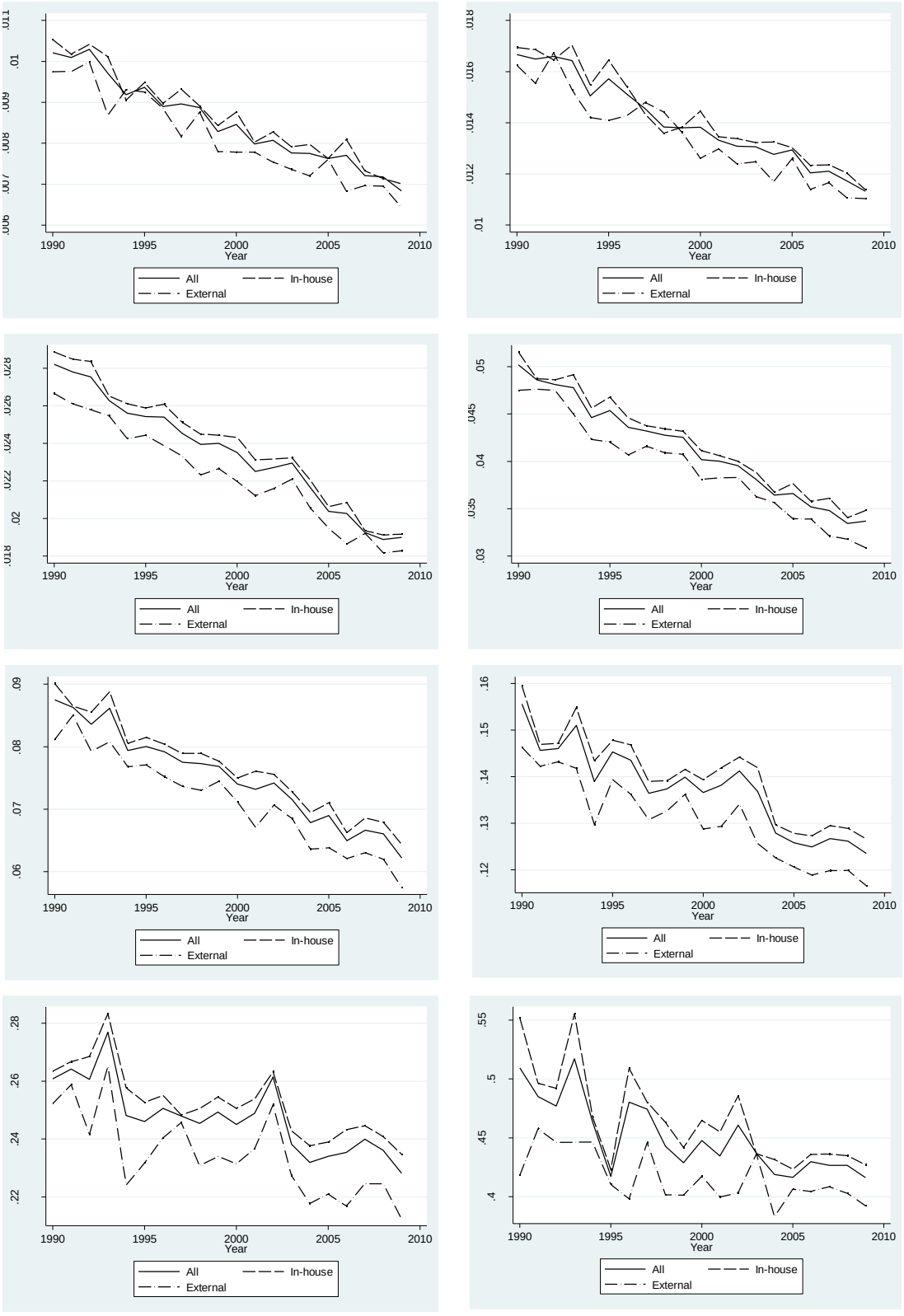
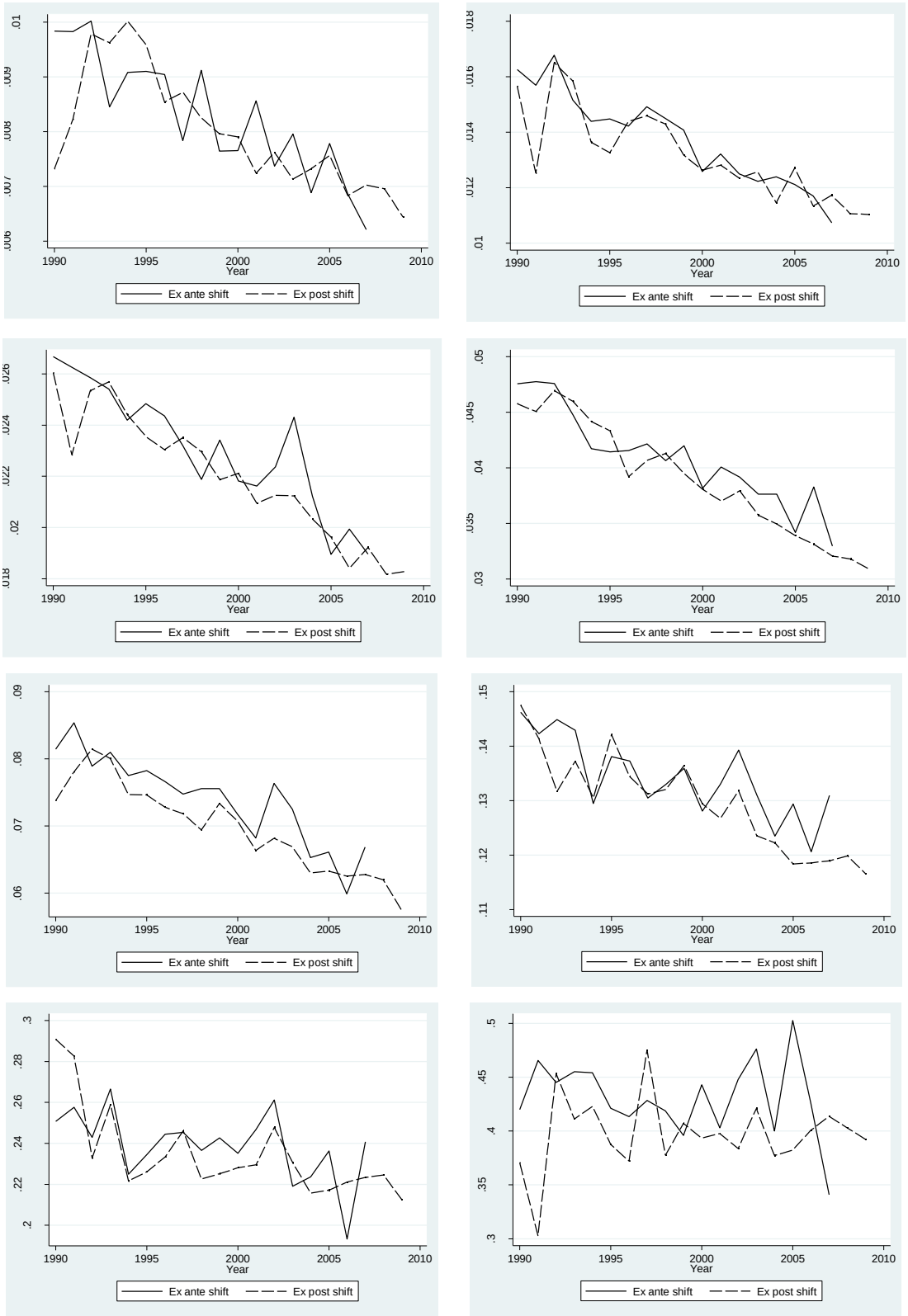


Figure 3. Mortality rate by age group. Municipalities that have shifted from in-house provision to procurement, ex ante (solid line) and ex post the shift (dashed line).



5. Empirical approach

We identify the effect of procurement from the municipality-wide changes in mortality following procurement, relative to contemporaneous changes in mortality among municipalities that have not shifted from in-house to external provision, i.e., with a difference-in-difference approach. [17] As already mentioned, using municipality-wide mortality rates largely avoids the problems of selection effects, since less than two out of one thousand elderly in permanent homes receive elderly care outside of their home municipalities.

We argue that mortality can be seen as a relatively objective measure of non-contractible quality. It is widely used as a quality indicator for medical and related services and it has the interesting property that it is observable to us, in the sense that it is amenable to statistical analysis, while it most likely cannot be contracted upon, for two reasons. First, because the relationship between mortality and elderly care quality is noisy, the number of patients would be too small within an individual provider-municipality relation to allow for significant inference and, hence, for effective incentive mechanisms to be linked to mortality. Second, explicit rewards (sanctions) linked to survival (mortality) would give providers incentives to screen patients. And even if mortality was in principle contractible, we know from the direct inspection of contracts that it was not contracted for in our data, so that it would still be a relatively good proxy for effects on other non-contractible quality dimensions.

Mortality panel data analysis

We opt for a random-effect model, rather than a fixed-effect model, trading a risk for biased estimates for the higher efficiency of the former model. To eliminate bias as far as possible, we include socio-economic variables such as educational level. Furthermore, while the fixed-effect model eliminates bias from time-constant non-observables that are correlated with the decision to procure, it will not eliminate bias from non-observables that are *not* constant over time and that are correlated with the key explanatory variable (here, the shift to procurement). Hence, as will be discussed further in Section 7, we strive to control for factors that are not constant over time and that are likely to be correlated with the decision to procure.[18]

[17] Sommers et al, 2012, uses similar methods to assess the impact of expanded Medicaid eligibility.
[18] Our modeling choice is supported by the Hausman test in …[x out of y age groups?]

The effect of a shift to procurement on mortality is estimated with feasible generalized least square (FGLS). We weigh municipalities with the square root of the population, since mortality rates will be more precise in larger municipalities, and we depart from a heteroskedastic model, since the variance differs between municipalities. All continuous variables are measured in logarithms.

Behind the choice of five-year age groups is a balance between having a sufficient number of observations in each group and taking into account differences in health needs between elderly of different ages. For small municipalities, the proportion of zeros is high for the oldest age groups. This is unfortunate because the model is logarithmic. Hence, we base our estimates on survival rate (*SURV*), which for age group *i* in municipality *m* at time *t* is defined as:

$$SURV_{imt} = \frac{Population_{imt} - No.of\ deceased_{imt}}{Population_{imt}} \quad (1)$$

where *Population* is measured at the start of year *t.* Expression (2) specifies the model used for estimating survival over the 1993-2009 period.[19]

$$SURV_{imt} = \alpha_0 + \beta_1 S_{mt} + \beta_2 D_{mt} + \beta_3 HE_{mt} + \beta_4 E_{mt} + \beta_5 LW_{mt} + \beta_6 IM_{mt} + \beta_7 E_{mt} + \sum_{t=1}^{17} \beta_{8t}\, TD_t + u_{mt} \quad (2)$$

where *i=1,…,9* represents age group, each group compromises five years; *m=1,…,276* represents municipality; *t=1,…,17* corresponds to the 1993-2009 time period and *TD* represents time dummy variables. The dummy variable S_{mt} assumes a value of 1 if elderly care in municipality *m* has been procured at time *t*. Municipality-and-time-specific control variables are the population density (D_{mt}), the share of the population with more than three years of university studies (higher education, HE_{mt}), the employment rate (E_{mt}) and the share of immigrants aged 65 and above (IM_{mt}).[20]

[19] The descriptive statistics and the graphs represent the period 1990 to 2009 but the long panel in the estimations represent the 1993 to 2009 period. This is due to lack of data on the employment rate for the first three years.

[20] The immigrant variable is the share immigrants aged 65 and above when the estimations are performed for the 7 oldest age groups and the immigrants aged 55 to 64 when the estimations are performed for the two youngest age groups.

The political situation in the local council is also controlled for. It is defined as the left wing, or socialist parties' share of the seats in the local council, LW_{mt}.

The error structure is given by

$$u_{mt} = \alpha_m + \varepsilon_{mt} \quad (3)$$

where α_m is a municipal-specific random effect and ε_{mt} is white noise – a municipal-and-time-specific error term.

The regression model is estimated for each of the nine age groups (55 to 59, 60 to 64, 65 to 69, 70 to 74, 75 to 79, 80 to 84, 85 to 89, 90 to 94, and 95 plus).[21] The effect of procurement on the specific age group is estimated by β_1.[22] A positive and significant effect of shift (S) would indicate higher quality (higher survival rate, or lower mortality) in a specific age group and vice versa.

Based on the graphs in Figure 3 and Figure 4 our prior is that β_1 will be significant and positive at least for the age groups where we find a sizeable share of the population in nursing homes, i.e., age groups 85 to 89 and above. We expect no significant effect of shift in age groups 55 to 59 years old and 60 to 64 years old. We expect no or very small effects in age group 65 to 69 due to the low share of the population in nursing home care, less than one percent (see Table A1 in the Appendix). The diff-in-diff methodology allows us to control for time-constant unobserved variation across municipalities.

6. Results: Survival and external provision

Expression (2) is estimated separately for each of the nine age groups and results are presented in Table 2. No significant effect of shift is found for the youngest age groups 55 to 59, 60 to 64 and 65 to 69, respectively. The results for the two youngest age groups are not reported in the table.

However, there *is* a significant effect on the survival in all of the more senior age groups, except the age group 85 to 89 years, although the significance level is lower for age groups 95-plus (6.8 percent) and 70 to 74 (7.3 percent). The coefficients

[21] We suppress the age-group index.
[22] In the standard notation of the diff-in-diff literature, S is the interaction of a treatment-group dummy and a post-treatment time dummy.

suggest a 1.4 to less than 0.1 percent effect on survival due to a shift from in-house regime to procurement, with larger effects for the more senior age groups, consistent with the fact that the fraction that receives care in nursing homes rises with age.

Table 2. Estimation results. WLS. Dependent is survival rate in municipality *m* in age group *i*, year *t*. Panels are heteroscedastic and weight is population. The time period is 1993 – 2009. The number of estimated covariances is 276.

	Age 95 plus		Age 90 to 94		Age 85 to 89		Age 80 to 84		Age 75 to 79		Age 70 to 74		Age 65 to 69	
Variable	β	z	β	z	β	z	β	z	β	z	β	z	β	z
S	0.014	1.82	0.004	2.25	0.001	1.03	0.001	2.90	0.001	2.76	0.000	1.79	0.000	1.26
D	0.004	1.11	0.004	4.35	0.002	4.20	0.001	6.24	0.000	0.84	0.000	-0.28	0.000	-3.52
HE	0.056	4.60	0.012	3.85	0.007	5.52	0.001	1.38	0.001	2.34	0.000	0.17	0.001	2.81
E	-0.040	-0.75	0.047	3.34	0.016	2.82	0.014	5.09	0.014	8.21	0.013	11.66	0.008	9.49
LW	-0.030	-2.10	-0.024	-6.99	-0.015	-11.30	-0.010	-14.50	-0.006	-15.19	-0.004	-13.14	-0.003	-15.13
IM 65 +	0.008	1.11	0.006	3.12	0.002	3.47	0.000	0.98	0.000	0.43	0.000	-3.40	0.000	-3.86
TD		yes		yes		yes		yes		yes		yes		yes
Constant	-0.484	-6.11	-0.245	-11.76	-0.134	-16.43	-0.085	-21.19	-0.038	-14.87	-0.020	-12.41	-0.011	-9.55
No. of obs		4503		4675		4675		4675		4675		4675		4675
No. of groups		276		276		276		276		276		276		276
Obs per group:														
min		9		12		12		12		12		12		12
avg		16.32		16.94		16.94		16.94		16.94		16.94		16.94
max		17		17		17		17		17		17		17
Wald chi2(22)		216.70		1092.36		1743.66		2391.69		2389.11		1829.05		1309.23
Prob > chi2		0.00		0.00		0.00		0.00		0.00		0.00		0.00

Although we are mainly interested in the effect of the shift variable and view the other variables as controls, we comment briefly on them. Most of them are significant and have the expected signs. More than three years of university level education seems to affect the survival rate in a positive direction. The only exceptions are age groups 80 to 84 and 70 to 74, respectively.

Higher employment rate is associated with higher survival rate for all age groups but the oldest one (95 plus). High population density decreases survival rates for the younger age groups, 65 years and less, while it has no or the opposite effect for the five oldest age groups. A higher socialist representation in the local council is associated with lower survival rate. The survival rate generally increases with the fraction of immigrants in the older age groups and decreases for the younger ones. The coefficients for the year dummies (not reported) indicate a clearly increasing trend in the survival rate.

An indication of the magnitude of the effect among those directly concerned can be obtained by dividing the estimated effect (as reported in the top row of Table 2) with the fraction of the population living in nursing home (Table A2 in the Appendix). According to this measure mortality is reduced by 1-3 percent, corresponding to a life-expectancy increase of two-three weeks after admittance to a nursing home. If we allocate the effect only to residents of procured elderly homes, assuming no impact on the municipalities' in-house units, the mortality reduction would be about three times as large for those concerned and the life-time extension would be around two months.

7. Extending the empirical analysis

There are at least three possible objections to our result. First, the effect could be due to differences in mortality or survival trends between procuring and non-procuring municipalities. Second, the decision to procure could be correlated with changes in expenditure. Third, it may be that while survival increases, quality deteriorates in other dimensions.

Addressing these concerns will also take us some way towards an understanding of the *mechanisms* behind the improvements observed after procurement, given that the results are robust to the three objections just mentioned. The most obvious

mechanism is that private firms are simply more efficient. Alternatively, the procurement process may compel the procuring authority to be systematic about care practices and quality standards and this effort may spill over also to the in-house units. A third explanation is that poorly performing units – with weak managers or dysfunctional "corporate" cultures – are the first to be targeted for procurement. If an adverse selection is replaced with average-quality units this will show up as an improvement.

Differential mortality trends

It has been suggested that the mortality may have been falling faster among well-educated citizens than among others.[23] Since municipalities that procure tend to have better educated and richer voters the shift variable could then pick up this trend divergence and erroneously lead us to conclude that procurement improves survival. To address this possible problem, we introduce a variable, *HET*, that allows the effect of higher education to vary over time. The variable is defined as the share of higher education times a trend variable. In a similar manner the effect of education is also allowed to vary over time by inclusion of a variable defined as the share of population employed times a trend variable (*ET*). Equation (2) is repeated below as equation (4) with the new variables included.

$$SURV_{imt} = \alpha_0 + \beta_1 S_{mt} + \beta_2 D_{mt} + \beta_3 HE_{mt} + \beta_4 E_{mt} + \beta_5 LW_{mt} + \beta_6 IM_{mt} + \beta_7 HET_m + \beta_8 ET_m + \sum_{t=1}^{17} \beta_{9t} TD_t + u_{mt} \quad (4)$$

where *i=1,…,9* represents age group, each group compromises five years; *m=1,…,276* represents municipality; *t=1,…,17* corresponds to the 200-2009 time period.

As can be seen in Table 3 and in contracts to Shkolnikov et al. (2011), there is no clear evidence of an increased positive effect of education, since the *HET* coefficient is insignificant. This could be explained by the differences in the approach, the data used and the periods of observation. (Their estimations build on the population in the Nordic countries aged 40 and above and separate analyses are performed for men and women.) There is one exception: the coefficient for age 75 to 79. The *HET*

[23] Sholnikov et al, (2011).

coefficient is significant and *negative* for this age group, contrary to our expectations. Further, there is no evidence of an increased positive effect of employment, since the *ET* coefficient is insignificant.

Table 3. Estimation results. WLS. Dependent is survival rate in age group i. Panels are heteroscedastic and weight is population. The time period is 1993 – 2009. The number of estimated covariances is 276. Control for trend effects in higher education (*HET* and employment rate (*ET*).

	Age 95 plus		Age 90 to 94		Age 85 to 89		Age 80 to 84		Age 75 to 79		Age 70 to 74		Age 65 to 69	
Variable	β	z	β	z	β	z	B	z	β	z	β	z	β	z
	0.014	1.76	0.004	2.14	0.001	1.11	0.001	3.03	0.001	3.26	0.000	1.85	0.000	1.21
S	0.004	1.04	0.004	4.19	0.002	4.24	0.001	6.46	0.000	1.40	-0.000	-0.23	-0.000	-3.45
D	0.056	3.09	0.010	2.30	0.006	3.39	0.002	2.12	0.002	4.00	0.000	0.42	0.001	2.48
HE	-0.095	-0.88	0.046	1.59	0.031	2.76	0.008	1.53	0.012	3.62	0.013	5.77	0.006	3.44
E	-0.030	-2.12	-0.024	-6.97	-0.015	-11.21	-0.010	-14.63	-0.006	-15.04	-0.004	-13.15	-0.003	-15.13
LW	0.008	1.15	0.006	3.15	0.002	3.27	0.000	0.78	-0.000	-0.15	-0.000	-3.40	-0.000	-3.74
IM 65 +	0.014	1.76	0.004	2.14	0.001	1.11	0.001	3.03	0.001	3.26	0.000	1.85	0.000	1.21
HET	0.000	0.06	0.000	0.57	0.000	0.55	-0.000	-1.59	-0.000	-3.42	-0.000	-0.41	-0.000	-0.76
ET	0.006	0.57	0.000	0.07	-0.002	-1.56	0.001	1.22	0.000	0.61	0.000	0.14	0.000	1.60
TD		yes		yes		yes		yes		yes		yes		yes
Constant	-0.524	-5.23	-0.249	-9.77	-0.125	-12.58	-0.087	-17.78	-0.037	-11.85	-0.020	-10.21	-0.013	-8.65
No. of obs		4503		4675		4675		4675		4675		4675		4675
No. of groups		276		276		276		276		276		276		276
Obs per group:														
min		9		12		12		12		12		12		12
avg		16.32		16.94		16.94		16.94		16.94		16.94		16.94
max		17		17		17		17		17		17		17
Wald chi2(22)		215.86		1080.72		1750.39		2409.63		2394.24		1828.00		1313.08
Prob > chi2		0.00		0.00		0.00		0.00		0.00		0.00		0.00

Contemporaneous expenditure shifts

Another possible weakness of our method is that there could be shocks that impact both on our measure of quality (survival) and on the regime choice. For example, a negative budget shock could trigger a transition to procurement *and* cuts in the budget for elderly care. Alternatively, given the apparent positive effect of procurement, the politicians may have "bribed" their constituencies into accepting procurement by simultaneously increasing spending on elderly care. A statistical analysis could then lead to the erroneous conclusion that procurement causes changes in non-contractible quality. To resolve this concern as far as possible, we control for expenditures per client in elderly care.

For the 2000-2009 time period we have, for each municipality, access to average costs for nursing-home care and the number of residents in different age group. We use this information to define two indices: a cost index (*COSTI*) and an admission-policy index (*RESI*). The cost index measures the municipality's actual cost per resident relative to the average cost for a municipality with similar population composition; the admission-policy index measures the municipality's relative generosity in admitting elderly to nursing homes. The exact definitions are provided in the Appendix.

As a first step, we estimate the effect of the shift to procurement on costs. We estimate the following regression equations, using either the municipality's total cost for nursing home care (*COSTT*), or the total cost per nursing home resident (*COSTR*) in municipality *m* at time *t*, as the dependent variable:

$$COSTT_{mt} = \alpha_0 + \beta_1 S_{mt} + \beta_2 D_{mt} + \beta_3 HE_{mt} + \beta_4 E_{mt} + \beta_5 LW_{mt} + \beta_6 IM_{mt} + \beta_7 RESI_{mt} + \beta_8 POP_{mt} + u_{mt} \quad (5)$$

$$COSTR_{mt} = \alpha_0 + \beta_1 S_{mt} + \beta_2 D_{mt} + \beta_3 HE_{mt} + \beta_4 E_{mt} + \beta_5 LW_{mt} + \beta_6 IM_{mt} + \beta_7 RESI_{mt} + u_{mt} \quad (6)$$

where *m=1,…,276 and t=2000,…,2009* and

$$u_{mt} = \alpha_m + \varepsilon_{mt} \quad (7)$$

As above α_m is the random effect and ε_{mt} is white noise. The effect of procurement on cost is estimated by β_1. In addition to the controls used above, the total-cost model

includes population in municipality *m* at year *t*, POP_{mt}. Again, all continuous variables are logarithmic. In both models the admission policy index (*RESI*) is included.

Table 4 reports our findings on the cost of provision of nursing home care for the elderly. The dependent variable is the log of costs. The first two columns report results for the cost per resident while in the last two columns total cost is the dependent variable.

Table 4. Estimation results. WLS (FGLS). Dependent is total cost or cost per care taker in municipality *m* in year *t*. Panels are heteroscedastic and weight is population. Time period is 2000 – 2009. Estimated covariances are 276.

	Total Cost		Cost per care taker	
Variable	*B*	*Z*	*β*	*z*
S	-0.004	-0.67	-0.029	-5.79
D	-0.074	-26.61	-0.026	-10.63
POP	1.008	217.58		
E	-1.230	-23.49	0.207	5.12
HE	-0.052	-4.83	0.045	5.19
LW	-0.045	-3.75	-0.007	-0.74
lM 65 +	-0.090	-19.67	0.023	6.13
RESI	0.153	17.65	-0.0143	-17.15
TD		yes		yes
Constant	-6.780	-73.49	6.225	117.84
No of obs		2672		2693
No of groups		276		276
Obs per group:				
Min		1		2
Avg		9.68		9.76
Max		10		10
Wald chi2(17)		102362.31		2275.57
Prob > chi2		0.00		0.00

Starting with the total cost there are no significant effects of a shift from in-house provision to procurement on total costs, possibly due to concurrent increases in the number of available beds. This can for example be explained by the decision to procure being prompted by a decision to increase the supply of beds in nursing home care for the elderly. The idea is that one change (expanding the number of beds)

prompts another change (change of type of provision). Another plausible explanation is that private providers have stronger incentives to maintain full occupancy. There is no apparent contradiction between these two possible explanations.

The cost-per-resident shift coefficient clearly suggests that private provision leads to a reduction in cost per resident. The estimated cost reduction is 3.0 percent. Taken together with the results showing a fall in mortality, procurement of elderly care seems to reduce cost per resident at the same time as it increases quality.

Commenting briefly on our control variables, we find that high population density and large representation of socialist parties is associated with lower costs per resident and lower total costs. Educational level, share of immigrants and employment rate are associated with higher costs per resident, but have no significant effect on total costs. A more generous admittance policy is associated with lower costs per resident and higher total costs, suggesting that elderly with better health status are admitted.

Additionally, to check the robustness of the finding that a shift from in-house to private provision seems to decrease mortality we include the cost index (*COSTI*) and the admission index (*RESI*) in a modified survival equation (see expression (2) for the original model):

$$SURV_{imt} = \alpha_0 + \beta_1 S_{mt} + \beta_2 D_{mt} + \beta_3 HE_{mt} + \beta_4 E_{mt} + \beta_5 LW_{mt} + \beta_6 IM_{mt} + \beta_7 ET_{mt} + \beta_8 COSTI_{mt} + \beta_9 RESI_{mt} + \sum_{t=1}^{10} \beta_{10t}\, TD_t + u_{mt} \qquad (8)$$

where *i=1,…,9; m=1,…,276; t=2000,…,2009* and with variables as defined above.

The extended model can only be estimated over the 2000 to 2009 period. The results are reported in Table 5.

The coefficients for shift for the different age groups confirm the previous findings: there is a positive and significant effect on the survival rate in all age groups aged 70 and above. The coefficients for the four oldest age groups are significant at the 5.3, 4.5, 1.7 and 4.1percent level, respectively. The magnitude is similar to that found for the long panel.

Table 5. Estimation results. WLS (FGLS). Dependent is survival rate in municipality *m* in age group *i*, year *t*. Panels are heteroscedastic and weight is population. The time period is 2000 – 2009. The number of estimated covariances is 276.

	Age 95 plus		Age 90 to 94		Age 85 to 89		Age 80 to 84		Age 75 to 79		Age 70 to 74		Age 65 to 69	
Variable	*β*	*z*	*β*	*z*	*β*	*z*	*B*	*z*	*β*	*z*	*B*	*z*	*β*	*z*
S	0.018	1.94	0.005	2.01	0.002	2.38	0.001	2.04	0.001	4.10	0.000	2.02	0.000	0.93
D	0.002	0.37	0.002	2.02	0.002	3.85	0.001	3.18	0.000	1.17	-0.000	-1.72	-0.000	-5.15
HE	0.056	3.96	0.014	3.42	0.007	4.38	0.001	1.58	-0.000	-0.31	0.000	0.73	0.001	5.40
E	-0.001	-0.01	0.079	4.51	0.014	2.01	0.025	7.00	0.016	6.73	0.015	10.19	0.009	8.02
LW	-0.031	-2.01	-0.019	-5.41	-0.013	-8.78	-0.009	-11.99	-0.005	-10.25	-0.003	-8.82	-0.002	-10.54
IM 65 +	0.014	1.68	0.009	3.92	0.002	1.97	0.001	2.12	-0.001	-2.22	-0.000	-2.70	-0.000	-2.83
RESI	0.018	1.31	-0.001	-0.34	-0.001	-0.63	-0.001	-1.57	-0.001	-2.62	0.000	0.46	0.000	0.29
COSTI	-0.012	-0.49	-0.024	-4.07	-0.010	-4.41	-0.006	-5.05	-0.002	-2.95	-0.001	-2.02	-0.001	-3.12
TD		yes		yes		yes		yes		Yes		yes		yes
Constant	-0.374	-3.99	-0.164	-6.41	-0.126	-13.15	-0.058	-11.65	-0.036	-11.47	-0.014	-6.62	-0.005	-2.95
No of obs		2605		2672		2672		2672		2672		2672		2672
No of groups		276		276		276		276		276		276		276
Obs per group:														
min		1		1		1		1		1		1		1
avg		9.44		9.68		9.68		9.68		9.68		9.68		9.68
max		10		10		10		10		10		10		10
Wald chi2(17)		159.16		715.41		994.17		1111.95		751.25		685.73		539.91
Prob > chi2		0		0		0		0		0		0		0

Somewhat surprisingly, the cost index coefficient indicates a negative relationship between expenditures and survival rate. It is negative and significant for all age groups but the 95-plus-years-olds. Our interpretation is that poor health drives expenditures and mortality. The coefficient of *RESI* is significant only for the age group 75 to 79, for which the coefficient is negative.

The results for the socioeconomic factors and year dummy variables are qualitatively the same as for the longer panel and are therefore not commented upon.

Other quality dimensions – perceived quality

The municipality's *CSI*, Consumer Satisfaction Index, is a subjective measure of perceived quality. One may argue that perhaps higher mortality is linked to better service provision in other dimensions, for example more freedom to go out walking under the risk of catching a cold and then pneumonia. The *CSI*, however, will allow us to control also for this.

Customer satisfaction – cross-section analysis

We do not have access to panel data for the *CSI*. Hence, we estimate the following equation on 2008 cross-sectional data:

$$CSI_m = \alpha_0 + \beta_1 S_m + \beta_2 D_m + \beta_3 HE_m + \beta_4 E_m + \beta_5 LW_m + \beta_6 IM_m + \beta_7 COSTI + \beta_8 RESI_m + \sum_{n=1}^{7} \beta_{9n} QY_{mn} + \sum_{n=1}^{5} \beta_{10n} MED_{mn} + \varepsilon_m \quad (9)$$

Except for some additions, variables and notation are as above, with *t* suppressed. Socio-economic factors have been shown to affect patient satisfaction in elderly people and therefore controlled for. (E.g., Lee and Kasper, 1998.) We add seven quality indicators for elderly care (QY_m) provided by the NBHW. The definitions of the quality variables are found in Table A1 in the Appendix. In addition, five health related factors, such as use of pharmaceuticals, are also controlled for (MED_m). See Table A1 in the Appendix for definition and descriptive statistics.

The quality and health related variables represent (objective and contractible) quality indicators measured by the NBHW and SALAR,[24] respectively, that mainly relate to inputs. Equation (9) is first estimated using the socioeconomic factors only and then estimated with QY_m and MED_m included. This allows us to check for robustness in the outcome with respect to systematic differences in quality and health indicators with respect to type of provision.

None of the quality or health related parameters are too highly correlated to be included in the regression equation (see Table A4 in the Appendix). Equation (9) is also estimated including the share of beds procured (*SP*) and the experience of procurement (*EXP*). The latter variable is defined as *EXP = 2008 – year of shift*.

Consumer satisfaction index as explained by type of provision

Consumer satisfaction is, in principle, a ranking variable, suggesting that a method such as ordered probit or logit should be used. On the other hand, the large number of possible outcomes and the fact that individual values are aggregated to the municipal level suggest that OLS should be used. Table 6 reports ordinary least square estimates. As reported above, the average *CSI* was observed to be slightly lower among the procuring municipalities but the difference was not statistically significant. After adding more controls (results are reported in Table A5 in the Appendix), there is still no significant effect of the type of provision on the consumer satisfaction index. This is also the case when the quality and health indicators are excluded.

Of the socio-economic factors, only population density and the political situation in the municipal council have significant effects on customer satisfaction. Higher population density and larger share of the seats in the local council assigned to the left wing are associated with less satisfaction.

Adding controls (see Table A5 in the Appendix for results) the coefficient for cost index becomes significant at the five percent level, suggesting that generous spending on nursing homes improves the *CSI*. The marginal effect on *CSI* of doubling the spending, starting from the average expenditure level, is about three.

[24] The Swedish Association of Local Authorities and Regions.

The admission policy index also becomes significant and is positive. The more generous admission policy – the more satisfied the residents (or their relatives) are.

Table 6. Results, OLS estimation, dependent is customer satisfaction index (CSI). Robust standard errors.

	Shift		Shift, share procured (SP) and experience (EXP).	
Variables	*B*	*t*	*β*	*t*
S	-0.139	-0.19	-0.142	-0.17
SP			-8.917	-2.95
EXP			0.121	1.24
D	-0.002	-3.16	-0.002	-2.79
HE	-23.519	-2.38	-14.301	-1.30
E	7.729	0.55	8.757	0.61
LW	-7.411	-2.48	-8.566	-2.72
IM 65 +	-18.818	-1.37	0.281	0.01
COSTI	1.783	1.21	1.427	0.93
RESI	0.601	1.14	0.501	0.87
Constant	73.406	10.38	72.875	10.16
No of obs		275		255
F(8, 266)		5.12		5.61
Prob > F		0		0
R-squared		0.12		0.14
Root MSE		5.147		5.085

Consumer satisfaction index as explained by extent of external provision

Based on the results presented in Table 6 we conclude that there is no statistically significant effect of type of provision on the consumer satisfaction index. Given that the provision has been procured, however, there is some evidence of a negative impact of the *share* of beds procured. The point estimate for the effect of the fraction of nursing home beds under private management is negative and statistically significant at the 9.4 percent level with quality and health variables included (Table A5) and highly significant if these controls are left out of the regression (Table 6).

Experience of procurement does not seem to have any effect on the *CSI* and neither the coefficient for *COSTI* nor that for *RESI* is significant. In other respects, the results are not sensitive for inclusion of controls for spending and admission policy.

Equation (9) is also estimated separately for only those municipalities that do procure (dropping *S* from the regression equation) and controlling for degree of procurement (*SP*) and experience. The results show (not reported) a negative effect of degree of procurement and CSI and a model that seems to fit the data better. The explanatory power increases from 14 percent to 41 percent.

Towards an understanding of the mechanism – the effect of the share procured

In order to shed further light on the effect on mortality of procurement (Cf. Table 2), equation (2) is also estimated with share of beds procured (*SP*). Again, due to data availability this is performed for the shorter panel, 2000 to 2009. The results are reported in Table 7.

The effect of shift is, with one exception, stable for the inclusion of share of beds procured. The previously (Table 2) result of a 6.8 level significant effect for the 95 plus aged group is now lost. However, there is a significant and positive effect of share of beds operated by private providers. For the other age groups the effect of shift is stable and a negative (aged 80 to 84) or no effects of share of beds procured is found.

The findings for the controls groups show a 5.7 percent significant and positive effect of shift for the part of the population aged 65 to 69 (a group where we can find a small fraction of nursing home residents) or no effect for the age groups outside the nursing home care (results not reported). The other controls are not commented upon as the outcome do not divert from the previous findings.

Table 7. Estimation results. WLS (FGLS). Dependent is survival rate in municipality *m* in age group *i*, year *t*. Panels are heteroscedastic and weight is population. The time period is 2000 – 2009. The number of estimated covariances is 276. Share of beds procured is controlled for.

	Age 95 plus		Age 90 to 94		Age 85 to 89		Age 80 to 84		Age 75 to 79		Age 70 to 74		Age 65 to 69	
Variable	*β*	*z*	*β*	*z*	*β*	*z*	*B*	*Z*	*β*	*z*	*β*	*z*	*β*	*z*
S	0.008	0.78	0.003	1.29	0.002	2.24	0.002	3.19	0.001	4.69	0.000	2.05	0.000	1.91
SP	0.073	2.24	0.007	0.74	0.001	0.32	-0.004	-2.04	-0.002	-2.21	-0.000	-0.31	-0.001	-2.42
D	-0.002	-0.42	0.003	2.81	0.002	4.57	0.001	4.59	0.000	2.19	-0.000	-1.49	-0.000	-3.78
HE	0.053	4.30	0.012	2.94	0.006	3.95	0.001	1.42	-0.000	-0.31	0.000	0.58	0.001	4.44
E	0.005	0.08	0.061	3.58	0.007	1.04	0.019	5.68	0.013	5.92	0.015	10.03	0.008	7.51
LW	-0.019	-1.21	-0.020	-5.80	-0.014	-9.76	-0.011	-13.09	-0.006	-11.01	-0.003	-8.90	-0.003	-11.75
IM 65 +	0.014	1.64	0.008	3.58	0.002	2.12	0.001	2.22	-0.000	-1.78	-0.000	-2.41	-0.000	-3.38
TD		yes		yes		yes		Yes		yes		yes		yes
Constant	-0.353	-4.08	-0.191	-7.81	-0.135	-15.31	-0.065	-13.95	-0.038	-12.45	-0.014	-7.08	-0.007	-4.78
No of obs		2604		2671		2671		2671		2671		2671		2671
No of groups		276		276		276		276		276		276		276
Obs per group:														
Min		1		1		1		1		1		1		1
avg		9.44		9.68		9.68		9.68		9.68		9.68		9.68
max		10		10		10		10		10		10		10
Wald chi2(17)		171.90		854.33		1032.33		1098.60		715.66		677.24		512.16
Prob > chi2		0		0		0		0		0		0		0

8. Discussion and conclusions

Somewhat contrary to our expectations and to some of the theoretical predictions, we find evidence suggesting that non-contractible quality *increases* following procurement. Survival improvements are concentrated to the age groups where nursing home residency is common. We arrive at our results after controlling for municipality characteristics and year effects, using a difference-in-difference random-effect approach. This finding is robust for controlling for trend specific effect of socioeconomic factors (education and employment).

For a shorter panel we are able to control also for admittance policy and costs. We find that per-resident costs fall after procurement, that total costs remain unchanged and that higher costs are associated with a *negative* effect on survival. We interpret the latter effect to be driven by variations in health status between municipalities: poor health increases costs while reducing survival. Our main result, that procurement increases survival, comes out even stronger in the shorter panel. This finding is robust also for the inclusion of *share* of beds operated by private providers – for all age groups but the oldest old. In that case, even though the there is an insignificant effect of the shift to procurement, the results indicate that a higher share of beds procured is associated with higher survival rate.

Using cross-sectional data, we find no statistically significant difference in customer satisfaction between procuring and non-procuring municipalities. We do, however, find that among procuring municipalities, those with a smaller share of procured beds have more satisfied clients.

We conclude that procurement has increased quality (survival) while simultaneously reducing costs per resident. There is, however, some indication that customer satisfaction falls after procurement. A simple explanation is that efficiency increases when production is transferred from in-house production units to private providers. An alternative interpretation is that the decrease in mortality is due to the process that precedes the procurement auction. The reform forces the municipalities to think systematically about quality standards; standards that can be implemented also in units that remain in-house. Yet other interpretations are that it is *competition* rather

than procurement that improves quality and that procurement is selectively used to oust under-performing management.[25]

As mentioned, during most of the period we have studied the public procurement rules were rather liberal, in the sense that the buyer had relatively large freedom to select the winner. This may have allowed buyers to maintain quality through informal reputational threats; and may have reduced competition and curbed cost efficiencies. The fact that procured elderly care during our period of study was expanding rapidly further boosted the importance of future sales relative to current profitability. It will be interesting to see if our result holds up in a few years, when EU's new and stricter rules impose more rigid procedures aimed at open competition and when the market has left the first expansionary phase. We conjecture that quality degradation may become a problem in future, after the 2008 Procurement Act that imposed stricter procedural rules limiting discretion and fostering open competition.

[25] If competition were driving quality, however, we would expect to see higher survival rates in densely populated municipalities – and we do not.

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Appendix

Table A1. Descriptive statistics, cross sectional data on observable quality.

		Min	Max	Mean	Std. dev.	N
CSI All	Consumer satisfaction index based	56	88	70.90	5.42	283
Shift	on client survey.	56	87	70.33	5.02	94
No shift		57	88	71.15	5.60	189
Degree of competition	Percentage of beds managed by private firms.	0	1	0.29	0.28	94
	SCORE FOR:					
Participation	Share of clients with an implementation plan with active participation of the client.	1.00	5.00	2.89	1.42	275
Staff density	Staff per client.	1.00	5.00	3.01	1.40	275
Competence	Share of regular staff with vocational training at the secondary level or similar; staff work experience	1.00	5.00	2.94	0.95	276
Continuity	Share of staff with full-tim employment; *staff turnover*.	1.00	5.00	2.88	0.80	270
Privacy	Private room and access to individual hygiene and cooking facilities.	1.00	4.80	3.07	0.78	264
Food	Choice of meals; *duration of night-fasting period*	2.30	5.00	3.47	0.80	262
Management	*Staff per manager*.	1.00	5.00	2.86	1.39	274
	PERCENTAGE OF RESIDENTS					
Total risk	With hazardous drug combinations.	0.01	0.06	0.03	0.01	274
Total ten	Taking more than ten prescribed drugs (80 years and older only)	0.06	0.21	0.12	0.03	274
Total three	Taking three or more psychotropic drugs (80 years and older only)	0.02	0.08	0.05	0.01	274
Stroke	Assessing their health as very or fairly good three months after stroke (stroke patients only)	0.54	0.94	0.76	0.06	274
	PER 1000 POPULATION AGED 80 AND OLDER					
Hospital	Number of unplanned hospital admissions	274.00	769.00	512.55	82.69	274

See NBHW (2008) and SALAR (2008) for full description of the surveys from which the data is collected. The seven score variables are composite measures constructed by the NBHW; component measures in italics are inversely related to the scores.

Treatment of costs and availability of beds

The variable $COSTI_{mt}$ measures costs per bed and year and $RESI_{mt}$ is a measure of the number of residents at elderly-care homes per 100 inhabitants aged 65 or more. Higher spending per resident is likely to increase quality (as shown by Grabowski, 2004, in his study of US nursery homes). However, costs per bed may be high also because the municipality has a restrictive policy and only accepts clients in poor health into nursing homes. Similarly, the number of residents per capita may be high because the municipality has a population that is older than in most other municipalities or because it has a generous admittance policy. For this reason, $COSTI_{mt}$ and $RESI_{mt}$ are index variables, designed to measure the municipality's relative generosity in terms of spending per resident and in terms of accepting residents, relative to an average municipality with the same population profile.

First, we model the expected number of residents per (1000) capita as follows:

$$ACTRES^*_{mt} = \Sigma b^*_i P_{kmt} \quad \text{(A1)}$$

where $ACTRES^*_{mt}$ is the expected number of residents per 1000 inhabitants in municipality m at time t, calculated as the sum of the product of P_{imt}, population in age group i, and the fraction of people in age group i living in elderly care at the national level, b^*_i. The values for the year 2007 are as shown in Table A2; we used contemporaneous values in the estimations and interpolated for two years where data was missing. Comparing actual number of residents, $ACTRES_{mt}$, to the predicted number gives us an index of the relative number of residents as

$$RESI_{mt} = ACTRES_{mt}/ACTRES^*_{mt} \quad \text{(A2)}$$

If $RESI_{mt} > 1$ the municipality m has an admittance policy that is more generous than the average municipality and vice versa.

Table A2. The percentage of the population by age intervals living in nursery homes, 2007) (NBHW)

Age (years)	Women	Men	All
65-74	0.912559	0.971143	0.941043
75-79	3.793745	3.149455	3.50845
80-84	9.186855	6.703249	8.183698
85-89	19.22256	12.48988	16.82569
90-94	34.3794	24.10474	31.41487
95-	50.22578	39.5069	47.9476

The cost per resident will increase if the average health status is reduced. We do not know the health status of individuals, but we assume health deteriorates with age and, therefore, that we can use the average age of the clients as a proxy for their health. However, since we do not know average age either, we have to make assumptions about that as well. We assume that average age can be approximated as[26]

$$AAGE^*_{mt} = \frac{\Sigma A_i b^*_i P_{imt}}{\Sigma b^*_i P_{imt}} \tag{A3}$$

using the notation from equation (A1) with A_i representing the average age in age group *i.*[27] That is, we assume that all municipalities admit fraction b^*_i of its population in age group *i*. We also assume that a more generous admittance policy, i.e., a high value of *RESI*, implies that the average health status of the clients is better. Hence, we model the cost per resident as

$$c_{mt} = c_0 + c_1 RESI_{mt} + c_2\, AAGE^*_{mt} + \varepsilon_{mt} \tag{A4}$$

where c_{mt} is the per-client cost in municipality *m* at time *t*. Using the parameter estimates of the model, we can predict the expected cost per resident in the municipality as

$$\widehat{ec}_{mt} = \hat{c}_0 + \hat{c}_{mt}\, RESI_{mt} + \hat{c}_2\, AAGE_{mt} \tag{A5}$$

[26] The average age of Swedes aged 95 or more is 97 years, as calculated from Statistics Sweden's population statistics.

[27] We use the mid-point of the closed intervals and assume that the average age in the highest age group is 97 years.

where hat indicates fitted values. Finally, we can construct our index of relative cost generosity as[28]

$$COSTI_{mt} = c_{mt}/\widehat{ec}_{mt} \quad \text{(A6)}$$

If $COSTI_{mt}>1$ then municipality *m* is spending more per health-adjusted resident than the average municipality. In the survival equation above, we expect both *COSTI* and *RESI* to have a positive impact on survival.

We generate the index for the number of residents per capita in each municipality *m*, $RESI_{mt}$, according to equation (A2), and the predicted average age, AGE_{mt}, according to equation (A3) using the same panel data approach as in the estimation of survival. The resident index ranges from 0.14 to 7.58 (for 2008), with an average of 1.04 and a standard deviation of 0.66. The average age of residents ranges from almost 83 to just over 86 years, with an average of 84.75 and a standard deviation of 0.59.

We then estimate actual costs per persons by municipality as a function of *RESI* and *AAGE*, according to a linear version of expression (A4). This expression is actually estimated using the panel structure of the data for the period 2000 to 2008 and as a cross section for the year 2008. The random effect estimates are used in the estimation of survival for the shorter panel and the cross section ordinary least square estimate is used in the estimation of *CSI*. The results are reported in Table A3.

Table A3. Estimation results. Cost per resident as explained by admittance policy (*RESI*) and average age (all municipalities), short panel and cross section (2008).

Panel (WLS)	Coefficient	*t*-value
RESI	7.582	9.84
AAGE	0.004	189.18
Constant	-9.874	-7.37
Wald Chi2(2)		35953.66
Prob > Chi2		0.00
N		2736
Cross section (OLS estimates)		
RESI	3.853	1.23
AAGE	0.004	93.30
Constant	17.512	4.31
Adj R^2		0.97
N		281

None of the explanatory variables in cross section regression have a significant effect on the cost per resident and the explanatory power of the model is poor. This is not too problematic since the main point is to construct an index that can be used in the regression of customer satisfaction index and mortality.

The cost per resident index has, as expected, a mean of one and it is distributed between 0.49 and 2.31. The municipality with highest cost per resident spends almost five times more than the municipality with the lowest cost per resident.

Table A4. Correlation matrix, variables in the cross section data used in the CSI regressions.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	1.00																		
2	0.05	1.00																	
3	0.10	-0.02	1.00																
4	0.19	0.01	0.49	1.00															
5	0.07	-0.01	0.28	0.44	1.00														
6	0.18	0.10	-0.18	-0.37	-0.44	1.00													
7	-0.08	0.01	0.14	-0.06	-0.25	0.00	1.00												
8	-0.01	-0.05	0.11	0.10	0.03	-0.02	0.17	1.00											
9	-0.06	0.06	-0.02	0.00	0.00	0.01	0.07	0.01	1.00										
10	-0.17	-0.09	-0.09	-0.07	0.12	-0.14	-0.05	0.05	-0.03	1.00									
11	0.15	0.05	-0.09	-0.18	-0.30	0.42	0.00	0.17	-0.08	-0.18	1.00								
12	-0.08	-0.06	0.09	0.22	0.17	-0.10	0.02	0.05	0.28	-0.05	0.02	1.00							
13	0.06	0.06	0.21	0.25	0.24	-0.08	-0.01	0.11	0.02	-0.05	-0.06	0.05	1.00						
14	0.00	0.07	-0.04	-0.16	-0.07	0.09	-0.07	0.07	-0.09	0.04	0.01	-0.05	-0.09	1.00					
15	-0.06	-0.06	0.08	-0.04	-0.02	0.00	0.07	0.06	-0.06	0.09	-0.10	0.07	-0.04	0.12	1.00				
16	-0.05	-0.10	0.08	0.16	0.10	-0.16	-0.04	0.14	-0.13	0.19	-0.06	-0.06	-0.05	0.00	0.50	1.00			
17	-0.05	0.02	-0.04	-0.14	-0.11	0.00	0.18	0.11	-0.04	-0.05	-0.06	0.02	0.01	0.15	0.37	0.10	1.00		
18	0.18	-0.08	-0.01	0.03	-0.15	0.23	0.08	-0.02	-0.11	-0.12	0.06	0.03	0.05	0.12	0.15	-0.05	-0.03	1.00	
19	-0.13	0.15	-0.26	-0.12	-0.12	-0.11	0.13	-0.02	0.00	0.04	-0.12	-0.13	-0.04	-0.03	-0.04	0.04	0.06	-0.03	1.00

1) COSTI. 2) RESI. 3) Density. 4) Education. 5) Employment. 6) Left wing. 7) Immigrants 65+. 8) Participation. 9) Staff density. 10) Competence. 11) Continuity. 12) Privacy. 13) Food. 14) Management. 15) Total ten. 16) Total three. 17) Total risk. 18) Hospital. 19) Stroke.

Table A5. Results, OLS regression, Customer satisfaction is dependent, also controlling for inputs. Robust standard errors.

Variables	β	t	β	t
S	-0.317	-0.42	0.248	0.27
SP			-6.399	-1.59
EXP			0.164	1.46
D	-0.003	-3.63	-0.002	-2.24
HE	-17.130	-1.50	-14.912	-1.16
E	17.680	1.08	14.602	0.85
LW	-5.835	-1.69	-6.231	-1.75
IM 65 +	-16.977	-1.32	-6.616	-0.34
COSTI	2.953	1.94	2.700	1.66
RESI	0.757	2.06	0.694	1.73
Participation	-0.079	-0.30	-0.035	-0.13
Staff density	-0.096	-0.39	0.011	0.04
Competence	0.702	1.79	0.742	1.81
Continuity	0.532	1.15	0.467	1.00
Privacy	0.147	0.34	0.160	0.35
Food	0.020	0.04	-0.040	-0.09
Management	-0.318	-1.22	-0.321	-1.23
Total ten	-11.726	-0.67	-7.068	-0.39
Total three	30.740	0.92	20.568	0.58
Total risk	79.544	2.05	63.414	1.55
Hospital	-0.006	-1.30	-0.006	-1.24
Stroke	7.363	1.20	8.788	1.36
Constant	59.458	5.56	60.003	5.48
No of obs		247		231
F(20, 226)		3.52		3.00
Prob > F		0.00		0.00
R-squared		0.18		0.19